MECHANICAL ENGINEERING

I YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits
A21001	English	2	0	0	2.0
A21002	Mathematics-I	3	1	0	4.0
A21004	Chemistry	3	1	0	4.0
A21501	Programming For Problem Solving-I	2	0	0	2.0
A21081	English Language Skills Lab	0	0	2	1.0
A21083	Chemistry Lab	0	0	3	1.5
A21381	Engineering Workshop	0	1	3	2.5
A21581	Programming For Problem Solving Lab-I	0	0	2	1.0
TOTAL CRIEDTS		**10**	**3**	**10**	**18**

I YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits
A22006	Mathematics-II	3	1	0	4.0
A22007	Engineering Physics	3	1	0	4.0
A22302	Engineering Graphics & Modeling	1	0	3	2.5
A22303	Engineering Mechanics	4	0	0	4.0
A22502	Programming For Problem Solving-II	2	0	0	2.0
A22084	English communication Skills Lab (ECSL)	0	0	2	1.0
A22085	Engineering Physics Lab	0	0	3	1.5
A22582	Programming For Problem Solving Lab-II	0	0	2	1.0
TOTAL CREDITS		**13**	**2**	**10**	**20**

Note: All End Examinations (Theory and Practical) are of three hours duration.

II YEAR I SEMESTER

Subject Code	Subject Name	L	T	P/D	Total Credits
A23009	Numerical Methods & Partial Differential Equations	3	-	-	3.0
A23304	Materials Technology	3	-	-	3.0
A23305	Mechanics of Solids	4	-	-	4.0
A23306	Thermodynamics	3	-	-	3.0
A23010	Professional Communications	3	-	-	2.0
A23307	Production Technology	3	-	-	3.0
A23383	Metallurgy and Mechanics of Solids Lab	0	-	2	1.0
A23384	Production Technology Lab	0	-	2	1.0
A23MC1	Environmental Science	**2**	-	-	-
Total No.of Credits		**21**	**-**	**4**	**20**

II YEAR II SEMESTER

Subject Code	Subject Name	L	T	P/D	Total Credits
A24013	Probability and Statistics	3	-	-	3.0
A24211	Basic Electrical Engineering	3	-	-	3.0
A24308	Machine Drawing & Drafting	3	-	-	3.0
A24309	Kinematics of Machines	3	-	-	3.0
A24310	Thermal Engineering	3	-	-	3.0
A24311	Mechanics of Fluids and Hydraulic Machines	3	-	-	3.0
A24385	Mechanics of Fluids and Hydraulic Machines Lab	0	-	2	1.0
A24286	Basic Electrical Engineering Lab	0	-	2	1.0
A24MC1	Gender Sensitization	**2**	-	-	-
Total No.of Credits		**20**	**-**	**4**	**20**

Note: All End Examinations (Theory and Practical) are of three hours duration.

COURSE STRUCTURE FOR B.TECH III YEAR

B.Tech III Year I Semester:

S.No.	Course Code	Course Title	L	T	P	C
1	A25016	Managerial Economics and Financial Analysis	4	0	0	3
2	A25312	Dynamics of Machinery	3	0	0	3
3	A25313	Design of Machine Members-I	3	0	0	3
4	A25314	Applied Thermodynamics	3	0	0	3
5	A25315	Automobile Engineering	3	0	0	3
	A25316	Composite Materials				
	A25317	Additive Manufacturing				
6	A25318	Elements of Mechanical Engineering	3	0	0	3
	A25319	Product Engineering				
7	A25386	Thermal Engineering Lab	0	0	2	1
8	A25087	Advanced Communication Skills Lab	0	0	2	1
9	A25TP1	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**21**	**0**	**4**	**21**

B.Tech III Year II Semester:

S.No.	Course Code	Course Title	L	T	P	C
1	A26320	Design of Machine Members-II	3	0	0	3
2	A26321	Heat Transfer	3	0	0	3
3	A26322	Metrology & Machine Tools	3	0	0	3
4	A26323	Finite Element Method	3	0	0	3
5	A26324	Refrigeration And Air Conditioning	3	0	0	3
	A26325	Industrial Management				
	A26326	Automation In Manufacturing				
6	A26327	Optimisation Techniques	3	0	0	3
	A26328	Maintenance and Safety Engineering				
7	A26387	Heat Transfer Lab	0	0	2	1
8	A26388	Metrology & Machine Tools Lab	0	0	2	1
9	A26TP1	Personality Development & Behavioural Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

B.Tech IV Year I Semester

S. No.	Course Code	Course Title	L	T	P	C
1	A27329	Instrumentation and Control Systems	3	0	0	3
2	A27330	CAD/CAM	3	0	0	3
3	A27331 A27332 A27333	Robotics Gas Dynamics Production And Operations Management	3	0	0	3
4	A27334 A27335 A27336	Operations Research Energy Conservation And Management Fluid Power Systems	3	0	0	3
5	A27337 A27338	Basic Automobile Engineering Material Science Engineering	3	0	0	3
6	A27389	CAD/CAM Lab	0	0	2	1
7	A27390	Instrumentation and Control Systems Lab	0	0	2	1
8	A273P1	Industry Oriented Mini Project	0	0	0	3
Total			**15**	**0**	**4**	**20**

B.Tech IV Year II Semester

S. No.	Course Code	Course Title	L	T	P	C
1	A28339	Production Planning & Control	3	0	0	3
2	A28340	Unconventional Machining And Processes	3	0	0	3
3	A283TS	Technical Seminar	3	1	0	2
4	A283CV	Comprehensive Viva Voce	0	0	0	2
5	A283P2	Major Project	0	0	0	10
Total			**18**	**1**	**0**	**20**

MATHEMATICS - I
(Matrices and Calculus)

I Year I Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Write the matrix representation of system of linear equations and identify the consistency of the system of equations.
2. Find the Eigen values and Eigen vectors of the matrix and discuss the nature of the quadratic form.
3. Analyze the convergence of sequence and series.
4. Discuss the applications of mean value theorems to the mathematical problems, Evaluation of improper integrals using Beta and Gamma functions.
5. Examine the extreme of functions of two variables with/ without constraints.

UNIT-I:

Matrices and Linear System of Equations:

Matrices and Linear system of equations: Real matrices – Symmetric, skew - symmetric, Orthogonal. Complex matrices: Hermitian, Skew – Hermitian and Unitary. Rank-Echelon form, Normal form. Solution of Linear Systems – Gauss Elimination, Gauss Jordan & LU Decomposition methods.

UNIT-II:

Eigen Values and Eigen Vectors:

Eigen values, Eigen vectors – properties, Cayley-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonalization of matrix- Quadratic forms: Reduction to Canonical form, Nature, Index, Signature.

UNIT-III:

Sequences & Series:

Basic definitions of Sequences and series, Convergence and divergence, Ratio test, Comparison test, Cauchy's root test, Raabe's test, Integral test, Absolute and conditional convergence.

UNIT-IV:

Beta & Gamma Functions and Mean Value Theorems:

Gamma and Beta Functions-Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Generalized Mean Value theorem (all theorems without proof) – Geometrical interpretation of Mean value theorems.

UNIT-V:

Functions of Several Variables:

Partial Differentiation and total differentiation, Functional dependence, Jacobian Determinant-Maxima and Minima of functions of two variables with constraints and without constraints, Method of Lagrange Multipliers.

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, Jain & Iyengar, Narosa Publications.

Reference Books:

1. Calculus and Analytic Geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
3. Advanced Engineering Mathematics (2nd Edition), Michael D. Greenberg.

CHEMISTRY

I Year I Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Acquire knowledge of atomic, molecular and electronic changes related to conductivity.
2. Apply the various processes of treatment of water for both domestic and industrial purpose.
3. Apply the knowledge of electrode potentials for the protection of metals from corrosion.
4. Analyze the major chemical reactions that are used in the synthesis of compounds.
5. Apply the knowledge of polymers in every day's life.

UNIT- I:

Atomic and Molecular Structure:

Introduction, Concept of atomic and molecular orbitals, LCAO, Molecular orbitals of di-atomic molecules, Molecular orbital energy level diagrams of diatomic molecules (N_2, O2 & F_2). Pi-molecular orbitals of butadiene and benzene.

Crystal field theory (CFT): Crystal field theory, Crystal field splitting patterns of transition metal ion d- orbital- tetrahedral, octahedral and square planar geometries.

UNIT- II:

Water Technology:

Hardness of water, expression of hardness ($CaCO_3$ equivalent), units and types of hardness. Estimation of temporary and permanent hardness of water by EDTA method. Numerical problems based on hardness of water. Potable water: characteristics, treatment of water for domestic supply. Desalination of brackish water: reverse osmosis. Alkalinity of water and its determination. Boiler feed water and its treatment: Internal treatment (colloidal, phosphate calgon conditioning of water). External treatment (ion –exchange process).

UNIT- III:

Electrochemistry and Corrosion:

Electrode, electrode potential, galvanic cell, cell reactions and cell notation, cell EMF, types of electrodes (Calomel electrode and Quinhydroneelectrode), Determination of P^H using quinhydrone electrode. Nernst equation, Numerical problems.Batteries: Introduction to cell and battery, Primary (lithium cell) and secondary cells, (lead-Acid cell, and Lithium ion cells). Fuel cells – Hydrogen – Oxygen fuel cell, advantages and engineering applications of fuel cells.

Corrosion: Introduction, types of corrosion: chemical and electrochemical corrosion, factors affecting the rate of corrosion: nature of the metal, position of metal in galvanic series, purity of metal, nature of corrosion product, nature of environment: effect of temperature, effect of pH, humidity. Corrosion control methods: Cathodic protection: sacrificial anode method and impressed current cathode method. Protective coatings: metallic coatings (anodic and cathodic), methods of application on metals, electroplating (of copper), electroless plating (of Ni), organic coatings- paints.

UNIT-IV:

Stereochemistry:
Structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity. Conformations of cyclic (cyclohexane) and acyclic systems (Ethane).

Organic Reactions and Synthesis of a Drug Molecule:
Introduction to reactions involving substitution (SN1 & SN2), addition (addition of HBr to propene, Markownikoff and Anti Markownikoff addition), elimination, oxidation (oxidation of alcoholsusing $KMnO_4$& CrO_3), reduction (reduction of carbonyl compounds by $LiAlH_4$& $NaBH_4$). Synthesis of a commonly used drug molecule- paracetamol and Asprin.

UNIT-V:

Polymer Chemistry:
Introduction, classification of polymers, types of polymerization (addition and condensation, mechanisms not included). Plastics- types of plastics -thermoplastics and thermosetting plastics. Preparation, properties and engineering applications of PVC, Teflon and Bakelite. Fibers: Nylon 6, 6 and Terelene (Dacron). Elastomers: natural rubber, structure, vulcanization. Synthetic rubbers: Buna-S, Butyl rubber & Thikol rubber. Conducting polymers: classification and applications.
Biodegradable polymers:Types, examples: Polyhydroxy butyrate (PHB) ,Poly-Hydroxybutyrate-co-b-Hydroxy valerate (PHBV) ,Polyglycolic acid (PGA) , Polylactic acid (PLA) ,Poly (Î-caprolactone) (PCL). Applications of biodegradable polymers.

Textbooks:
1. Engineering Chemistry, P.C Jain & Monica Jain, Dhanpat Rai Publications, 2017.
2. Engineering Chemistry, Bharathi Kumari. Y, VGS Publications, 2018.

Reference Books:
1. March's Advanced Organic Chemistry, Smith, Wiley Publications, 2017.
2. Engineering Chemistry, Shiva Sankar, TMH Publications, 2010.

CHEMISTRY LAB

I Year I Semester

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Determination of parameters like hardness, alkalinity and chloride content in water.
2. Estimation of rate constant of a reaction from concentration-time relationships.
3. Determination of physical properties like adsorption, surface tension and viscosity.
4. Synthesize a small drug molecule and analyze a salt sample.
5. Calculation of strength of compound using instrumentation techniques.

Choice of 10-12 experiments from the following:

1. Estimation of total hardness of water by EDTA method.
2. Determination of alkalinity of water.
3. Determination of chloride content of water.
4. Estimation of HCl by conductometric titration.
5. Estimation of mixture of acids by conductometric titration.
6. Estimation of HCl by potentiometric titration.
7. Estimation of Fe^{2+} by potentiometry using $KMnO_4$.
8. Determination of the rate constant of a reaction.
9. Determination of surface tension.
10. Determination of viscosity of a lubricant.
11. Chemical analysis of a salt.
12. Synthesis of a polymer/drug.
13. Adsorption of acetic acid by charcoal.
14. Determination of Saponification /acid value of an oil.

Reference Books:

1. Practical Engineering Chemistry by Mukkanti, B.S. Publications, 2010.
2. Volga's Qualitative Inorganic Chemistry by PEAR Publications 2010.

ENGLISH

I Year I Semester

L	T	P	C
2	0	0	2

Course Outcomes:

1. Infer the importance of scientific discoveries in promoting social responsibilities.
2. Comprehend the given texts and respond appropriately for technical and professional purposes.
3. Communicate confidently and transfer information into various forms of writing.
4. Understand the importance of health and nutrition for a better society.
5. Present various forms of business writing skills for successful careers.

UNIT-I:

'The Raman Effect' from the prescribed textbook **'English for Engineers'**

Grammar: Articles & Prepositions

Reading : Reading and Its Importance- Techniques for Effective Reading.

Writing : Organizing principles of paragraphs in documents.

Vocabulary: The concept of word Formation, synonyms, antonyms, and standard abbreviations.

UNIT-II:

'Ancient Architecture in India' from the prescribed textbook **'English for Engineers'**

Reading : Improving Comprehension Skills – Techniques for good comprehension

Writing :Sentence Structures, Use of phrases and clauses in sentences

Writing Formal Letters-Eg. Letter of Complaint, Letter of Requisition,

Job Application with Resume.

Vocabulary: Root words and acquaintance with prefixes and suffixes from foreign languages in English, to form derivatives

UNIT-III:

'Blue Jeans' from the prescribed textbook **'English for Engineers'**

Grammar: Tenses: Types and uses.

Reading : Sub-skills of Reading- Skimming and Scanning

Writing : Identifying Common Errors in Writing

Subject-Verb agreement in number, gender and person

Information Transfer-Process writing

UNIT-IV:

'What Should You Be Eating' from the prescribed textbook **'English for Engineers'**

Reading : Intensive Reading and Extensive Reading

Writing : Nature and Style of Sensible Writing

Describing & Defining

Identifying common errors in writing

UNIT-V:

'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook **'English for Engineers'**

Vocabulary : Technical Vocabulary and their usage

Reading : Reading Comprehension-Exercises for Practice

Writing : Cohesive Devices

Précis Writing

Technical Reports-Introduction, Characteristics of a Report – Categories of Reports, Formats- Structure of Reports (Manuscript Format) –Types of Reports - Writing a Report.

Textbooks:

1. English for Engineers, Sudarshana, N.P. and Savitha, C. Cambridge University Press, 2018.

Reference Books:

1. Effective Technical communication, Muhammed Rizvi, TMH, 2008.
2. Advanced English Grammar, Hewings, Cambridge University Press, 2010.

ENGLISH LANGUAGE SKILLS LAB

I Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Reproduce speech sounds and improve fluency in language.
2. Understand syllables and consonant clusters for appropriate pronunciation.
3. Exhibit effective professional skills with rhetoric eloquence.
4. Deliver enthusiastic and well-practiced presentation.
5. Learn Task-Based Language Learning (TBLL) through various language learning activities effectively.

Exercise-I:
CALL Lab:
Introduction to Pronunciation- Speech Sounds, Vowels and Consonants- Practice for Listening
ICS Lab:
Ice-Breaking activity and JAM session

Exercise-II:
CALL Lab:
Silent Letters, Consonant Clusters, Homographs
ICS Lab:
Common Everyday Situations: Conversations and Dialogues

Exercise-III:
CALL Lab:
Syllables
ICS Lab:
Communication at Workplace, Social and Professional Etiquette

Exercise-IV:
CALL Lab:
Word Accent and Stress Shifts
ICS Lab:
Formal Presentations, Visual Aids in Presentations

Exercise-V:
CALL Lab:
Intonation, Situational dialogues for practice
ICS Lab:
Interviews, Types of Interviews

Reference Books:

1. A Textbook of English Phonetics for Indian Students, T. Balasubramanian, Macmillan Publishers, 2010.
2. Speaking English Effectively, Mohan, Macmillan Publishers, 2010.

PROGRAMMING FOR PROBLEM SOLVING-I

L	T	P	C
2	0	0	2

I Year I Semester

Course Outcomes:

1. Design Algorithms and Flowcharts for real world applications using ‘C’.
2. Know the usage of various operators in Program development.
3. Design programs involving decision and iteration structures.
4. Apply the concepts code reusability using Functions.
5. Analyze various searching and sorting techniques using Arrays.

UNIT-I:

Problem Solving Using Computers: Introduction, Algorithms, Flowcharts and Pseudo code, Applications of C language.

Overview of C Language: Introduction, Salient Features of C Language, Structure of a “C” Program.

C Language Preliminaries: Keywords and Identifiers, Constants, Variables, Data Types, and Input/ Output Statements with suitable illustrative “C” Programs.

UNIT-II:

Operators: Assignment Operators, Relational and Logical Operators, Increment and Decrement Operators, Bitwise Operators, Ternary Operator, Type Conversion, Precedence and Associativity with suitable illustrative “C” Programs.

UNIT-III:

Statements in C:

Conditional/Decision Statements: if, if-else, Nested if-else, else-if ladder, and Switch-Statement with suitable illustrative “C” Programs.

Loop Control Statements: while, do-while and for with suitable illustrative “C” Programs.

UNIT-IV:

Functions: Introduction to Functions, benefits of functions, types of functions, Function calls, return vs exit (), Parameter Passing mechanism: Call-by-Value, Recursion, and Storage Classes.

UNIT-V:

Arrays: Introduction to Arrays, One-Dimensional Arrays, Two-Dimensional Arrays, Arrays and Functions.

Searching and Sorting: Linear Search, Binary Search, Bubble Sort, and Insertion Sort.

Textbooks:

1. COMPUTER SCIENCE: A Structured Programming Approach Using C, B.A.Forouzon and R.F. Gilberg, Third edition, 2016.
2. C and Data Structures, Ashok N. Kamthane, Pearson Education.

Reference Books:

1. Problem Solving Using C, M.T. Somashekara, PHI, 2nd Edition 2009.
2. Computer Fundamentals and Programming in C, A.K.Sharma, 2nd Edition, University Press.
3. Programming in C 2/e, PradipDey and Manas Ghosh, Oxford UniversityPress, 2nd Edition 2011.
4. The Fundamentals of Computers, Rajaraman V., 4th Edition, Prentice Hall of India, 2006.
5. Programming in C, R S Bichker, University Press, 2012.

PROGRAMMING FOR PROBLEM SOLVING LAB – I

I Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: At the end of this course, the student would be able to

1. Apply the specification of syntax rules for numerical constants and variables, data types.
2. Know the Usage of various operators and other C constructs.
3. Design programs on decision and control constructs.
4. Develop programs on code reusability using functions.
5. Implement various searching and sorting techniques using arrays.

Week 1:
Ubuntu and Linux Commands.

Week 2:
Designing of flowcharts and algorithms using raptor tool
1. Areas of Polygons.
2. Calculation of Simple and Compound Interest.
3. Swapping of Two numbers with and without temporary variable.
4. Checking whether a number is even or odd.
5. Sum of first ‘n’ natural numbers.
6. Checking a number whether it is divisible by any given number.
7. Evaluation of mathematical expressions.
8. Programs using scanf( ) and printf( ) statements.

Week 3:
Programs on operators.(Minimum 4 Programs)

Week 4, 5 & 6:
Programs on Conditional Statements. (Minimum 12 Programs)

Week 7,8 & 9:
Programs on Control Statements. (Minimum 12 Programs)

Week 10 &11:
Programs on Functions. (Minimum 6 Programs)

Week 12:
Programs on One Dimensional Arrays. (Minimum 3 Programs)

Week 13:
Programs on Two Dimensional Arrays. (Minimum 2 Programs)

Week 14:
Implementation of Linear Search and Binary Search.

Week 15:
Implementation of Bubble Sort and Insertion Sort.

Week 16:
Review

ENGINEERING WORKSHOP

I Year I Semester

L	T	P	C
0	1	3	2.5

Course Outcomes:

1. Understanding the tools and methods of using to fabricate engineering components
2. Applying the measuring techniques to verify the dimensional accuracy
3. Evaluating various methods and trades of workshop in the component building

(i) Lectures & videos:

Detailed contents

1. Manufacturing Methods- Metal Forming, Machining, Advanced manufacturing methods (2 lectures)
2. CNC machining, Additive manufacturing (2 lectures)
3. Fitting operations & power tools (1 lecture)
4. House wiring (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding (1 lecture)
7. Metal casting (1 lecture)
8. Welding (1 Lecture)

(ii) Workshop Practice:

Detailed contents:

1. Machine shop (Lathe machine)
2. Fitting shop
3. Carpentry
4. House Wiring
5. Welding shop (Arc welding)
6. Tin Smithy

Reference Books:

1. Elements of Workshop Technology, Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Manufacturing Engineering and Technology, Kalpakjian S. and Steven S. Schmid, 4th edition, Pearson Education India Edition, 2002.

MATHEMATICS - II
(Ordinary Differential Equations and Vector Calculus)

I Year II Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Classify the various types of differential equations of first order and first degree and apply the concepts of differential equations to the real world problems.
2. Solve higher order differential equations and apply the concepts of differential equations to the real world problems.
3. Find the Laplace Transform of various functions and apply to find the solutions of differential equations.
4. Evaluate the multiple integrals and identify the vector differential operators physically in engineering problems.
5. Evaluate the line, surface and volume integrals and converting them from one to another by using vector integral theorems.

UNIT-I:

First order Ordinary Differential Equations and their Applications:

Formation of Differential equations, Differential equations of first order and first degree: exact, linear and Bernoulli, Applications of ODE: Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT-II:

Higher Order Linear Differential Equations:

Linear differential equations of second and higher order with constant coefficients, RHS term of the type f(X) $= e^{ax}, \sin ax, \cos ax \; and \; x^k, e^{ax}V(x), x^k V(x)$. Method of variation of parameters.

UNIT-III:

Laplace Transforms:

Laplace transform of standard functions Inverse transform first shifting Theorem, Transforms of derivatives and integrals Unit step function second shifting theorem Dirac's delta function Convolution theorem Periodic function Differentiation and integration of transforms Application of Laplace transforms to ordinary differential equations.

UNIT-IV:

Multiple Integrals & Vector Differentiation:

Multiple integrals double and triple integrals change of order of integration (Only Cartesian form) change of variables (Cartesian to Polar for double integral, Cartesian to Spherical for triple integral). Gradient- Divergence Curl and their related properties Potential function Laplacian and second order operators.

UNIT-V:

Vector Integration:

Line integral, work done, Surface and Volume integrals. Vector integrals theorems: Green's, Stoke's and Gauss Divergence Theorems (Only Statements & their Verifications).

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 36th Edition, 2010.
2. Advanced Engineering Mathematics, Jain & Iyengar,Narosa Publications.

Reference Books:

1. Calculus and Analytic Geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
3. Advanced Engineering Mathematics (2nd Edition), Michael D. Greenberg.

ENGINEERING PHYSICS

I Year II Semester

L	T	P	C
3	1	0	4

Course Outcomes:

1. Interpret the forced damped harmonic oscillations and Transverse waves.
2. Identify various optical phenomena of light.
3. Explain the working principle of optical fibers and lasers.
4. Describe the crystalline structures of solids.
5. Classify magnetic and dielectric behavior of materials.

UNIT-I:

Oscillations and Waves:

Simple harmonic motion, equation of simple harmonic motion, Simple Pendulum, Torsional pendulum, damped harmonic motion-heavy, critical and light damping, energy decay in a damped harmonic oscillator, power dissipation, quality factor. Forced vibration, steady state motion of forced damped harmonic oscillator, Amplitude of forced vibration, Resonance, Electrical analogy of simple harmonic oscillator.Transverse waves in a stretched string, differential equation, reflection and transmission of transverse waves at a boundary, standing waves.

UNIT-II:

Wave Optics:

Huygen's principle, superposition of waves, coherence and methods to produce coherent sources, young's double slit experiment, interference by parallel thin film by reflection, Newton's rings. Diffraction: Introduction, Fraunhofer diffraction at single slit, plane diffraction Gratings and its resolving power. Polarization: Introduction, methods of polarization, double refraction- Nicol Prism.

UNIT-III:

Fiber Optics and Lasers:

Introduction, total internal reflection, acceptance angle and numerical aperture, losses associated with optical fibers, step and graded index fibers, applications of optical fibers. Introduction to interaction of radiation with matter: stimulated absorption, spontaneous emission and stimulated emission, Einstein's coefficients and their relation, characteristics of a laser, components of a laser: active medium, pumping source, optical resonator. Population inversion, Construction and working of Ruby laser, He-Ne laser and Semiconductor laser. Applications of lasers.

Unit-IV:

Crystal Structures, Crystal Planes and XRD:

Space lattice – Unit cell – Lattice parameter – Crystal systems – Bravais lattices, Atomic radius – Co-ordination number - Structures and Packing fractions of Simple Cubic – Body Centered Cubic – Face Centered Cubic crystals. Miller Indices for Crystal planes and directions – Inter planar spacing of orthogonal crystal systems –Diffraction of X-rays by crystal planes and Bragg's law–Powder method – Applications of X-ray diffraction.

UNIT-V:

Dielectric and Magnetic properties of Materials:

Dielectric polarization, permittivity and dielectric constant, polar and non-polar dielectrics, Electronic, Ionic and Orientation Polarization – Calculation of electronic and Ionic Polarizability – Internal fields – Claussius – Mossotti equation – Basic concepts of Piezo, Pyro and Ferro electricity, applications of dielectrics.Introduction to magnetism – Basic definitions - Origin of magnetic moment, Bohr magneton – Classification of magnetic materials (Dia, Para and Ferro)- Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials – properties of Anti ferro and Ferri magnetic materials, applications.

Textbooks:

1. Engineering Physics, P K Palanisamy, Scietech publication.
2. Engineering Physics, Hitendra K Malik, A K Singh, McGraw Hill Edition (I) Private Limited.

Reference Books:

1. A Text book of Engineering Physics, M N Avadhanulu, P G Kshirsagar; S Chand.
2. Physics Volume I & II, Resnick and Halliday, John Wiley and sons, Inc.

ENGINEERING PHYSICS LAB

I Year II Semester

L	T	P	C
0	0	3	1.5

Course Outcomes:

1. Characterize the mechanical properties of given material.
2. Demonstrate various types of oscillation and rotational motion to determine mechanical parameters.
3. Evaluate the magnetic Induction along the axis of current carrying coil.
4. Apply optical phenomena to characterize optical sources and components.
5. Characterize LCR and RC circuits.

List of Experiments

1. Torsional pendulum: Determination of Rigidity modulus of a material.
2. Fly-wheel: Determination of moment of Inertia.
3. Melde's Experiment: Determination of frequency of electrically maintained tuning fork.
4. Sonometer: Determination of velocity of transverse wave in a string.
5. Newton's rings: Determination of the radius of curvature of the given lens by forming Newton's rings.
6. Diffraction grating: Determination of wavelength of given light using diffraction grating.
7. Dispersive power: Determination of dispersive power of the prism material using spectrometer.
8. Single Slit Diffraction using Lasers- Determination of Wavelength of a Monochromatic Source.
9. Stewart & Gee's experiment: Determination of magnetic field along the axis of current carrying coil.
10. LCR Circuit: Determination of Resonance frequency of forced electrical oscillator.
11. RC- Circuit: Determination of time constant of RC-circuit.
12. Optical Fiber: Determination of Numerical Aperture of Optical Fiber.

Note: Any 10 experiments are to be performed

ENGINEERING MECHANICS

I Year II Semester

L	T	P	C
4	0	0	4

Course Outcomes:

1. Understand the concepts of engineering mechanics
2. Apply the laws of mechanics for various engineering applications
3. Analyze the motion of body
4. Evaluate performance of various engineering components interms of their energy capacities

UNIT-I:

Introduction to Engineering Mechanics - Force Systems: Basic concepts, particle equilibrium in 2D & 3D, rigid body equilibrium, system of forces, coplanar concurrent forces, components in space, resultant, moment of forces and its application, couples and resultant of force system, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar systems and spatial systems.

UNIT-II:

Friction: Types of friction, limiting friction, laws of friction, static and dynamic friction, motion of bodies, wedge friction, screw jack & differential screw jack, centroid and centre of gravity, centroid of lines, areas and volumes from first principle, centroid of composite sections, centre of gravity and its implications, theorem of pappus.

UNIT-III:

Area Moment of Inertia: Definition, moment of inertia of plane sections from first principles, theorems of moment of inertia, moment of inertia of standard sections and composite sections, product of inertia, parallel axis theorem, perpendicular axis theorem

Mass Moment of Inertia: Moment of inertia of masses, transfer formula for mass moments of inertia, mass moment of inertia of composite bodies.

UNIT-IV:

Review of Particle Dynamics: Rectilinear motion, plane curvilinear motion, relative and constrained motion, work-kinetic energy, power, potential energy, impulse-momentum (linear, angular), impact (direct and oblique).

UNIT-V:

Kinetics of Rigid Bodies: Basic terms, general principles in dynamics, types of motion, D'Alembert's principle and its applications in plane motion and connected bodies, work energy principle and its application in plane motion of connected bodies, kinetics of rigid body rotation.

Textbooks:

1. Engineering Mechanics, Shames and Rao (2006), Pearson Education
2. Singer's Engineering Mechanics, Statics & Dynamics, Reddy Vijay Kumar K. and J. Suresh Kumar (2010),

Reference Books:

1. Engineering Mechanics, Timoshenko S.P and Young D.H., McGraw Hill International Edition, 1983.
2. Engineering Mechanics, Andrew Pytel, Jaan Kiusalaas, Cengage Learning, 2014.
3. Mechanics for Engineers, Beer F.P & Johnston E.R Jr. Vector, TMH, 2004.
4. Engineering Mechanics, Hibbeler R.C & Ashok Gupta, Pearson Education, 2010.
5. Engineering Mechanics – Statics & Dynamics, Tayal A.K., Umesh Publications, 2011.
6. Engineering Mechanics, Basudeb Bhattacharyya, Oxford University Press, 2008.
7. Engineering Mechanics, Volume-II Dynamics, Meriam. J. L., John Wiley & Sons, 2008.

ENGINEERING GRAPHICS & MODELING

I Year II semester

L	T	P	C
1	0	3	2.5

Course Outcomes:

1. Understand the concepts of engineering drawing of planes, solids and the CAD drawing software.
2. Applying the principles of engineering graphics while drawing the engineering components.
3. Analyze the sectional views for their configurations.
4. Evaluate the surfaces of solids developed for further processing in the engineering applications.

UNIT– I:
Introduction to Engineering Drawing: Principles of engineering graphics and their significance, usage of drawing instruments, conic sections, including the rectangular hyperbola- General method only. Cycloid, Epicycloid, Hypocycloid. Scales – Plain & Diagonal only.

Introduction to CAD: Introduction to CAD software and its importance, standard toolbar/menus and navigation tools used in the software, using basic commands limits ,units, grid, test , move, offset ,mirror, rotate, trim, extend, fillet etc. drawing lines using line command. Drawing spline, ellipse, circle, rectangle etc.. Concept of layers and dimensioning.

UNIT-II:
Principles of Orthographic Projections: Conventions, projections of points, projections of lines (first angle projection) inclined to both planes (traces and midpoint problem to be excluded).
Implementation of CAD: Drawing orthographic projections of points and lines using a CAD package.

UNIT – III:
Projections of the Planes: Projections of regular planes inclined to both the planes.
Projections of Solids: Projections of regular solids inclined to both the planes (prisms, pyramids, cones and cylinders, change of potion method only).
Implementation in CAD: Drawing orthographic projection of planes and regular solids using a CAD package.

UNIT – IV:
Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone. Development of surfaces of right regular solids - Prism, Pyramid, Cylinder and Cone.
Implementation in CAD: Concept of hatching, drawing sectional views of solids and the development of right regular solids using a CAD package.

UNIT-V:
Principles of Isometric projection: Isometric scale, isometric views, conventions, isometric views of lines, planes, simple solids, conversion of isometric views to orthographic views and vice-versa, conventions.
Implementation in CAD: Drawing isometric views of simple solids. Drawing isometric views from giving orthographic views and vice-versa using a CAD package.

Note: Implementation in CAD (For Internal Evaluation Weightage Only)
Textbooks:

1. Engineering Drawing, Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Charotar Publishing House.

Reference Books:

1. Engineering Graphics, Agrawal B. & Agrawal C. M. (2012), TMH Publication, Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah (2008), Scitech Publishers.
2. Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. (2008), Pearson Education.
3. http://docs.autodesk.com/ACDMAC/2013/ENU/PDFs/acdmac_2013_users_guide.pdf

ENGLISH COMMUNICATION SKILLS LAB

I Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Understand the variants in pronunciation.
2. Identify the diverse purposes of listening and speaking.
3. Discuss ideas in diverse communicative settings.
4. Exhibit increased confidence in public speaking.
5. Display critical thinking, problem solving and decision making skills through GD's.

Exercise-I:
CALL Lab:
Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.
ICS Lab:
Spoken vs. Written language -Formal and Informal English- Introducing Oneself and Others.

Exercise-II:
CALL Lab:
Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
ICS Lab:
Features of Good Conversation – Strategies for Effective Communication Role-Play- Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise-III:
CALL Lab:
Information Transfer
ICS Lab:
Descriptions-Narrations-Giving Directions and Guidelines-GivingInstructions-Seeking Clarifications-Asking for and Giving Directions-Thanking and Responding-Agreeing and Disagreeing-Seeking and Giving Advice-Making Suggestions.

Exercise-IV:
CALL Lab:
Past Tense Marker and Plural Marker
ICS Lab:
Public Speaking- Exposure to Structured Talks - Non-verbal Communication- Making a Short Speech - Extempore

Exercise-V:
CALL Lab:
Intonation- Sentence Stress -Weak Forms and Strong Forms.
ICS Lab:
Group Discussion, Mock Group Discussion sessions

Reference Books:

1. A Textbook of English Phonetics for Indian Students, T. Balasubramanian Macmillan Publishers, 2010
2. Speaking English Effectively, Mohan, Macmillan Publishers, 2010

PROGRAMMING FOR PROBLEM SOLVING-II

L	T	P	C
2	0	0	2

I Year II Semester

Course Outcomes:

1. Identify various string handling functions in 'C'.
2. Develop programs with user defined data types.
3. Use Dynamic memory allocation functions with pointers.
4. Distinguish between Stacks and Queues.
5. Analyze various Dynamic Data Structures.

UNIT – I:

Overview of Arrays and Functions.
Strings: Introduction to Strings, String I/O, String Operations with and without built-in functions (strlen( ), strcmp( ), strcat( ),strcpy( ) and strrev( )).

UNIT -II:

Structures: Definition and Initialization of Structures, Accessing structure members, Nested Structures, Array of Structures, Structures and Functions, Unions, typedef, Enumerated Data types.

UNIT-III:

Pointers: Introduction to Pointers, Pointer Arithmetic, Pointers and Arrays, Pointer to Structure, Pointers and Strings, Parameter passing mechanism: Call by Reference, Pointer to Pointer, Dynamic Memory Allocation.

UNIT-IV:

Introduction to Data Structures: Lists and Operations, Linear and Nonlinear Data structures.
Stacks- Introduction to Stacks, Operations, Implementation of Stack using Arrays.
Queues- Introduction to Queues, Operations, Implementation of Queue using Arrays.

UNIT-V:

Linked Lists: Introduction to Linked List, Operations on Single Linked List (search, Insertion & Deletion).
Files: Introduction to Files, File Operations (Open, Close, read & Write).

Textbooks:

1. COMPUTER SCIENCE: A Structured Programming Approach Using C, B.A.Forouzon and R.F. Gilberg, Third edition, 2016.
2. C and Data Structures, Ashok N. Kamthane, Pearson Education.

Reference Books:

1. Problem Solving Using C, M.T. Somashekara, PHI, 2^{nd} Edition 2009.
2. Computer Fundamentals and Programming in C, A.K.Sharma, 2nd Edition, University Press.
3. Programming in C 2/e, PradipDey and Manas Ghosh, Oxford University Press, 2nd Edition 2011.
4. The Fundamentals of Computers, Rajaraman V., 4th Edition, Prentice Hall of India, 2006.
5. Programming in C, R S Bichker, University Press, 2012.

PROGRAMMING FOR PROBLEM SOLVING LAB – II

L	T	P	C
0	0	2	1

I Year II Semester

Course Outcomes:

1. Build programs on various string handling functions.
2. Develop applications on user defined data types.
3. Apply dynamic memory allocation through pointers.
4. Implement linear data structures through stacks and queues.
5. Create linked list dynamically through stacks and queues.

Week 1:
Programs on Arrays and Functions. (Minimum 3 Programs)

Week 2 & 3:
Programs on Strings with and without string built-in Functions. (Minimum 6 Programs)

Week 4:
Programs on Accessing Structures and Nested Structures. (Minimum 3 Programs)

Week 5 & 6:
Programs on Array of Structures, Structures and Functions. (Minimum 5 Programs)

Week 7:
Programs on Unions, typedef and enum. (Minimum 4 Programs)

Week 8:
Programs on Pointers, pointer arithmetic, pointer expression, One Dimensional and Two dimensional arrays. (Minimum 4 Programs)

Week 9:
Programs on Pointer to structure, Call by Reference, Pointer to Pointer. (Minimum 3 Programs)

Week 10:
Programs on Dynamic Memory Allocation Functions. (Minimum 3 Programs)

Week 11:
Programs on Stacks and Queues using Arrays.

Week 12 & 13:
Programs on Single Linked List.

Week 14 & 15:
Programs on File Operations. (Minimum 6 Programs)

Week 16:
Review

COURSE STRUCTURE FOR B.TECH II YEAR

B.Tech II Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	BS – 1	Numerical Methods& Partial Differentiation	3	0	0	3
2	ES – 1	Materials Technology	3	0	0	3
3	PC – 1	Mechanics of Solids	3	1	0	4
4	PC – 2	Thermodynamics	3	0	0	3
5	PC – 3	Production Technology	3	0	0	3
6	H&S - 1	Professional Communication	2	0	0	2
7	PC Lab – 1	Metallurgy and Mechanics of Solids Lab	0	0	2	1
8	PC Lab – 2	Production Technology Lab	0	0	2	1
9	MC – 1	Environmental Sciences	2	0	0	0
		Total	**19**	**1**	**4**	**20**

B.Tech II Year II Semester:

S. No.	Course Category	Course Title	L	T	P	C
1	BS – 2	Probability and Statistics	3	0	0	3
2	ES – 2	Basic Electrical Engineering	3	0	0	3
3	PC – 4	Machine Drawing & Drafting	3	0	0	3
4.	PC – 5	Kinematics of Machinery	3	0	0	3
5	PC – 6	Thermal Engineering	3	0	0	3
6	PC – 7	Mechanics of Fluids and Hydraulic Machines	3	0	0	3
7	PC Lab – 3	Mechanics of Fluids and Hydraulic Machines Lab	0	0	2	1
8	PC Lab – 4	Basic Electrical Engineering Lab	0	0	2	1
9	MC – 2	Gender Sensitization	2	0	0	0
		Total	**20**	**0**	**4**	**20**

NUMERICAL METHODS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	0	0	3

II Year I Semester

Course Outcomes:

1. Develop skills in solving engineering problems involving Algebraic and transcendental equations.
2. Acquires the knowledge of interpolation in predicting future out comes based on the present knowledge and also to fit different types of Curves.
3. To know various types of numerical methods in solving engineering problems.
4. Classify the nature of second and Higher order partial differential equations and find the solutions of linear and non linear PDE.
5. To apply Partial differential Equations in different engineering problems.

UNIT-I:

Numerical Techniques: Solution of Algebraic and Transcendental Equations:
Introduction - The Bisection Method- The Method of False Position- The Iteration Method- Newton-Raphson Method. Solving system of linear Non- Homogeneous equations by Jacobi's and Gauss- Seidel Iteration methods.

UNIT-II:

Curve Fitting and Numerical Integration:
Curve fitting: Fitting a straight line -second degree curve-exponential curve, power curve by method of least squares.
Numerical Integration – General Quadrature (Newton's Cote's formula), Trapezoidal rule, Simpson's rule $\left(\frac{1}{3}^{rd} \& \frac{3}{8}^{th}\right)$.

UNIT-III:

Numerical Solutions of Initial Value Problems:
Numerical solution of Ordinary Differential equations: Introduction- Solution by Taylor's series method- Picard's Method of successive approximations- Single step methods-Euler's Method - Runge-Kutta (second and classical fourth order) Methods- Predictor Corrector method- Adam's - Bashforth method .

UNIT-IV:

Partial Differential Equations:
Introduction- Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Solutions of first order Linear (Lagrange) Equation, Nonlinear Equations- Charpits Method.

UNIT-V:

Applications of Partial Differential Equations:
Introduction- Classification of general second order partial differential equations- Method of separation of variables for second order equations- Applications of Partial Differential Equations- One dimensional wave equation – One dimensional heat equation- Steady State two dimensional Heat equation (or Laplace equation).

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 35th Edition,
2. Numerical Methods, S. S. Sastry – PHI Publications

Reference Books:

1. Numerical Methods, E. Balaguruswamy, Tata-Mc Graw Hill
2. Numerical Methods, SRK Iyengar & RK Jain, New Age International Publishers
3. Ordinary and Partial Differential Equations: Theory and Applications, Shah and Nita H,PHI Publications.

MATERIALS TECHNOLOGY

B.Tech II Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding basic structure of metals and its relation to properties.
2. Applying the concepts of phase rules for building equilibrium diagrams.
3. Analyzing the effect of alloying elements on the microstructure during heat treatment.
4. Evaluation of the properties of different materials used in various engineering applications.

UNIT - I

Structure of Metals: Crystal structures-BCC, FCC and HCP, Crystal imperfections – point, line, surface and volume imperfections. Atomic diffusion: Phenomenon, Fick's laws of diffusion, Factors affecting diffusion.

Mechanical Behavior of Materials: Stress-Strain diagram for ductile and brittle materials, Fatigue: Description of the phenomenon, S-N diagram. Creep: Description of the phenomenon, creep curve.

UNIT – II

Phase Diagrams: Necessity of alloying, Hume - Rothery rules, Types of solid solutions, Phase rule. Construction and interpretation of phase diagrams, Lever rule, Binary phase diagrams, Isomorphous, Eutectic, Eutectoid, Peritectic, Peritectectoid transformations with examples. Detailed study of Iron-Carbon phase diagram and different phases with microstructures. Identification of zones of steel and cast iron in the diagram.

UNIT - III

Heat Treatment: Principles of heat treatment, Annealing, Normalizing, Hardening and Tempering. TTT curves, Continuous Cooling curves, Austempering, Martempering, Hardenability, Effect of Alloying elements.

Surface Hardening Methods: Carburizing, Nitriding, Cyaniding, Chromizing, Siliconizing, Flame hardening, Induction hardening and Age hardening.

UNIT – IV

Ferrous Materials: Classification of steels: Plain, low alloy and high alloy steels including stainless steels, tool steels and die steels. Cast Iron: Properties, composition and uses of grey cast iron, malleable iron, SG iron.

Non-Ferrous Materials: Properties, composition and uses of copper and its alloys, Aluminium and its alloys, Al-Cu, Al-Si, Al-Zn alloys, Titanium and its alloys.

UNIT - V

Ceramic Materials and Polymers: Crystalline ceramics, glasses, Cermets: Structure, properties and applications. Classification, Properties and Applications of Polymers.

Composite Materials and Nanomaterials: Classification, properties and applications of composites. Nanomaterials and High entropy alloys.

TEXT BOOKS:

1. Foundations of Materials Science and Engineering, Smith, 4th Edition, McGraw Hill, 2009.
2. Material Science and Engineering and Introduction, William D. Callister, Wiley, 2006.

REFERENCES:

1. The Science and Engineering of Materials, Donald R. Askland and Pradeep.P.Phule, Cengage Learning, 4lh Ed., 2003.
2. Materials Science and Engineering, V.Raghavan, PHI, 2002
3. Mechanical Metallurgy, George Ellwood Dieter, McGraw-Hill.
4. Engineering Materials and Metallurgy, U.C. Jindal, Pearson, 2011.

MECHANICS OF SOLIDS

L	T	P	C
3	1	0	4

B.Tech II Year I Semester

Course Outcomes:
1. Understanding different stresses in structural members.
2. Determining the stress pattern and deflections when subjected to various types of loads.
3. Analyse and design structural members, thin and thick cylinders.
4. Evaluate the strains and deformation that will result due to elastic stresses.

UNIT – I
Simple Stresses & Strains:
Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel –Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic module & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, Impact and shock loadings.

UNIT – II
Shear Force and Bending Moment:
Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure

UNIT – III
Flexural Stresses:
Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = F/Y = E/R$ Neutral axis –Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections.
Shear Stresses:
Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV
Principal Stresses and Strains:
Introduction-stress on an inclined section of a bar under axial loading- compound stresses- Normal and tangential stresses on an inclined plane for biaxial stresses by using Mohr's circle method
Deflection of Beams:
Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads and U.D.L

UNIT – V
Thin Cylinders:
Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders
Thick Cylinders:
Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

TEXT BOOKS:

1. Engineering Mechanics of Solid, Egor P., Popov, PHI New Delhi, 2001
2. Strength of Materials, W.A Nash , TMH

REFERENCES:

1. Strength of Materials, R.Subramanian, Oxford University Press.
2. Mechanics of Materials, Ferdinad P. Been, Russel Johnson Jr and John J. Dewole, TMH, New Delhi, 2005
3. Fundamentals of Solid Mechanics, M.L. Gambhir, PHI.
4. Strength of Materials, S.S. Rattan, Mc Graw Hill.

THERMODYNAMICS

L	T	P	C
3	0	0	3

B.TECH II Year I Semester

Course Outcomes:

1. Understand the concept of classical thermodynamics and the laws governing thermodynamics.
2. Applying the laws of thermodynamics to various engineering applications.
3. Analyze the thermodynamic cycles for engineering applications.
4. Evaluate the performance of energy conversion devices.

UNIT – I

Introduction: Basic Concepts: System, Control volume, Surrounding, boundaries, Universe. Types of systems, Macroscopic and Microscopic view points, Concept of Continuum. Thermodynamic Equilibrium, state, Property, Process, Cycle – Reversibility – Quasi – static Process, irreversible process, Causes of irreversibility – Energy in state and Transition, Types , Work and heat, Point and path function. Zeroth Law of Thermodynamics – Concept of quality of temperature – Principles of Thermometry – Reference points – Constant. Volume gas thermometer – Scales of temperature, Ideal gas scale.

First Law of Thermodynamics – Corollaries – First law applied to a process – applied to a flow system – Steady flow energy equation.

UNIT – II

Second Law of Thermodynamics - Limitations of the first law – Thermal Reservoir, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvin planck and Clausius Statements and their Equivalence/ Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of temperature, Clausius inequality.
Entropy - Principle of Entropy increase – Energy equation, Availability and irreversibility – Thermodynamic Potentials, Gibbs and Helmhoultz functions, Maxwell Relations, Tds equations – Elementary Treatment of the third law of thermodynamics.

UNIT – III

Pure Substances - P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables, Mollier charts – Various thermodynamic processes, Joules Thomson co-efficient – Steam calorimetry.

UNIT –IV

Perfect Gas Laws – Equation of State, specific and universal Gas constants – various Non-flow processes, properties, end states, Heat and work Transfer, changes in internal energy – Throttling and free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander walls Equation of State – Compressibility charts – variable specific Heats – Gas tables.

Mixtures of Perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant. Molecular internal Energy, Enthalpy, specific. Heats and Entropy of Mixture of perfect Gases.

UNIT – V

Power Cycles : Otto, Diesel and Dual combustion cycles, – comparison, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis.

TEXT BOOKS:

1. Engineering Thermodynamics, PK Nag, TMH.
2. Thermodynamics, An Engineering Approach, Yunus Cengel & Boles, TMH

REFERENCES:

1. Thermodynamics for Engineers, Kenneth A. Kroos & Merle C. Potter, Cengage
2. Engineering thermodynamics, P. Chattopadhyay, Oxford University press
3. Engineering Thermodynamics, Jones & Dugan, PHI
4. Thermodynamics, J.P Holman, McGrawHill

PRODUCTION TECHNOLOGY

B.TECH II Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Appreciating the concepts of different production processes.
2. Predict the process variables to produce defect free products.
3. Design the gates, risers, dies and other tools employed in the manufacturing of products.
4. Evaluate the production processes for their consequent applications in the production of different components.

UNIT I

Casting: Steps involved in making a casting, Advantages of casting and its applications. Patterns and pattern making – types of patterns, materials used for patterns, pattern allowances. Principles of gating – gating ratio and design of gating systems, Risers – types, function and design. Solidification of casting.

Special casting processes – centrifugal, die-casting and investment; Fettling of casting, casting defects – causes and remedies.

UNIT II

Welding: classification of welding processes, types of welded joints and their characteristics.

Arc welding – types, gas welding –equipment and types of flames, Resistance welding- types, Solid -state welding – types, Thermit welding.

Heat affected zones in welding, welding defects – causes and remedies, Destructive and Non-destructive tests of welds.

UNIT III

Metal Forming: hot working and cold working, strain hardening, recovery, recrystallization and grain growth.

Rolling – theory of rolling, types of rolling mills and products, forces in rolling and power requirements.

Forging – tools and dies, types of forging – smith forging, drop forging, roll forging and rotary forging, forging defects.

UNIT IV

Extrusion and Drawing : Basic Extrusion process and it's characteristics, hot extrusion and cold extrusion, forward extrusion and backward extrusion, Impact extrusion, Hydrostatic extrusion.

Drawing and its types – wire drawing and tube drawing.

Sheet metal operations –spring back effect, stamping operations – blanking, piercing, coining, embossing, bending and spinning.

UNIT V

High Velocity Forming: Explosive forming, Hydraulic forming, Magnetic pulse forming high velocity forming.

Plastics: Types, properties, applications and their processing methods.

TEXT BOOKS:

1. Manufacturing Technology, P N Rao Vol. 1, TMH.
2. Manufacturing Engineering & Technology, Serope Kalpakjian, Steven R. Schmid, Pearson

REFERENCES:

1. Production Technology, R K Jain, Khanna.
2. Introduction to Manufacturing Process, John A Chey, Mc Graw Hill
3. Principles of Metal Castings, Rosenthal, Mc Graw Hill.
4. Workshop Technology, Hazra Chowdry, Vol.1, Standard Publishers.

PROFESSIONAL COMMUNICATION

L	T	P	C
2	0	0	2

II Year I Semester

Course Outcomes:

1. Acquire enhanced personality
2. Exhibit appropriate professional etiquette
3. Practice team building with strong communication skills
4. Develop problem solving skills and decision-making
5. Demonstrate effective presentation skills

UNIT-I:
Self-Appraisal:

Self-Introspection/ Self Retrospection
Introducing self & others
Goal setting
SWOT Analysis,

UNIT- II:
Professional Etiquette:

Etiquette-Telephone Etiquette- Netiquette
Email, Social Network
Behavioural Traits
Case study

UNIT-III:
Team Building:

Leadership skills-Case Studies
Team Essentials
Negotiation Skills
Group Discussion-Functional Aspects

UNIT-IV:
Logical Thinking and Analytical Reasoning:

Decision Making
Problem Solving
Conflict management
Case Study

UNIT-V:
Presentation Skills:

Poster Presentation
Oral Presentation-Individual Presentation, Team Presentation, Thematic Presentation

Textbooks:

1. Effective Technical Communication, Ashrif Rizvi. Tata Mc Gahill, 2011

Reference Books:

1. Speaking and Writing for Effective Business, Soundaraja, MACMILLAN, 2010.
2. English for Professional Success, Hector Sanchez, THOMSON, 2010.

METALLURGY AND MECHANICS OF SOLIDS LAB

L	T	P	C
0	0	2	1

B.Tech II Year I Semester

Course Outcomes:

1) Understand and identify microstructure of metals and measure their mechanical properties.
2) Analyze the microstructure and mechanical properties of metals by applying metallurgical principles.
3) Compare the hardness and mechanical properties of treated and untreated steels tested.

(A) Metallurgy Lab:

1. Preparation and study of the Microstructure of pure metals like iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steel, low carbon steels, highCarbon steels.
3. Study of the Microstructure of Cast irons.
4. Study of the Microstructure of Non-Ferrous alloys.
5. Study of the Microstructure of Heat treated steels.
6. Hardenability of steels by Jominy End Quench test.
7. To find out the hardness of various treated and untreated steels.

(B) Mechanics of Solids Lab:

1. Direct tension test
2. Bending test on
   i. Simple supported
   ii. cantilever beam
3. Torsion test
4. Hardness test a) Brinell's hardness test, b) Rockwell hardness test.
5. Test on springs
6. Impact test

NOTE: Any 10 experiments from the above are to be performed taking at least 4 from each section.

REFERENCES:

1. Metallurgy and Material science, Raghavan, Prentice Hall of India (P) ltd.

PRODUCTION TECHNOLOGY LAB

L	T	P	C
0	0	2	1

B.TECH II Year I Semester

Course Outcomes:
1. Understand the operating methods of welding mechanical press and moulding machines.
2. Measuring the properties of moulding sand.
3. Evaluate the quality of welded joints and products made by mechanical press.

I. Metal Casting Lab:
1. Pattern Design and making – for one casting drawing.
2. Sand properties testing – Exercise for strengths and permeability
3. Moulding Melting and Casting

II. Welding Lab:
1. Spot Welding
2. Gas Welding
3. Soldering and Brazing

III. Mechanical Press Working:
1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing.
3. Bending operations.

IV. Processing of Plastics:
1. Injection Moulding
2. Blow Moulding

REFERENCES:

1. Manufacturing Technology, P.N.Rao,TMH.

ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

B.TECH II Year I Semester

Course Outcomes

1. Define and explain the structure and functions of ecosystem, value of biodiversity, threats and conservation of biodiversity.
2. Explain the limitations of the resources and impacts of over utilization of all natural resources.
3. Explain the sources and effects of environmental pollutions and list the available techniques to control the pollution.
4. Explain the global environmental issues like climate change, ozone hole and can explain the scope of EIA, Environmental Management Plan, and environmental audit and list the EIA methods.
5. Mention the salient features of environmental acts and rules, define the sustainable goals along with measures required for the sustainability.

UNIT- I

Ecosystem: Definition, Scope and Importance of ecosystem, Structure and Functions of ecosystem: Food chains, Food Web and Ecological Pyramids, Flow of energy; Bio-magnification.

Biodiversity and Biotic Resources: Introduction, Definition, levels of Biodiversity, Value of biodiversity, Hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity: In-Situ and Ex-situ conservation.

UNIT- II

Natural Resources: Classification of Resources, **Water resources**: use and over utilization of surface and ground water, Dams: benefits and problems, Rain water harvesting; **Energy resources**: growing energy needs, Renewable and Non Renewable Energy resources. **Land resources**: land degradation – Landslide and Soil Erosion; **Forest Resources –** Uses and Exploitation.

UNIT- III

Environmental Pollution And Control: Types of Pollution, Sources, Effects and Control measures of Air Pollution, WaterPollution, Soil Pollution and Noise Pollution.

UNIT- IV

Global Environmental Problems and Global Efforts: Greenhouse effect, Global Warming, climate change and their impacts on human environment; Ozone depletion and Ozone depleting substances (ODS); Aid Rains.

Environmental Impact Assessment (EIA): Scope of EIA and EIA methods, scope of Environmental audit and Environmental Management Plan.

UNIT- V

Environmental Policy, Legislation, Rules And Regulations: Salient features of Environmental Protection act, Air (Prevention and Control of pollution) Act- 1981, Water (Prevention and Control of pollution) Act-1974, Forest Conservation Act, Municipal solid waste, Hazardous waste, E-waste, Bio-medical waste, Radioactive waste Rules.

Towards Sustainable Future: Concept of Sustainable Development, Sustainable goals defined by UN, Threats to Sustainability, Environmental Education, Role of IT in Environment, Smart Cities, Concept of Green Building, Low Carbon Lifestyle, Life cycle assessment and Ecological Foot Print.

TEXT BOOKS:

1. Text Book of Environmental Studies by Anubha Kaushik (4^{th} Edition), New age International Publishers.
2. Environmental studies by Erach Bharucha 2005, University Grants Commission, and University Press.

REFERENCES:

1. Text book of Environmental Science and Technology by M.Anji Reddy 2007
2. Environmental Science: Towards a Sustainable Future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.

PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

II Year II Semester

Course Outcomes:

1. To differentiate among random variables involved in the probability models which are useful for all branches of engineering.
2. Derive relationship among variety of performance measures using probability distributions.
3. Acquire elementary knowledge of parametric and non-parametric –tests and understand the use of observing state analysis for predicting future conditions.
4. Identify and examine situations that generate using problems and able to solve the tests of ANOVA for classified data.
5. Apply proper measurements, Indicators and techniques of Correlation and regression analysis.

UNIT-I:

Probability and Random Variables:

Introduction to Probability, Random variables- Discrete and Continuous, Expectation, Probability Distribution Function, Mass Function/ Density Function of a Probability Distribution.

UNIT-II:

Probability Distributions:

Fitting of Binomial, Poisson & Normal distributions and their properties (only Statements) Moment Generating Functions of the above three distributions and hence finding the mean and variance.

UNIT-III:

Sampling Theory & Testing of Hypothesis I:

Sampling Distribution-Definition of Sample, Population, and Types of Sampling. Estimation-Point estimation, Interval estimation, Testing of Hypothesis- Null hypothesis – Alternative hypothesis, Type I, & Type II errors – critical region confidence interval for mean, Testing of hypothesis for single mean and difference between the means for large samples.
Confidence interval for the proportions, Tests of hypothesis for the proportions- single and difference between the proportions for large samples

UNIT-IV:

Testing of Hypothesis II:

Small Samples - t-distribution, F-Distribution, χ^2 distribution, ANOVA for one-way classified data

UNIT-V:

Correlation, Regression & Curve Fitting:

Coefficient of Correlation-Regression coefficients- The lines of Regression- the Coefficient of Rank Correlation.
Curve Fitting- Fitting a Straight line- Second Degree Polynomial- Exponential, Power Curve by Method of Least Squares.

Textbooks:

1. Probability and Statistics for Engineers,Richard Arnold Johnson, Irvin Miller and John E Freund, New Delhi Prentice Hall.
2. Introduction to Probability & Statistics for Engineers and Scientists, Sheldon M.Ross.

Reference Books:

1. An Introduction to Probability and Statistics, 2nd,Vijay K. Rohatgi, A.K. Md. Ehsanes Saleh, Weley.
2. Probability & Statistics for Engineers & Scientists, Walpole, Myers.et.al, Prentice Hall.
3. Fundamentals of probability and statistics for engineers, T T Soong, Weley.

BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes:

1. Understand the fundamentals of basic circuit components and their characteristics.
2. Analyze basic electrical circuits with A.C excitation.
3. Understand the concepts of magnetic circuits and transformers.
4. Acquire the basic concepts of electrical motors.
5. Understand the concept of A.C generator and low voltage electrical installations.

UNIT I
INTRODUCTION TO ELECTRICAL ENGINEERING AND DC CIRCUITS:
Basic definitions, types of elements, types of sources, Kirchhoff's Laws, resistive networks, inductive networks, series, parallel circuits, Star- Delta and Delta- Star transformation, Network theorems- Superposition, Thevenin's - simple problems.

UNIT II
AC CIRCUITS:
Representation of sinusoidal waveforms, peak, rms and average values. Elementary treatment of single-phase AC circuits consisting of R, R-L, R-C, R-L-C combinations (series and parallel). Phase representation, real power, reactive power, apparent power, resonance concept. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III
MAGNETIC CIRCUITS &TRANSFORMERS:

Magnetic Circuits: Magnetic materials, Faraday's laws of Electromagnetic Induction, BH characteristics, Magnetic Circuits - concept of Self & Mutual Inductance.
Transformers: Ideal and practical single phase transformer, OC-SC tests, equivalent circuit, losses in transformer, regulation and efficiency - simple problems.

UNTI IV
DC MACHINES AND INDUCTION MOTORS:

DC Machines: Construction, Principle and Operation of DC Motor, Voltage- torque equations - simple problems
Three Phase Induction Motor: Construction, Principle and working of three phase Induction Motor, torque slip characteristics, -simple problems.
Single Phase Induction Motor: Single phase Induction Motor construction and working principle, capacitor start- applications

UNIT V

AC GENERATOR & ELECTRICAL INSTALLATION:

AC Generator: Construction, Principle of operation of Synchronous Generator, Pitch Factor-Distribution Factor (or winding factor) - EMF equation – simple problems.

Electrical Installation: Fuse, Circuit breakers, difference between fuse and circuit breaker, Types of Batteries, battery backup.

TEXT BOOKS:

1. Basic Electrical Engineering, D.P Kothari & I.J Nagrath, Tata McGraw Hill Publishing Company Limited-2nd Edition.
2. Basic Electrical Engineering, T.K. Nagsarkar and M.S. Sukhija, Oxford University Press-3rd Edition.

REFERENCE BOOKS:

1. Circuits and Networks, A.Sudhakar & Shyam Mohan.S, Tata McGraw Hill Publishing Company limited, 5th Edition.
2. Basic Electrical Engineering, K.Uma Rao and A.Jayalakshmi, Pearson Publications.
3. Basic Electrical Engineering, D C Kulshreshtha, McGraw Hill Education Private limited, 1st Edition.

MACHINE DRAWING & DRAFTING

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes

1. Prepare the engineering drawings by employing conventional representation.
2. Develop the assembly drawings using part drawings of machine components.
3. Applying the drawing practice using solid works software.

PART-A:

Drawing of Machine Components:

1. Conventional representation of materials, machine components and popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Riveted joints for plates : chain and Zig-Zag
4. Shaft couplings: flanged coupling, flexible coupling, universal coupling, oldham coupling
5. Journal, Bushed journal bearing and Foot step bearings.

PART-B:

Assembly Drawing Practice:

Draw different views of assembly drawings

1. Steam engine parts – stuffing box, steam engine cross head, Eccentric.
2. Machine tool parts: Tail stock, Square Tool Post, Machine Vice.
3. Other machine parts - Screw jack, Pipe vice, Plummer block, Connecting rod.
4. Machine drawing practice using SOLIDWORKS software.

TEXT BOOKS:

1. Machine Drawing, K.L Narayana, P.Kannaiah & K.Venkata Reddy, New Age publishers.
2. Machine Drawing, N.D Bhatt, Charotar

REFERENCES:

1. Machine Drawing, P.S. Gill, Kataria & Sons Publishers
2. Machine Drawing, Luzzader, PHI
3. Machine Drawing, Ajeet Singh, TMH.
4. A Textbook of Machine Drawing, R. K. Dhawan, S. Chand.

KINEMATICS OF MACHINERY

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes:

1. Identifying mechanisms based on their form and motion.
2. Computing the velocity, acceleration of the links for subsequent designing.
3. Design and analyse different mechanisms for optimal functioning.
4. Evaluate the relative motions obtained by the mechanisms for application in mechanical engineering components.

UNIT-I

Mechanisms: Elements or links – Classification – Rigid Link, Flexible and fluid link – Types of kinematic pairs – Types of constrained motion – kinetic chain. Mechanism - machine – Structure – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical advantage – Grubler's Criterion.
Straight-Line Motion Mechanism: Exact and approximate copied and generated types – Peaucellier- Hart – Scott Russel – Grasshopper – Watt – Tchebicheff's and Robert Mechanism – Pantographs

UNIT-II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.
Plane Motion of Body: Instantaneous center of rotation – centrodes and axodes – Three centers in the theorem - Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.
Kliens construction – Coriolis acceleration – Determination of Coriolis component of acceleration.

UNIT-III

Steering Gears: Conditions for correct steering – Davis Steering gear, Ackermann's Steering gear.
Hooke's Joint: Single and double Hooke's joint – velocity ratio – application – problems

UNIT-IV

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases.
Analysis of Motion of Followers: Tangent cam with Roller follower.

UNIT-V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.
Gear Trains: Introduction – Types – Simple – Compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box – Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines, Thomas Bevan, CBS
2. Theory of Machines, Rattan .S.S, TMH, 2009 Edition

REFERENCES:

1. Kinematics and Dynamics of Machinery, Charles E. Wilson, J. Peter Sadler, Pearson
2. Mechanism and Machine Theory, JS Rao and RV Dukkipati, NewAge
3. Theory of Machines and Mechanisms, Joseph E. Shigley, Oxford.
4. Kinematics & Dynamics Of machinery, Norton, Mc Graw Hill

THERMAL ENGINEERING

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes

1. Understand the concepts of power cycles and working principles of IC engines.
2. Analyze the fuels and their combustion phenomenon in engines.
3. Synthesize the alternate fuels and their applications in engines with advanced features.
4. Evaluate the performance of IC engines under the operating conditions.

UNIT – I

I.C. Engines: Introduction- Classification- Valve and Port Timing Diagrams

Fuel Air Cycles and Their Analysis

Introduction- Significance- Composition of cylinder gases- Variable specific heats- Dissociation- Effect of number of moles- Comparison of Air Standard and Fuel Air Cycles- Effect of operating variables

Actual Cycles and Their Analysis

Introduction- Comparison between Air Standard and Actual Cycles- Time Loss Factor- Heat Loss Factor- Exhaust blow down- Loss due to Rubbing Friction- Actual and Fuel-Air Cycles of I.C. Engines.

UNIT – II

Combustion in S.I. Engines

Homogeneous mixture- Heterogeneous mixture- Stages of combustion- Flame front propagation- Factors influencing the flame speed- Rate of pressure rise- Abnormal combustion- Phenomenon of Knock- Types of Combustion chambers- Fuel requirements and fuel rating

UNIT – III

Combustion in C.I Engines

Combustion process- stages of combustion- Delay period and its importance- Factors affecting Delay period- Diesel Knock- Comparison of Knock in C.I and S.I engine- Combustion chambers in C.I. Engine- Fuel requirements and fuel rating

UNIT – IV

Measurements and Testing

Friction power- Indicated power- Brake power- Fuel consumption- Air consumption- Speed- Exhaust and Coolant temperature

Performance Parameters and Characteristics

Introduction- Engine power- Engine efficiencies- Engine Performance characteristics- Variables affecting Performance characteristics- Methods of improving engine performance- Heat balance

UNIT-V

Fuels

Classification of fuels- Complete combustion equation- Air fuel ratio and equivalence ratio- Flue gas analysis- Enthalpy of formation- Adiabatic flame temperature

Alternate Fuels

Liquid fuels: Alcohol- Methanol- Ethanol- Gaseous fuels: Hydrogen-Natural gas- CNG-LPG

Recent trends in IC Engines: HCCI, VTC, VVT, VCR engines

TEXT BOOKS:

1. I.C Engines, V. GANESAN, TMH
2. I.C Engines, Heywood, Mc GrawHill.

REFERENCES:

1. IC Engines, Mathur & Sharma, Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines, Pulkrabek, Pearson, PHI
3. High Speed Combustion Engines, Heldt P.M., Oxford & IBH.
4. Internal Combustion Engines & Air Pollution, R. Yadav, Central Book Publishers

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

L	T	P	C
3	0	0	3

B.TECH II Year II Semester

Course Outcomes

1. Understand the basic static, kinematic and dynamic principles of fluid flow.
2. Compute drag and lift co-efficient using the theory of boundary layer flows.
3. Develop the performance equations of hydraulic machines under different input parameter.
4. Evaluate the performance of hydraulic machines for various engineering applications.

UNIT – I

Fluid Properties and Fluid Statics: Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Surface tension Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Hydro static law, Piezometer, Simple and differential manometers.

UNIT - II

Fluid Kinematics: Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows.

Fluid Dynamics: Surface and Body forces, Euler's and Bernoulli's equation derivation, Application of Bernoulis Equation: Venturimeter, Orifice meter, Pitot tube, Navier stokes equation (explanation only), Momentum equation – applications.

UNIT - III

Close Conduit Flow: Reynolds Experiment, Darcy's equation, Minor losses - pipes in series, pipes in parallel, total energy line and hydraulic gradient line, numerical problems.

Boundary Layer Concepts: Definition, thickness, characteristics along thin plate, laminar and turbulent layers (No Derivation) boundary layer in transition, and separation of boundary layer submerged objects drag and lift.

UNIT – IV

Impact of Water Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and a tip-velocity triangles at inlet and outlet expressions for work done and efficiency, Series vanes, Radial flow turbines.

Hydraulic Turbines: Overshot and undershot water wheels, classification of Water turbines, Pelton Wheel, work done and working proportions, Francis, Kaplan turbines, draft tubes, types & its efficiency.

Performance of Turbines: Performance under unit head, unit quantities, performance under specific conditions, specific speed, performance characteristic curves, model testing of turbines, cavitation, governing of turbines, surge tanks. Water hammer.

UNIT – V

Centrifugal Pumps : Types Component parts and working, work done by the impeller, Manometric head losses and efficiencies, minimum starting speed, loss of head due to reduced or increased flow, diameters of impeller and pipes, Specific speed, Model testing of pumps, Multistage Pumps, Pumps in parallel, performance of pumps, characteristics curves, NPSH, Cavitation, priming devices, pump troubles and remedies.

Reciprocating Pumps: Main components and working of a reciprocating pump, types of reciprocating pumps, power required driving the pump, coefficient of discharge and slipping indicator diagram.

TEXT BOOKS:

1. Fluid mechanics and Hydraulics Machinery MODI and SETH. Rajsons Publication.
2. Fluid Mechanics, John F.Douglas, Janusz M. Gasiorek, John A. Swaffield, Lynne B. Jack, Pearson

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering, D.S Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age International.
3. Fluid Mechanics F.M.White, Mc Graw Hill.
4. Hydraulic Machines, Banga & Sharma, Khanna Publishers.

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

L	T	P	C
0	0	2	1

B.TECH II Year II Semester

Course Outcomes

1. Understanding the operating steps of machines.
2. Measuring the performance of hydraulic machines under different loads.
3. Evaluate the parameters discharge, friction and compared vis-a-vis with theoretical values.

LIST OF EXPERIMENTS:

1. Impact of jets on Vanes
2. Performance test on Pelton wheel
3. Performance test on Francis Turbine
4. Performance test on Kaplan Turbine
5. Performance test on single stage centrifugal pump
6. Performance test on Multi stage centrifugal pump
7. Performance test on Reciprocating pump
8. Calibration of Venturimeter
9. Calibration of Orifice meter
10. Determination of friction factor for a given pipe line
11. Determination of loss of head due to sudden contraction in a pipeline
12. Verification of Bernoulli's theorems

NOTE: Any 10 of the above experiments are to be performed

REFERENCES:

1. Fluid Mechanics and Fluid Machinery, Modi & Seth, SBH Publication

BASIC ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

B.TECH II Year II Semester

Course Outcomes:

1. Get an exposure to basic electrical laws.
2. Understand the response of different types of electrical circuits to different excitations.
3. Understand the measurement, calculation and relation between basic electrical parameters.
4. Understand the performance characteristics of D.C electrical machines.
5. Understand the performance characteristics of A.C electrical machines

List of experiments/ demonstrations:

Any 5 experiments from Part A and Part B should be conducted (Total 10 Experiments)

Part A

1. Verification of Ohms law
2. Verification of KVL and KCL
3. Verification of Thevenin's Theorem
4. Verification of Superposition Theorem
5. Transient Response of Series R- L and R - C circuits using DC excitation
6. Determination and Verification of Impedance and Current of RL and RC series circuits

Part B

1. Transient Response of R-L-C Series circuit using DC excitation
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. OC & SC Test on Single phase transformer
4. Brake test on DC shunt motor
5. Brake test on Three Phase Squirrel cage induction motor.
6. OCC of Three phase alternator.

REFERENCE BOOKS:

1. Circuits and Networks, A.Sudhakar & Shyam Mohan.S, Tata McGraw Hill Publishing Company Limited, 5th Edition.
2. Basic Electrical Engineering , by T.K. Nagsarkar and M.S. Sukhija, Oxford University Press, 3rd Edition
3. Basic Electrical Engineering , D.P Kothari & I.J Nagrath, Tata McGraw Hill Publishing Company Limited, 2nd Edition

GENDER SENSITIZATION

II Year II Semester

L	T	P	C
2	0	0	0

Course Outcomes:

1. To develop awareness about gender discrimination and take measurable steps to counter it.
2. To identify the basic dimensions of biological, sociological, psychological and legal aspects of gender.
3. To acquire knowledge about gendered division of labour in relation to politics and economics.
4. To prepare the students against gender violence.
5. To prepare the students to work and live together as equals.

UNIT-I:

Understanding Gender:

Gender: Why Should We Study It?

Socialization: Making Women, Making Men

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT-II:

Gender and Biology:

Missing Women: Sex Selection and Its Consequences

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary

Two or Many? Struggles with Discrimination.

UNIT-III:

Gender and Labour:

Housework: the Invisible Labour

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV:

Issues of Violence:

Sexual Harassment: Say No!

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking Out
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.
Thinking about Sexual Violence
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT-V:

Gender: Co– Existence:
Just Relationships: Being Together as Equals
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

Textbooks:

1. **Towards a World of Equals: A Bilingual TextbookonGender**, A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote,Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu Published by **Telugu Akademi, Hyderabad**,Telangana State,**2015**.

Reference Books:

1. Seeing like a Feminist, Menon, Nivedita, New Delhi, Zubaan, Penguin Books, 2012.
2. I Fought For My Life…and Won, Abdulali Sohaila,.

B.TECH III Year I & II Semester

B.TECH III Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	H&S – 2	Managerial Economics and Financial Analysis	4	0	0	3
2	PC – 8	Dynamics of Machinery	3	0	0	3
3	PC – 9	Design of Machine Members-I	3	0	0	3
4	PC - 10	Applied Thermodynamics	3	0	0	3
5	PE - 1	Automobile Engineering Composite Materials Additive Manufacturing	3	0	0	3
6	OE – 1	Elements of Mechanical Engineering Product Engineering	3	0	0	3
7	PC Lab – 5	Thermal Engineering Lab	0	0	2	1
8	H & S Lab	Advanced Communication Skills Lab	0	0	2	1
9	MC – 3	Quantitative Methods & Logical Reasoning	2	0	0	1
Total Number of Credits			**21**	**0**	**4**	**21**

B.TECH III Year II Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 11	Design of Machine Members-II	3	0	0	3
2	PC – 12	Heat Transfer	3	0	0	3
3	PC – 13	Metrology & Machine Tools	3	0	0	3
4	PC – 14	Finite Element Method	3	0	0	3
5	PE – 2	Refrigeration And Air Conditioning Industrial Management Automation In Manufacturing	3	0	0	3
6	OE – 2	Optimisation Techniques Maintenance and Safety Engineering	3	0	0	3
7	PC Lab – 6	Heat Transfer Lab	0	0	2	1
8	PC Lab – 7	Metrology & Machine Tools Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioural Skills	2	0	0	1
Total Number of Credits			**20**	**0**	**4**	**21**

B.TECH III Year II Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 11	Design of Machine Members-II	3	0	0	3
2	PC – 12	Heat Transfer	3	0	0	3
3	PC – 13	Metrology & Machine Tools	3	0	0	3
4	PC – 14	Finite Element Method	3	0	0	3
5	PE – 2	Refrigeration And Air Conditioning Industrial Management Automation In Manufacturing	3	0	0	3
6	OE – 2	Optimisation Techniques Maintenance and Safety Engineering	3	0	0	3
7	PC Lab – 6	Heat Transfer Lab	0	0	2	1
8	PC Lab – 7	Metrology & Machine Tools Lab	0	0	2	1
9	MC – 4	Personality Development & Behavioural Skills	2	0	0	1
10	PC– 18	Production Planning & Control	3	0	0	3
Total Number of Credits			**23**	**0**	**4**	**24**

MANAGERIAL ECONOMICS & AND FINANCIAL ANALYSIS

B.TECH III Year I Semester

L	T	P	C
4	0	0	3

Course Outcomes:

1. Understand the importance of certain basic issues governing the business operations namely demand and supply, production function, cost analysis.
2. Apply managerial tools and techniques in obtaining optimal solutions for business problems.
3. Differentiate the various forms of business organizations.
4. Evaluate and interpret the financial statements of companies using ratios.
5. Apply the methods of capital budgeting in effective investment decision making.

UNIT –I:
Introduction to Managerial Economics& Demand Analysis:

Definition, Nature and Scope of Managerial Economics.Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT –II:
Production & Cost Analysis:

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts (Opportunity cost vs outlay costs, Fixed, variable and semi variable costs, marginal cost vs average cost, out of pocket vs book cost, imputed cost, implicit & explicit cost, incremental and decremental cost, sunk vs future cost, separable and joint costs) Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT –III:
Markets & New Economic Environment:

Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organization: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

UNIT –IV:
Introduction to Financial Accounting & Financial Analysis:

Accounting concepts and Conventions - Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis: Analysis and Interpretation of Liquidity Ratios (current ratio, quick ratio), Activity Ratios(inventory turnover ratio, debtors turnover ratio), and Capital structure Ratios(debt equity ratio, interest coverage ratio) and Profitability ratios(gross profit ratio, net profit ratio, operating profit ratio, P/E ratio, EPS). Du Pont Chart.

UNIT –V:

Capital Budgeting

Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital, Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) ,Net Present Value Method (simple problems), IRR and PI method.

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
2. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.

REFERENCES:

1. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
2. Narayanaswamy: Financial Accounting—A Managerial Perspective, Pearson, 2012.
3. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
4. Dwivedi: Managerial Economics, Vikas, 2012.
5. Kasi Reddy, Saraswathi, MEFA, PHI Learning, 2012.

DYNAMICS OF MACHINERY

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:
1. Understanding the behavior of members of machines under the influence of forces.
2. Compute the magnitude of forces, couples in each of the links of machines.
3. Analyze the effect of forces on each link and hence the overall effect on the machinery.
4. Evaluation of the forces and couples in members for application in the design of machine members.

UNIT – I

Precession: Gyroscopes, effect of precession, motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Brakes and Dynamometers: Simple block brakes, internal expanding brake, band brake of vehicle, Dynamometers absorption and transmission types.

UNIT –II

Clutches: Friction clutches Single Disc or plate clutch, Multiple Disc clutch, Cone clutch, Centrifugal clutch.

Governors: Watt, Porter and Proell governors, spring loaded governors Hartnell and Hartung with auxiliary springs, Sensitiveness, isochronisms and hunting.

UNIT – III

Static and Dynamic Force Analysis of Planar Mechanisms: Introduction Free Body Diagrams Conditions for equilibrium two, three and four force Members Inertia forces and D' Alembert's Principle – planar rotation about a fixed center.

Turning Moment Diagram and Fly Wheels: Turning moment inertia Torque, connecting rod angular velocity and acceleration, crank effort and torque diagrams Fluctuation of energy fly wheels and their design.

UNIT –IV

Balancing: Balancing of rotating masses, single and different planes. Balancing of Reciprocating Masses, Primary and secondary balancing of reciprocating masses. Analytical and graphical methods unbalanced forces and couples Multi cylinder in line and radial engines, balancing of locomotive.

UNIT –V

Vibration: Free Vibration of mass attached to vertical spring Forced damped vibration, Vibration isolation & Transmissibility Whirling of shafts, critical speeds, Torsional vibrations of two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines, S.S. Ratan, Mc Graw Hill.
2. Theory of Machines, Shigley, Mc Graw Hill.

REFERENCES:

1. Theory of Machines, Sadhu Singh, Pearson
2. Kinematics and Dynamics of Machinery, R.L.Norton, Mc Graw Hill.
3. Theory of Machines, Thomas Bevan, CBS Publishers
4. Mechanism and Machine Theory, JS Rao and RV Dukkipati , Newage

DESIGN OF MACHINE MEMBERS-I

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

NOTE: Design Data books are not permitted in the Examinations.

Course Outcomes

1. Understanding the concepts of stresses under different loading conditions.
2. Analyze in terms of loads and criteria of failure with reference to the materials employed.
3. Design the machine members on strength and rigidity conditions.
4. Justifying the design with reference to standard data codes.

UNIT – I

Introduction: General considerations in the design of engineering components Materials and their properties selection manufacturing consideration in design.

Stresses in Machine Members: Simple stresses Complex stresses impact stresses stress strain relations static theories of failure factor of safety Design for strength and rigidity. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II

Stresses Due to Fatigue Loading: Stress concentration Theoretical stress Concentration factor Fatigue stress concentration factor notch sensitivity Design for fluctuating stresses Endurance limit Estimation of Endurance strength Fatigue theories of failure Goodman and Soderberg.

UNIT – III

Riveted Joints: Modes of failure of riveted joints Strength equations efficiency of riveted joints– eccentrically loaded riveted joints.

Welded Joints: Design of Fillet welds axial loads Circular fillet welds bending and torsion eccentrically loaded joints.

UNIT – IV

Bolted Joints: Design of bolts with pre-stresses Design of joints under eccentric loading bolt of uniform strength, Cylinder cover joints.

Axially Loaded Joints: Keys, cotters and Knuckle joints: Design of keys-stresses in keys Cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

UNIT – V

Design of Shafts: Design of solid and hollow shafts for strength and rigidity Design of shafts for complex loads Shaft sizes BIS code Design of shaft for a gear and belt drives.

Design of Shaft Couplings: Rigid couplings Muff, split muff and flange couplings, Flexible couplings Pin Bush coupling.

TEXT BOOKS:

1. Machine Design, V.Bhandari, TMH Publishers
2. Machine Design, R.L.Norton, Mc Graw Hill

REFERENCES:

1. Machine Design, Pandya & Shah,Charotar Publishing House Pvt. Ltd
2. Design of Machine Elements, V.M. Faires, Macmillan Coll Div
3. Design of Machine Elements, Kulkarni, Mc Graw Hill.
4. Shigley's Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Mc Graw Hill.

APPLIED THERMODYNAMICS

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Note: Steam Table Book are Permitted in the Examinations.

Course Outcomes

1. Understand the functionality of major components of steam and gas turbine plants.
2. Apply the laws of thermodynamics and thermodynamics cycles.
3. Compute the magnitude of work, power, efficiency in turbines, compressors and rocket engines
4. Analyze and subsequently evaluate the energy transfer took place in the systems.

UNIT – I

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

Boilers: Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principle. Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance

UNIT – II

Steam Nozzles: Function of nozzle Applications and Types- Flow through nozzles-Thermodynamic analysis-Velocity at nozzle exit-Ideal and actual expansion in nozzle-Condition for maximum discharge- Critical pressure ratio- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson Line

Steam Condensers: Requirements of steam condensing plant Classification of condensers Working principle of different types-Vacuum efficiency and Condenser efficiency Air leakage, sources and its affects, Air pump- Cooling water requirement

UNIT – III

Steam Turbines: Impulse Turbine - Mechanical details - Velocity diagram Effect of friction Power developed, Axial thrust, Blade or diagram efficiency Condition for maximum efficiency, De-Laval Turbine - its features, Methods to reduce rotor speed

Reaction Turbine: Mechanical details Principle of operation, Thermodynamic analysis of a stage, Degree of reaction Velocity diagram Parson's reaction turbine Condition for maximum efficiency.

UNIT-IV

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

Rotary Compressor: Roots blower, vane sealed compressor, Lysholm compressor mechanical details and principle of working efficiency considerations.

Gas Turbines: Simple gas turbine plant Ideal cycle, essential components Parameters of performance Actual cycle Regeneration, Inter cooling and reheatingclosed and Semi-closed cycles.

UNIT – V

Jet Propulsion: Principle of OperationClassification of jet propulsive engines Working Principles with schematic diagrams and representation on T-S diagram Thrust, Thrust Power and Propulsion Efficiency Turbo jet engines Needs and Demands met by Turbo jet Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation Methods.

Rockets: Application Working Principle Classification Propellant Type Thrust, Propulsive Efficiency Specific Impulse Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering, Mahesh M Rathore, Mc Graw Hill
2. Thermal Engineering, Rajput, Lakshmi Publications.

REFERENCES:

1. Thermodynamics and Heat Engines, R. Yadav, Central Book Depot.
2. Thermal Engineering, Ballaney, Khanna Publications.
3. Gas Turbines, V.Ganesan, TMH.
4. Thermal Engineering – R.S. Khurmi & J.S.Gupta, S.Chand Pub

AUTOMOBILE ENGINEERING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the basic structure of an automobile and its functioning
2. Applying mechanical engineering principles and mechanisms in the constructional features of sub systems of an automobile
3. Develop the sub systems keeping in view of their effective working and improved performance of automobile
4. Appraise the automobile emission levels at national and international standards

UNIT – I

Introduction about Evolution of Modern Automobiles- Components of four wheeler automobile rear wheel drive, front wheel drive, 4 wheel drive types of automobile engines.
Engine Lubrication System: Splash and pressure lubrication systems.
Cooling System: Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication system Radiators- Types- Cooling fans Water pumpThermostatEvaporating cooling-Pressure cooling.
S.I. Engines: Fuel supply systems, Mechanical and electrical fuel pump filters carburetor types – air filters – petrol injection. M.P.F.I system, GDI system
C.I. Engines: Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

UNIT--II

Ignition System: Function of an ignition system, battery ignition system, auto transformer, Magneto coil ignition system, electronic ignition system, spark advance and retard mechanism.
Electrical System: Charging circuit, generator, current voltage regulator starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge oil pressure gauge, engine temperature indicator.

UNIT – III

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel gear boxes, types, sliding mesh, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive, torque converter. Propeller shaft Hotch- Kiss drive, Torque tube drive, universal joint, differential, gear axles types wheels and tyres.
Suspension System: Objects of suspension systems rigid axle suspension system, torsion bar, shock absorber, independent suspension system. Chassis-Types-Body of automobile, ergonomics and anthropometry

UNIT – IV

Steering System: Steering geometry – camber, castor, King pin rake, combined angle toe-in, center point steering. Steering gears – types, steering linkages.
Braking System: Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes- Master cylinder, wheel cylinder, Requirements of brake fluid, Pneumatic, vacuum, parking and hand brakes.

UNIT – V

Pressure Changes in Engines Super chargers and turbo chargers

Emission from Automobiles Pollution standards National and international Pollution control Techniques. Noise pollution and controls. Energy Alternatives, Solar, Photo-Voltaic, hybrid vehicles

TEXT BOOKS:

1. Automobile Engineering ,Vol. 1 & Vol. 2 ,Kirpal Singh,Standard Publishers Distributors Delhi
2. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication

REFERENCES:

1. Automotive Mechanics , G.B.S.Narang, Khanna Publishers
2. Automotive Mechanics , J.Heitner, CBS Publications
3. Automobile Engineering, William Crouse, TMHILL Publishers.
4. Automotive Engines , Srinivasan, MCgraw-Hill Education (India) Ltd

COMPOSITE MATERIALS

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1: Understand the concepts of composite materials.
2: Analyze macro and micro mechanical behavior of a lamina
3: Design the machine components with composite materials.
4: Evaluate the composite materials applications in aerospace and automobiles.

UNIT-I

Introduction to Composite Materials: Introduction, classification, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber, reinforced composites and nature-made composites and applications.

Reinforcements: Fibers Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide, fibers. Particulate composites, Polymer composites, Thermoplastics, Thermostats, Metal matrix and ceramic composites.

UNIT – II

Manufacturing Methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

Macro Mechanical Analysis of a "Lamina": Introduction, Definitions: stress, strain, Elastic Moduli, strain Energy. Hooke's Law for different types of materials, Hooks Law for a two dimensional unidirectional lamina, plane stress assumption, reduction of Hooks Law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of a lamina.

UNIT – III

Elastic Theory of Composites: Hookes Law for a Two-Dimensional Angle Lamina, Engineering constants of an Angle Lamina. Invariant Form of Stiffness and compliance Matrices for an Angle Lamina Strength Failure. Envelops, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu Failure Theory Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress-Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress-Strain Relationships for a Angle Lamina.

UNIT– IV

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion .

UNIT- V

Macro Mechanical Analysis of Laminates: Introduction, Laminate Code, Stress- Strain Relations for a Laminate, In-Plane and Flexural Modules of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates.

Failure Analysis and Design of Laminates: Introduction Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

TEXT BOOKS:

1. Engineering Mechanics of Composite Materials, Isaac and M Daniel, Oxford University Press, 1994.
2. Mechanics of Composite Materials, R. M. Jones, McGraw Hill Company, New York, 1975.

REFERENCES:

1. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), Autar K. Kaw, CRC Publisher
2. Finite Element Analysis of Composite Materials, Ever J. Barbero, CRC Press, 2007.
3. Analysis and Performance of Fibre Composites, B. D. Agarwal and L.J. Broutman, Wiley-Interscience, New York, 1980.
4. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.

ADDITIVE MANUFACTURING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the additive manufacturing technologies employing liquids solids and along with the relevant software.
2. Distinguish the additive manufacturing methods and their specific use.
3. Analyze various case studies for weighing the pros and cons of the processes.
4. Applying additive manufacturing technologies in engineering components.

UNIT – I

Introduction: Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

UNIT – II

Liquid-Based AM Systems: Stereo Lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid Ground Curing (SGC): Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Polyjet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Micro fabrication.

Solid-Based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT – III

Powder Based AM Systems: Selective Laser Sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three Dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid

Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT – IV

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques.

AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, Surgi Guide, 3-matic, Simplant, MeshLab.

UNIT –V

AM Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customised Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Web Based Rapid Prototyping Systems.

TEXT BOOKS:

1. Rapid Prototyping: Principles and Applications - Chua C.K., Leong,World Scientific Publishing Co Pvt. Ltd
2. Rapid Prototyping, K.F. and LIM C.S, World Scientific publications, Third Edition, 2010.

REFERENCES:

1. Rapid Prototyping and Engineering applications: A tool box for prototype development, Liou L.W. and Liou F.W, CRC Press, 2007.
2. Rapid Prototyping & Engineering Applications, Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.
3. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001
4. Wholers Report 2000 – Terry Wohlers, Wohlers Associates, 2000

ELEMENTS OF MECHANICAL ENGINEERING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the basic concepts of mechanical engineering.
2. Applying thermodynamic laws in IC engines.
3. Develop manufacturing methods to produce engineering components.
4. Comparing various standards relevant to automobiles.

UNIT-I

Thermal Engineering Basic Concepts: Zeroth Law of Thermodynamics- First law of Thermodynamics- Second Law of Thermodynamics- Boyles Law Charles Law Thermodynamic processes- Otto cycle Diesel cycle- Four stroke petrol and diesel engines. Brake Power, Indicated Power, Mechanical efficiency, Air Refrigeration, Vapour Compression Refrigeration.

UNIT-II

Theory of Machines : Types of Gears and Geartrains Transmission of power by Belts, Ropes and Chain drives- Cams and Followers. Free Vibration of mass attached to vertical spring Oscillation of pendulums Transverse loads.

UNIT-III

Production Technology: Metal Casting Sand Casting, Molten metal Pouring, Welding Arc Welding, Gas Welding, Brazing, Soldering. Metal Forming Forging, Drawing, Extrustion. Metal Cutting Lathe, Drilling, Milling operations.

UNIT-IV

Introduction To Design: Elasticity and plasticity Types of stresses and strains Hooke's law stress strain diagram for mild steel Working stress Factor of Safety Lateral Strain, Poisson's ratio and volumetric strain Temperature stresses.

UNIT-V

Automobile Engineering : Battery ignition system in Petrol engine, Injection system in Diesel engine, Cooling of engines, Electrical system, Braking system. Pollution standards, National and international Pollution Control Techniques Noise Pollution & control.

TEXT BOOKS:

1. Fundamentals of Mechanical Engineering, G.S Sawhmey PHI.
2. Elements of Mechanical Engineering, V. M. Maglik, PHI

REFERENCES:

1. Machine Design, V.Bandari, TMH Publishers
2. Theory of Machines, Rattan .S.S, TMH, 2009 Edition.
3. Elements of Mechanical Engineering, Mathur M.L. & F.S. Mehta & Tewari, Jain Brothers Publishers
4. Automobile Engineering ,Vol. 1 & Vol. 2 ,Kripal Singh,Standard Publishers Distributors Delhi.

PRODUCT ENGINEERING

B.TECH III Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the concepts of product design, documentation and manufacturing technologies.
2. Apply CAD principles for the product design
3. Develop RPT technologies in the product engineering.
4. Evaluating the processes with case studies

UNIT-I

Project Management

Introduction to Project Management (PM), Collaborative Working, PM Tutorials and their implementation for the same in their projects in tools such as Microsoft Projects.

UNIT-II

Ideation & Conceptual Design

Elements of design; Product development cycle overview; Market demands and trends for products; Product Lifecycle Management (PLM) overview; Ideation and conceptual design phase introduction; Benefits and use cases of ideation and conceptual design, Capturing Voice of the customer (VOC), Use of Trizz in ideation, Intellectual Property Rights (IPRs).

UNIT-III

Product Engineering Component Design

Product Design Phase I: The evolution of CAD: Benefits of Digital Prototyping Design: General 3D Design Concepts.

Product Design Phase–Part 2; Design for manufacturing, introduction; Design styled components.

Product Design Phase Part 3; top down and Bottom up Design Methods; Manufacturing and Engineering Bill of Materials (BOMs); Team and Collaborative based Design.

UNIT-IV

Product Engineering – Documentation (Drawings)

Design Documentation Requirements; Importance and benefits of design documentation; When do you need documentation and when do you not; Drawings requirements (Detailed drawings & Assembly Drawings), Design changes and Automation & Visualization Extending Design Data.

UNIT – V

Prototyping, Testing & User Trials

Need - Development of RP systems, RPT Technologies, Rapid Tooling & Case Studies.

TEXT BOOKS:

1. Joseph E. Shigley& Larry D. Mitchell, "Mechanical Engineering Design", Fourth Edition, McGraw-Hill International Book Company.
2. Machine Design - An Integrated Approach -- Robert L. Norton – Pearson Education.

REFERENCES:

1. Mastering Autodesk Inventor by Sybex
2. Autodesk Inventor 2012 for Designers by CAD CIM Technologies
3. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
4. Rapid Prototyping and Engineering applications: A tool box for prototype development, LiouW.Liou, Frank W.Liou, CRC Press,2007.
5. Rapid Prototyping: Theory and practice, Ali K. Kamrani, EmadAbouel Nasr, Springer,2006
6. Engineering Design and Design for Manufacturing by Dixen & Poly, University of Mas. Press

THERMAL ENGINEERING LAB

B.TECH III Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes

1: Understand the assembly/disassembly and their working of IC engines for performance measurement.
2: Analyze the output responses of the IC engines by applying thermodynamic principles.
3: Evaluate performance parameters for consequent applications.

List of Experiments:

1. I.C. Engines Valve / Port Timing Diagrams.
2. I.C. Engines Performance test (4 – Stroke Diesel Engines)
3. Evaluate of engine friction by conducting Morse test on 4 stroke Multi cylinder petrol engine.
4. Evaluate of engine friction by conducting motoring / retardation test on 4 stroke petrol engine.
5. Heat balance on IC Engines.
6. Determination of A/F Ratio and volumetric efficiency on IC engines
7. Determination of Economical speed test for fixed load on 4-stroke engine.
8. Disassembly / Assembly of engines.
9. Performance test on reciprocating air-compressor unit.
10. Study of boilers.

REFERENCES:

1. Automobile Engineering ,Vol. 1 & Vol. 2 ,Kirpal Singh,Standard Publishers Distributors Delhi

ADVANCED COMMUNICATION SKILLS (ACS) LAB

B.TECH III Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes:

1. Develop sound communication skills in various situations with the help of enriched vocabulary.
2. Practice reading techniques for a faster and better comprehension.
3. Exhibit strong writing skills to express ideas effectively.
4. Demonstrate effective presentation skills.
5. Use appropriate verbal and non-verbal skills for a successful career.

UNIT-I:
Activities on Fundamentals of inter-personal Communication and Building Vocabulary Starting a conversation responding appropriately and relevantly using the right body language Role Play in different situations & Discourse Skills using visuals Synonyms and antonyms, word roots, one word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

UNIT-II:
Activities on Reading Comprehension General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.

UNIT-III:
Activities on Writing Skills Structure and presentation of different types of writing letter writing/ Resume writing/ Statement of purpose E-correspondence/ Technical report writing / Portfolio writing planning for writing improving one's writing.

UNIT-IV:
Activities on Presentation Skills Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/e-mails/assignments etc.

UNIT-V:
Activities on Group Discussion and interview Skills Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation. Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video conference and Mock Interviews.

Reference Books:

1. Technical Communication, Meenakshi Raman &Sangeeta Sharma, Oxford University, 2nd Edition, 2011.
2. Functional English for Success, Orient Longman, 2014.

QUANTITATIVE METHODS & LOGICAL REASONING

B.TECH III Year I Semester

L	T	P	C
2	0	0	1

Course Outcomes:

1. To perform well in various competitive exams and placement drives.
2. To solve basic and complex mathematical problems in short time.
3. Quantitative Aptitude and Reasoning are very important in assessing various intangible skills of the students.
4. They are the instrumental in developing problem solving skills and analytical abilities, which play a great role in corporate and industry set up.
5. Therefore, it is essential to have thorough knowledge and understanding of these areas so as to be able to perform their job roles effectively to the corporate expectations.

<u>Quantitave Aptitude and Reasoning:</u>

Unit – I

1. Number System:
Speed maths, Numbers, Factors, prime & Co primes, LCM & HCF, Divisibility rules, finding unit place digit and last two digits of an expression

2. Ratio, Proportion and Variations:
Definition of ratio, ratio of Proportion, Comparison of ratios, Compound ratio, Direct and indirect proportion

3. Percentages:
Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings

4. Profit and loss:
Relation between Cost price and selling price, Discount and Marked price, Gain or Loss percentages on selling price

5. Simple and Compound Interest:
Problems on interest (**I**), amount (**A**), Principal (**P**) and rate of interest(**R**)
difference between the simple interest and compound interest for 2 and 3 years.

Unit-II

1.Partnership:
Relation between partners, period of investment and shares

2. Averages, Ages and Allegation
Average of different groups, change in averages by Adding, deleting and Replacement of objects, problems on ages. Allegation rule, mean value of the mixture, Replacement of equal amount of quantity.

3.**Time and Work:**
Men and Days, Work and Wages, pipes and cisterns, hours and work, Alternate days concept,

4.Time and Distance:
Difference between the average and Relative speeds, reaching the destination late and early, Stoppage time per hour, time and distance between two moving bodies Train crossing man, same and opposite directions, Speed of boat and stream

Unit-III

1. Progressions and Quadratic Equations

Arithmetic, Geometric and Harmonic Progressions, Arithmetic Mean, Geometric Mean and Harmonic Mean and their relations. General form of Quadratic equation, finding the roots of Quadratic equation, Nature of the Roots.

2. Permutation and Combination:

Fundamental rules, problems on permutations & combinations.

3. Probability

Definition of probability, notations and formulae, problems on probability.

4. Data Interpretation and Data Sufficiency:

Tabular and Pie-charts, Bar and Line graphs, Introduction to data sufficiency, problems on data sufficiency.

Unit-IV

1. Deductions:

Statements and conclusions using Venn diagram and Syllogism method

2. Series completion:

Number series, Alphabet series, letter series.

3. Coding and Decoding:

Letter coding, Number coding, Number to letter coding, Matrix coding, Substitution, Mixed letter coding, Mixed number coding, Deciphering individual letter codes by analysis.

4. Analytical Reasoning Puzzles:

Problems on Linear, Double line-up and Circular arrangements, Selections and Comparisons.

5. Blood Relations:

Defining the various relations among the members of a family, Solving Blood Relation Puzzles by using symbols and notations. Problems on Coded relations.

Unit-V

1. Direction sense test:

Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets.

2. Clocks:

Relation between minute-hour hands, angle vs time, exceptional cases in clocks

3. Calendars:

Definition of a Leap Year, Finding the Odd days, Finding the day of any random calendar date, repetition of calendar years.

4. Cubes and Dices:

Finding the minimum and maximum number of identical pieces and cuts, painting of cubes and cuts, problems on dice.

5. Venn diagrams:

Circular representation of given words, Geometrical representation of certain class, set theory based problems.

TEXT BOOKS:

1. R S Agarwal, (author) S.Chand, (publications) ‘A modern approach to logical Reasoning’ (Revised edition, 2016)
2. R S Agarwal, (author) S.Chand, (publications) ‘Quantitative Aptitude ’ (Revised edition, 2016)

REFERENCES:

1. Quantitative Aptitude-G.L BARRONS (new edition,2016)
2. Quantitative Aptitude-Abhijit Guha Mc Graw Hills(new edition,2016)
3. Quantitative Aptitude-U.Mohan Rao SCITECH (new edition,2016)

DESIGN OF MACHINE MEMBERS – II

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

NOTE: Design Data books are permitted in the Examinations.

Course Outcomes
1. Understand the functioning of engineering components, relevant design principles and the corresponding standards.
2. Estimate the life of bearings, gears and other parts under given service conditions.
3. Apply the design principles and subsequently analyze the components employing the criteria of failure.
4. Justifying the design with reference to standard data code.

UNIT – I
Sliding Contact Bearings: Types of Journal bearings basic modes of Lubrication Bearing construction bearing design bearing materials Selection of lubricants.
Rolling Contact Bearings: Types of rolling contact bearings selection of bearing type selection of bearing life Design for cyclic loads and speeds Static and dynamic loading of ball & roller bearings.

UNIT – II
Design of IC Engine Parts: Design of Connecting Rod; Thrust in connecting rod stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston Construction, Design and proportions of piston, Cylinder, Cylinder liners.

UNIT – III
Design of Belt and Rope Drives: Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types – Ropes Pulleys for belt and rope drives.
Mechanical Springs: Stresses and deflections of helical springs – Extension – compression springs Springs for fatigue loading – natural frequency of helical springs – Energy storage capacity helical torsion springs.

UNIT – IV
Design of Spur and Helical Gear Drives: Spur and Helical gears – Load concentration factor Dynamic load factor, Surface compressive strength – Bending strength – Design analysis of Spur and Helical gears –check for plastic deformation, Check for dynamic and wear considerations.

UNIT – V
Design of Bevel Gear Drives: Bevel gears – Load concentration factor – Dynamic load factor, Surface compressive strength – Bending strength – Design analysis of Bevel gears –check for plastic deformation, Check for dynamic and wear considerations.
Design of Power Screws: Design of screw, Square ACME, Buttress screws, design of nut.

TEXT BOOKS:
1. Machine Design, V.Bhandari, TMH Publishers
2. Mechanical Engineering Design, Bahi and Goel, Standard Publications.

REFERENCES:

1. Machine Design, Pandya& shah, Charotar Publishing House Pvt. Ltd.
2. Machine Design, R.L.Norton, McGraw Hill
3. Design of Machine Elements, Kulkarni, McGraw Hill.
4. Shigley's Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Mc Graw Hill.

HEAT TRANSFER

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the three basic modes of heat transfer.
2. Compute the temperature variation in components by analytical approximate or empirical methods.
3. Formulate and analyze the modes of heat transfer employing mathematical gathering equations.
4. Design the devices such as heat exchangers and evaluate for the heat loss.

UNIT – I

Introduction: Modes and mechanisms of heat transfer Basic laws of heat transfer General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier's law of conduction General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates. Simplification and forms of the field equation-steady, unsteady and periodic heat transfer- initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres overall heat transfer coefficient electrical analogy Critical radius of insulation.

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Variable thermal conductivity systems with heat sources or Heat generation, extended surface (Fins) Heat Transfer Long Fin, Fin with insulated tip and short Fin, Application to error measurement of temperature.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance Significance of Biot and Fourier Numbers Chart solutions of transient conduction systems Concept of Functional body.

UNIT – III

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, medium of flow Dimensional analysis as a tool for experimental investigation Buckingham Pi Theorem and method, application for developing semi empirical non dimensional correlation for convection heat transfer Significance of non-dimensional numbers Concepts of Continuity, Momentum and Energy equations.

Forced Convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer Flat plates and cylinders.

Internal Flows: Concepts of hydrodynamic and thermal entry lengths Division of internal flow based on this Use of empirical relations for horizontal pipe flow and annulus flow.

UNIT – IV

Free Convection: Development of hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for vertical plates and pipes

Boiling and Condensation: Pool boiling Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling. Film wise and Drop wise condensation on vertical and horizontal cylinders using empirical correlations.

UNIT – V

Heat Exchangers: Classification of heat exchangers overall heat transfer Coefficient and fouling factor LMTD and NTU methods Concepts and Problems

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation irradiation total and monochromatic quantities laws of Planck, Wien, Kirchoff, Lambert, Stefen and Boltzmann heat exchange between two black body's concepts of shape factor Emissivity heat exchange between grey bodies radiation shields electrical analogy for radiation networks.

TEXT BOOKS:

1. Fundamentals of Heat Transfer & Mass Transfer, Incropera & Dewitt, John Wiley Pub.
2. Heat and Mass Transfer, D. S Kumar , S.K.Kataria & Sons

REFERENCES:

1. Heat Transfer A Practical Approach Yunus Cengel, Boles, Mc GrawHill.
2. Heat Transfer , J.P. Holman, TMH
3. Heat Transfer , P.K.Nag , TMH
4. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, New Age International.

METROLOGY & MACHINE TOOLS

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the basic structure of machine tools used for machining and instruments employed for measurement.
2. Identifying the parameters for machining and working for optimality.
3. Analyze machining surfaces for their roughness and tolerances.
4. Evaluate the limits and fits with reference to design for manufacturing.

UNIT – I

Metal Cutting: Introduction, elements of cutting process orthogonal cutting, merchant circle, oblique cutting, Geometry of single point tools. ASA system. Chip formation and types of chips.

Engine Lathe: Principle of working, types of lathe, specifications. Taper turning Lathe attachments. Capstan and Turret lathe Single Spindle and Multi-Spindle automatic lathes tool layouts.

UNIT – II

Drilling and Boring Machines: Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications.

Shaping, Slotting and Planning Machines- Principles of working machining time calculations.

UNIT – III

Milling Machines: Principles of working Types of milling machines Geometry of milling cutters methods of indexing.

Grinding: Theory of grinding classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, Honing, comparison and Constructional features, machining time calculations.

UNIT – IV

Limits, Fits and Tolerances: Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly. Limit gauges: Taylor's principle, Design of GO and NO GO gauges. Measurement of angles, Bevel protractor, Sine bar. Measurement of flat surfaces: optical flat, auto collimator.

UNIT – V

Surface Roughness Measurement: Roughness, Waviness. CLAValues. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

Coordinate Measuring Machines: Types and Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology, I C Gupta, Danpath Rai
2. Engineering Metrology, R.K. Jain, Khanna Publishers

REFERENCES:

1. Production Technology, R.K. Jain and S.C. Gupta, Khanna Publications
2. Production Technology, Hindustan Machine Tools,McGraw Hill
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.
4. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.

FINITE ELEMENT METHOD

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes
1. Understanding fundamentals of finite element method for engineering applications.
2. Formulate finite element characteristic equation for different elements.
3. Apply FEM to solve problems in solid mechanics fluid mechanics and heat transfer.
4. Evaluate the solutions from ANSYS and numerical methods for comparison.

UNIT – I
Introduction To FEM: Basic concepts, historical background, Steps in FEM, applications of FEM, comparison of FEM with other methods, Basic equations of elasticity, Stress Strain and strain displacement relations, Rayleigh Ritz method, Galarkin's method, Problems.

UNIT – II
One Dimensional Problems: Stiffness matrix for a axial bar element, Assembly of Global stiffness matrix, properties of stiffness matrix, Finite element analysis of stepped and tapered bars subjected to mechanical and thermal loads, Quadratic shape functions, Problems.

UNIT – III
Analysis of Trusses: Finite Element Analysis of Trusses, Stiffness matrix of truss element, load vector, Problems.
Analysis of Beams: Analysis of 2-noded beam element with 2-DOF at each node, Hermite shape functions, stiffness matrix, load vector, problems with point load and uniformly distributed load.

UNIT – IV
2-D Structural Problems: CST element, Stiffness matrix and load vector for CST element, Introduction to LST element, Problems.
Isoperimetric element representation, Shape functions, Convergence requirements, two dimensional four-noded isoperimetric elements, Numerical integration, Problems.

UNIT – V
Analysis of Heat Transfer Problems: 1-D Heat conduction with lateral and edge convection, fin and composite wall analysis, 2-D heat transfer analysis, Problems.
Dynamic Analysis: Dynamic equations, Lumped and consistent mass matrices, Eigen Values and Eigen Vectors, mode shapes, Problems on stepped bars and beams.

TEXT BOOKS:

1. Concepts and Applications of Finite Element Analysis Robert Cook Wiley
2. The Finite Element Methods in Engineering, S.S.Rao, Elsevier, Pergamon

REFERENCES:

1. Finite Element Methods, Alavala, TMH
2. An Introduction to Finite Element Methods, J.N. Reddy, Mc Grawhill.
3. Introduction to Finite Elements in Engineering, Tirupathi K. Chandrupatla and Ashok D. Belagundu, Pearson
4. Finite Element Method, R. Dhanaraj & K. Prabhakaran Nair, Oxford

REFRIGERATION AND AIR CONDITIONING

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Distinguish various types of refrigeration system.
2. Apply the principles of thermodynamics to refrigeration systems.
3. Thermodynamically analyze refrigeration and air conditioning systems.
4. Evaluate the performance parameters while designing the refrigeration and air conditioning system.

UNIT – I

Introduction to Refrigeration: Necessity and applications - Unit of refrigeration and C.O.P. Mechanical Refrigeration, Ideal cycle of refrigeration.

Air Refrigeration: Bell Coleman cycle Brayton Cycle Open and Dense air refrigerationcycle - Air craft cooling systems.

UNIT – II

Vapour Compression Refrigeration: Introduction Working of simple VCR cycle Representation of cycle on T-S and p-h charts -Effect of sub cooling and super heating Actual VCR cycle Problems.

System Components: Compressors - General classification working principles **Condensers** classification Working Principles, **Evaporators** classification Working Principles, **Expansion Devices**Types Working Principles.

Refrigerants: Classification Desirable properties commonly used refrigerants Nomenclature.

UNIT III:

Vapor Absorption System: Introduction Description and working of NH_3- Water system, Calculation of Maximum COP Water Li-Br absorption system Triple Fluid absorption system.

Steam Jet Refrigeration System: Introduction Working Advantages and Disadvantages.

UNIT IV:

Psychometric: Introduction Psychometric terms Psychometric processes.

Inside and Outside Design Conditions: Introduction - Selection of inside design conditions Selection of outside design conditions.

UNIT – V:

Psychometric of Air Conditioning Systems: Introduction- Summer Air conditioning system inter Air conditioning system- All year air conditioning system.

Unitary refrigerant based systems.

Cooling Load Calculations: Introduction- Estimation of required cooling capacity.

TEXT BOOKS:

1. Refrigeration and Air Conditioning, CP Arora, TMH.
2. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpatrai

REFERENCES:

1. Principles of Refrigeration, Dossat, Pearson Education.
2. Refrigeration and Air Conditioning P.L. Bellaney, Khanna Publications
3. Refrigeration and Air Conditioning, Manohar Prasad, New Age.
4. Basic Refrigeration and Air Conditioning, Ananthanarayanan, TMH.

INDUSTRIAL MANAGEMENT

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the principles of management.
2. Compare management functions in different specializations of management.
3. Apply the concepts of materials management in reducing the total cost.
4. Evaluate the project cost time trade off values during application.

UNIT - I

Management and Organization Functions of Management Contributions of Taylor, Fayol, Douglas Mc-Gregor, Mayo Hertzberg and Maslow. Systems Approach to Management - Organisational Structures: Basic concepts related to Organization Departmentation and Decentralisation, Types of mechanistic and organic structures of organization and their merits, demerits and suitability.

UNIT- II

Operations Management-I: Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Types of plant layout various data analyzing forms-travel chart Work study: Method study and Work measurement. Inventory functions, types, Determination of Economic Order Quantity (EOQ), ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager, JIT System.

UNIT –III

Operations Management-II: Inspection and quality control, types of inspections - Statistical Quality Control-techniques- Charts for variables and attributes. Acceptance sampling plan-single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles, ISO 9000 series procedures. Functions of Marketing, Marketing vs. Selling, Marketing mix, Product Life Cycle.

Unit -IV

Human Resources Management (HRM): Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating Capability Maturity Model (CMM) Levels Performance Management System.

UNIT- V

PERT/ CPM: Project management, network modelling-probabilistic model, various types of activity time's estimation-programme evaluation review techniques- Critical Path-probability of completing the project, Critical Path Method (CPM) - Project crashing. Simple problems.

TEXT BOOKS:

1. Management Science, Aryasri, McGraw hill
2. Introduction to Management Science, Kumar, Rao and Chhalill, Cengage.

REFERENCES:

1. Manufacturing Organization and Management, Amrine, Pearson.
2. Operations Management, Chase, Jacobs, Aquilano, McGraw Hill.
3. Management, Pearson Education Stoner, Freeman, Gilbert, New Delhi.
4. Principles of Management, Koontz and Donell, McGraw Hill.

AUTOMATION IN MANUFACTURING

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Summarize the facets of automation in a manufacturing activity.
2. Applying various elements like sensors, pneumatics, and hydraulics to append in manufacturing automation.
3. Design the assembly lines by considering the on line process analysis.
4. Evaluate the automation elements for low cost automation investment.

UNIT-I

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT-II

Introduction to Material Handling: Overview of Material Handling Equipment, Considerations in Material Handling System Design, Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT -III

Manual Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT-IV

Transfer Lines: Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT-V

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

TEXT BOOKS:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover, Pearson Eduction.
2. CAD CAM: Principles, Practice and Manufacturing Management, Chris Mc Mohan, Jimmie Browne,Pearson edu. (LPE)

REFERENCES:

1. Industrial Automation, W.P.David, John Wiley and Sons.
2. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.
3. Automation, Buckinghsm W, Haper& Row Publishers, New York, 1961
4. CAD / CAM/ CIM, Radhakrishnan,New Age International

OPTIMIZATION TECHNIQUES

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the mathematical models development.
2. Identifying the variables and constraints to suit a mathematic model.
3. Applying the appropriate algorithm to arrive at the solutions of the given systems.
4. Compare the optimization techniques for their exactness vis-a-vis with simulation methods.

UNIT – I

Introduction: Development, Definition, Characteristics and phases, Types of operation Research models, applications. Allocation:

Linear Programming Method: Problem formulation, Graphical solution, Simplex method, Artificial variables Techniques, Two – phase method, Big-M method, Duality principle.

UNIT – II

Transportation Problem: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy, Assignment problem, Formulation, Optimal solution, Variants of Assignment Problem, Travelling salesman problem.

UNIT – III

Theory of Games: Introduction, Minimax (maximin), Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, dominance principle, m X 2 & 2 X n games, graphical method.

Waiting Lines: Introduction, Single Channel, Poisson arrivals exponential service times, with infinite population and finite population models, Multichannel, Poisson arrivals, exponential service times with infinite population.

UNIT – IV

Sequencing: Introduction, Flow Shop sequencing n jobs through two machines n jobs through three machines, Job shop sequencing, two jobs through 'm' machines.

Replacement: Introduction, Replacement of items that deteriorate with time, when money value is counted, Replacement of items that fail completely, group replacement.

Inventory: Introduction, Single item, Deterministic models, Purchase inventory models with one price break and multiple price breaks, shortages are not allowed, Stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, Single period model.

UNIT – V

Dynamic Programming: Introduction, Terminology, Bellman's Principle of optimality, Applications of dynamic programming, shortest path problem, capital budgeting.

Simulation: Definition, Types of simulation models, phases of simulation, applications of simulation, inventory and Queuing problems, Advantages and Disadvantages, Brief introduction of simulation languages.

TEXT BOOKS:

1. Operations Research, S.D.Sharma, Kedarnath
2. Operations Research, J.K. Sharma, MacMilan

REFERENCES:

1. Operations Research, A.M. Natarajan, P.Balasubramani, A.Tamilarasi, Pearson
2. Operations Research: Methods & Problems, Maurice Saseini, Arhur Yaspan & Lawrence Friedman.
3. Operations Research, R.Pannerselvam, PHI Publications
4. Introduction to Operation Research, Taha, PHI

MAINTENANCE AND SAFETY ENGINEERING

B.TECH III Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the need for maintenance of industries for overall productivity improvement.
2. Classifying the maintenance methods in terms of time and condition of equipment.
3. Applying the concepts of quality, reliability and inventory for effective maintenance and safety.
4. Evaluate the maintenance policies to reduce the total cost.

UNIT – I

Introduction: Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance strategy for the 21^{st} Century Engineering Maintenance Objectives and Maintenance in Equipment Life cycle, Terms and Definitions.

Maintenance Management and Control: Maintenance Manual Maintenance, Facility Evaluation Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control indices.

UNIT – II

Types of Maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program, PM Program Evaluation and improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

UNIT – III

Inventory Control in Maintenance: Inventory Control Objectives and Basic inventory Decisions, ABC inventory Control Models Two Bin inventory Control and Safety Stock, spares Determination Factors spares calculation methods.

UNIT – IV

Quality and Safety in Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

UNIT – V

Reliability, Reliability Centered Maintenance, RCM: Goals and Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement indicators, RCM Benefits and Reasons for its Failures, Reliability Versus Maintenance and Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

Maintainability: Maintainability importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS:

1. Reliability, Maintenance and Safety Engineering, Dr. A.K Guptha, Laxmi Publications.
2. Industrial Safety Management, L.M.Deshmukh, TMH

REFERENCES:

1. Maintenance Engineering & Management, R.C.Mishra, PHI
2. Reliability Engineering, Elsayed, Pearson
3. Engineering Maintenance a modern approach, B. S. Dhallon, C.R.R Publishers.
4. Industrial Safety Engineering, Garg, Danpathrai Publishers

HEAT TRANSFER LAB
(Consider Performance in Any 12)

B.TECH III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes

1. Understand the structural features of heat transfer equipment and their mode of working.
2. Analyze the output responses by comparing with the heat transfer governing equations.
3. Evaluate the process parameters for designing the heat transfer devices.

LIST OF EXPERIMENTS:

1. Composite Slab Apparatus Overall heat transfer co-efficient.
2. Heat Transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere.
4. Thermal Conductivity of given metal rod.
5. Heat Transfer in pin-fin.
6. Experiment on transient heat conduction.
7. Heat Transfer in forced convection apparatus.
8. Heat Transfer in natural convection.
9. Parallel and counter flow heat exchanger.
10. Emissive apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of Two – Phase flow.

REFERENCES:

1. Fundamentals of Heat Transfer & Mass Transfer, Incropera & Dewitt, John Wiley Pub.
2. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, New Age International.

METROLOGY & MACHINE TOOLS LAB

B.TECH III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes

1: Understand the kinematic structure of machine tools and their mode of working.
2: Perform the machining operations and the measurement of samples using instruments.
3: Evaluate the responses for their accuracy and precision.

SECTION – A

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and choral height of spur gear.
4. Machine tool alignment test on the lathe.
5. Tool maker's microscope.
6. Angle and taper measurements by Bevel protractor & Sine bars.
7. Use of spirit level in finding the flatness of surface plate.
8. Thread measurement by two wire / three wire method or Tool Makers' microscope.

SECTION – B

1. Introduction of general purpose machines – Lathe, Drilling Machine, Milling Machine, and shaper.
2. Planning Machine, Slotting Machine, and Cylindrical Grinder, Surface Grinder and Tool and Cutter grinder.
3. Step turning and Taper Turning on Lathe Machine.
4. Thread cutting and knurling on lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding

REFERENCES:

1. Engineering Metrology, I C Gupta, Danpath Rai
2. Engineering Metrology, R.K. Jain, Khanna Publishers

PERSONALITY DEVELOPMENT AND BEHAVIOURAL SKILLS

III Year II Semester

L	T	P	C
2	0	0	1

Course Outcomes:

1. Practice optimistic attitude for an efficient, socially viable and multi-faceted personality.
2. Demonstrate functions of non-verbal *communication in formal context.*
3. Build effective individual & team dynamics for professional accomplishments.
4. Analyze appropriate strategic Interpersonal Skills for productive workplace relationships.
5. Correspond in multiple contexts, for varied audiences, across genres and modalities.

UNIT – I:

Personality Development:

Definition - Various Aspects of Personality Development - Behavioural Traits.
Importance of Soft Skills for personal and professional development - Success stories.

UNIT– II:

Non Verbal Communication:

Kinesics, Haptics, Proxemics, Vocalics, Oculesics
Body Language informal contexts such as Group Discussions, Presentations and Interviews.

UNIT– III:

Team Dynamics:

Different Types of Teams Role of an individual communicating as a group or team leader
Individual Presentations/Team Presentation-Project Presentations- Case Studies

UNIT-IV:

Interpersonal Skills:

Time Management- Stress Management- Emotional Intelligence- Conflict Management- Relationship Management

UNIT-V:

Digital Correspondence:

Role of Multimedia in Communication in a Digital Edge (Video Conference Etc.)
Social Networking: Importance and Effects.

Textbooks:

1. Personality Development and Soft Skills, Preparing for Tomorrow, Shikha Kapoor 2nd Edition,2020.

References:

1. Personality Development and Soft Skills, Barun, K Mitra, Oxford University Press, 2nd Edition, 2016.
2. Professional Ethics, R Subramanian, Oxford University Press, 2ndEdition,2015.

B.TECH IV Year I Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 15	Instrumentation and Control Systems	3	0	0	3
2	PC – 16	CAD/CAM	3	0	0	3
3	PE – 3	Robotics Gas Dynamics Production And Operations Management	3	0	0	3
4	PE – 4	Operations Research Energy Conservation And Management Fluid Power Systems	3	0	0	3
5	OE – 3	Basic Automobile Engineering Material Science Engineering	3	0	0	3
6	PC Lab – 8	CAD/CAM Lab	0	0	2	1
7	PC Lab – 9	Production Drawing Practice and Instrumentation Control Systems Lab	0	0	2	1
8	PC-17	Industry Oriented Mini Project	0	0	0	3
Total Number of Credits			**15**	**0**	**4**	**20**

B.TECH IV Year II Semester

S. No.	Course Category	Course Title	L	T	P	C
1	PC– 18	Production Planning & Control	3	0	0	3
2	PC – 19	Unconventional Machining And Processes	3	0	0	3
3	PC– 20	Technical Seminar	3	1	0	2
4	PC –21	Comprehensive Viva Voce	0	0	0	2
5	PC –22	Major Project	0	0	0	10
Total Number of Credits			**18**	**1**	**0**	**20**

B.TECH IV Year I Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 15	Instrumentation and Control Systems	3	0	0	3
2	PC – 16	CAD/CAM	3	0	0	3
3	PE – 3	Robotics	3	0	0	3
		Gas Dynamics				
		Production And Operations Management				
4	PE – 4	Operations Research	3	0	0	3
		Energy Conservation And Management				
		Fluid Power Systems				
5	OE – 3	Basic Automobile Engineering	3	0	0	3
		Material Science Engineering				
6	PC Lab – 8	CAD/CAM Lab	0	0	2	1
7	PC Lab – 9	Production Drawing Practice and Instrumentation Control Systems Lab	0	0	2	1
8	PC – 17	Industry Oriented Mini Project	0	0	0	3
9	PC – 19	Unconventional Machining And Processes	3	0	0	3
		Total Number of Credits	**18**	**0**	**4**	**23**

B.TECH IV Year II Semester (Fast Track)

S. No.	Course Category	Course Title	L	T	P	C
1	PC – 20	Technical Seminar	3	1	0	2
2	PC – 21	Comprehensive Viva Voce	0	0	0	2
3	PC – 22	Major Project	0	0	0	10
		Total Number of Credits	**3**	**1**	**0**	**14**

INSTRUMENTATION AND CONTROL SYSTEMS

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the measurement of various quantities using instruments
2. Applying relevant engineering principles while arriving at the absolute readings from instruments
3. Analyze the errors that occurred in the measuring process
4. Compare the quantities measured for their accuracy & range of the instruments

UNIT – I

Definition – Basic principles of measurement – Measurement systems, instrument-classifications, generalized configuration and functional descriptions of measuring instruments – examples. Static and Dynamic performance characteristics – input and output configuration of measuring instruments, calibration, sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement Piezo electric, inductive capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT – II

Measurement of Temperature: Classification rangesvarious principles of measurement Expansion, pressure thermometers, Electrical thermometers, Thermistors Thermocouples-laws of thermocouples – Pyrometers.

Measurement of Pressure: Units classification different principles used. Manometers, Bourdon pressure gauges, Bellows pressure gauges Diaphragm gauges, Dead weight tester.

Low Pressure Measurement: Thermal conductivity gauges ionization pressure gauges, McLeod pressure gauges.

UNIT – III

Measurement of Level: Direct method indirect methods capacitive, ultrasonic, magnetic, cryogenic fuel level indicators Bubbler level indicators.

Flow Measurement: Rota meter, magnetic, ultrasonic, Turbine flow meters, hot wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical tachometers Electrical tachometers Stroboscope, Non-contact type of tachometers.

UNIT – IV

Measurement of Acceleration and Vibration: Different simple instruments Principles of seismic instruments Vibrometer and accelerometer using this principle

Stress Strain Measurements: Various types of stress and strain measurements electrical strain gauges – gauge factor method of usage of resistance strain gauge for bending compressive and tensile strains usage for measuring torque, strain gauge Rosettes, temperature compensation in strain gauges.

UNIT – V

Control Systems:

Open and closed loop translation and rotational elements of a mechanical system, Pneumatic control systems, Hydraulic control systems. Representation of Control Components and Systems, Mechanical Accelerometer.

TEXT BOOKS:

1. Measurement Systems: Applications & Design, E.O.Doebelin, Mc Graw Hill
2. Instrumentation, Measurement & Analysis by B.C.Nakra & K.K.Choudhary, TMH

REFERENCES:

1. Mechanical Measurement and Instrumentation by A.K.Sawhney & Dhanpat Rai Publications
2. Experimental Methods for Engineers, Holman, Mc Graw Hill
3. Instrumentation & Mechanical Measurements by A.K.Tayal, Galotia Publications.
4. Instrumentation , N.V.S. Raju, BS Publications

CAD/CAM

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the design and manufacture aspects of mechanical engineering components employing computers.
2. Apply mathematical techniques to generate different curves, surfaces and solids.
3. Develop the controlling methods using computer in the manufacturing and quality function.
4. Evaluate the products produced by CAD/CAM and reverse engineering methods.

UNIT – I

Introduction: Computers in industrial manufacturing, Product cycle, CAD/CAM hardware basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 2D and 3D transformations, viewing transformation, mathematics of projections, windowing and clipping, hidden surface removal.

UNIT – II

Geometric Modeling: Requirements, Geometric models, Curve representation methods, Surface representation methods, modeling facilities desired.

CAD Standards- Graphical kernel system, standards for exchange images, open graphics library, data exchange standards- IGES, STEP, and CALS etc.

UNIT – III

Numerical Control: NC, NC modes, NC machine tools structure of CNC machine tools, features of machining center, turning center, CNC part programming: Fundamentals, manual part programming methods, computer aided part programming.

Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, computer aided processes panning, retrieval type and generative type.

UNIT – IV

Computer Aided Quality Control: Terminology in quality control, computer applications, contact inspection methods, noncontact inspection methods – Optical, Noncontact, and inspection methods – non optical, Computer aided testing, integration of CAQC with CAD/CAM.

Computer Integrated Manufacturing Systems: Types of manufacturing systems, Machine tools and related equipment, computer control systems, human labour in the manufacturing systems, CIMS benefits.

UNIT – V

Reverse Engineering Technology: Introduction to reverse engineering, reverse engineering-Hardware and software, Applications of reverse engineering, reverse engineering process, fundamental reverse engineering operations, reasons for using reverse engineering.

TEXT BOOKS:

1. CAD/CAM: Computer- Aided Design and Manufacturing, Mikell P.Groover, Emory W.Zimmers, Pearson Education India, 1984.
2. CAD/CAM: Theory and Practice, Ibrahim Zeid, R Sivasubramanian, Mc Graw-Hill.

REFERENCES:

1. Automation, Production Systems & Computer Integrated Manufacturing", P. Groover, Pearson Education, 2016
2. Computer Numerical Control Concepts and Programming, Warren S. Seames, Vengage Learning, 2007.
3. Reverse Engineering: An industrial Perspective, Vinesh Raja, Kiran J. Fernandes, Springer, 2008.
4. Reverse Engineering: Technology of Reinvention, Wege Wang, CRC Press, 2010.

ROBOTICS

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the basic components of robots.
2. Model forward and inverse kinematics of robot manipulators.
3. Analyze forces in links and Joints of a robot.
4. Design intelligent robots using sensors.

UNIT – I

Introduction: Automation and Robotics, Overview of Robotics, Classification of robots by coordinate system and control systems, Components of industrial robots, Advantages, disadvantages of and applications of robotics.

End Effectors: Classification of end effectors, Types and working principles of grippers, General considerations of gripper selection and design, Different tools used as end effectors.

UNIT – II

Motion Analysis: Basic translation and rotation matrices, Transformations, Composite transformations, Homogeneous transformation, Problems.

Manipulator Kinematics of Position: Joint coordinates and world coordinates, forward and inverse kinematics of position, Problems.

UNIT – III

Manipulator Kinematics of Orientation: Forward and inverse kinematics of orientation, RPY angles, Euler Angles, D-H notations.

Differential Kinematics: Differential kinematics of manipulators, differential translation and rotation matrices, Jacobian, Problems.

UNIT – IV

Robot Dynamics: Importance of dynamic modeling, Lagrange – Euler formulation, Newton – Euler formulation, Problems on planar two link manipulators.

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – Types of motion: Slew motion – joint interpolated motion – straight line motion – problems.

UNIT – V

Robot Actuators and Sensors: Actuators: Working principles, applications, advantages and limitations of Pneumatic, Hydraulic and Electric Actuators, Sensors: Classification of sensors, working principles of different types of sensors like position, velocity, tactile, proximity sensors etc.

Industrial Applications of Robots: Robot Applications in Manufacturing: Material handling, Processing, Assembly & Inspection.

TEXT BOOKS:

1. Industrial Robotics, Groover M.P, Pearson Edu.
2. Introduction to Robotic Mechanics and Control, JJ Craig, Pearson.

REFERENCES:

1. Robot Dynamics & Control – Mark W. Spong and M.Vidyasagar, John Wiley & Sons
2. Introduction to Robotics: Analysis,Control and Applications, Saeed.B.Niku, Wiley
3. Robotics, Fu K.S, McGraw Hill.
4. Robotic Engineering, Richard D. Klafter, Prentice Hall

GAS DYNAMICS

B.TECH IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the features of different flows.
2. Comparing the flow in different cross sectional arcos.
3. Apply gas dynamics principles to Jet propulsion system.
4. Evaluate the effects with and without shocks during flow.

UNIT-I

Introduction: Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation. Basic concepts of compressible flow. Properties of atmosphere, Standard atmosphere, Relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

UNIT-II

Isentropic Flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed, maximum speed, variation of Compressibility with mach number.

UNIT-III

Variable Area Flow: Criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying back pressures.

Flow in Constant Area Duct: Adiabatic and isothermal-flow calculation of pressure, temperature, density, Mach number relationships, Limiting length of duct for adiabatic and isothermal flow, Fanno line, Diabatic flow, Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships, Limiting conditions, Rayleigh line.

UNIT-IV

Wave Phenomenon: Pressure disturbances in compressible fluid, type of shock waves – normal, shock pressure –density-velocity-temperature and Mach number relations for a plane normal shock-Shock tube-mach reflection- thin area prandtl theory.

UNIT-V

Shock: Shock intensity-Rayleigh-Pilot and Prandtl-Pitot equation for normal shock, introduction to oblique shockwaves and hypersonic flow- fenno flow.

TEXT BOOKS:

1. Gas Dynamics through Problems, Zoeb Hussain, Wiley Eastern ltd.
2. Fundamentals of Compressible flow, S.M. Yahya, New Age International.

REFERENCES:

1. Gas Dynamics, E.Radha Krishnan, P.H.I Publication.
2. Gas Dynamics for engineers, P.Balachandran, PHI, Easterr Economy Edition.
3. Gas Dynamics and Jet propulsion, S L Somasundaram, New age International Publishers.
4. Gas Dynamics, H.W.Lipman and A.Rashkho, John Wiley.

PRODUCTION OPERATION AND MANAGEMENT

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the importance of production and operations management for getting the competitive edge.
2. Analyze the factors effecting plant location and the volume of production to be made.
3. Apply the value engineering and work study method to standardize the manufacturing activity.
4. Evaluate the project management techniques to improve overall productivity.

UNIT-I:

Overview of Production & Operations Management (POM): Introduction-Definition-Importance-Historical Development of POM-POM scenario today

Product & Process Design: Role of product development- Product development process-Tools for efficient product development- Determination of process characteristics- Types of processes and operations systems- Continuous –Intermittent-Technology issues in process design- Flexible Manufacturing Systems- Automated Material Handling Systems

UNIT –II:

Value Analysis: Definition-Objectives-Types of Values-Phases- Tools -FAST diagram-Steps-Advantages-Matrix method-Steps.

Plant Location& Plant Layout: Factors affecting locations decisions-Location planning methods-Location factor rating -Centre of Gravity method-Load distance method. Plant layout- Definition-Objectives-Types of layouts-Design of product layout-Line balance-Terminology-RPW method.

UNIT- III:

Aggregate Planning: Definition- Objectives-Basic strategies for aggregate production planning-Aggregate production planning method-Transportation model- Master Production Scheduling. Material Requirement Planning: Terminology-Logic-Lot sizing methods-Advantages & Limitations

UNIT – IV:

Work Study: Work study: method study –definition-objectives-steps-Charts used- Work measurement-Time study- Definition-steps- Determination of standard time- Performance rating- Allowances. Work sampling- steps- comparison with time study.

Quality Management: Economics of quality assurance-Control charts for variables and for attributes – Acceptance sampling plans-Total Quality Management-ISO 9000 series standards-Six sigma

UNIT – V:

Scheduling: Need-basis for scheduling- Scheduling rules- Flow shop & Job shop scheduling. Line of Balance.

Project Management: PERT- Critical path determination- Probability of completing project in a given time- CPM- Types of floats- Critical path determination- Crashing of simple networks- Optimum project schedule.

TEXT BOOKS:

1. Operations Management for Competitive Advantages, Chase Aquinano, TMH, 2009
2. Operations Management: Theory and Practice, B.Mahadevan, Pearson.

REFERENCES:

1. Modern Production and Operations Managemet, Buffa, Wiley
2. Theory and Problems in Production and Operations Management, SN Chary, TMH.
3. Industrial Engineering and Management, Dr.Ravi Shankar, Galgotia Publications.
4. Operations Management 8e Process and Value Chains, Lee Krajewskiet,Pearson

OPERATIONS RESEARCH

B.TechIV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the mathematical models development.
2. Identifying the variables and constraints to suit a mathematic model.
3. Applying the appropriate algorithm to arrive at the solutions of the given systems.
4. Compare the optimization techniques for their exactness vis-a-vis with simulation methods.

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem - Formulation – Graphical solution – Simplex method –Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II

Transportation Problem: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment Problem: Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines –two jobs through 'm' machines

UNIT – III

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

Waiting Lines: Introduction –Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

Inventory: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V

Dynamic Programming: Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – budget allocation.

Network Scheduling: Critical path method, Programme evaluation and review technique, crashing of networks, resource leveling.

TEXT BOOKS:

1. Operations Research, Wagner, PHI Publications
2. Operations Research, ACS Kumar, Yesdee Publications

REFERENCES:

1. Operations Research, A.M. Natarajan, P. Balasubramaniam, A. Tamilarasi, Pearson.
2. Operation Research, J.K. Sharma, Mac Milan Publications.
3. Operations Research: Methods and Problems, Maurice Saseini, Arhur Yaspan and Lawrence Friedman, Literary Licensing Publishers
4. Introduction to O.R, Hillier & Libermann, TMH

ENERGY CONSERVATION AND MANAGEMENT

B.Tech IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the energy data to carry out audit.
2. Identifying the electrical, thermal and other systems with their energy consumption.
3. Perform energy audit of consumption of industries.
4. Evaluate the energy consumption of units by the economic concepts.

UNIT -I

Introduction

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT- II

Electrical Systems

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT- III

Thermal Systems

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT- IV

Energy Conservation in Major Utilities

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT-V

Economics

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, LifeCycle Costing –ESCO concept

TEXT BOOKS:

1. Industrial Energy Management and Utilisation, Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publ, Washington, 1988.
2. Energy Manager Training Manual (4 Volumes), www.energymanager training.com, A Website Administered By Bureau Of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government Of India, 2004.

REFERENCES:

1. The Efficient Use of Energy, Dryden. I.G.C., Butterworths, London, 1982
2. Energy Management Hand book, Turner. W.C., Wiley, New York, 1982.
3. Design and Management for Energy Conservation, Callaghn, P.W, Pergamon Press, Oxford,1981.
4. Energy Management, Murphy. W.R. and G. Mc KAY, Butterworths, London 1987.

FLUID POWER SYSTEMS

B.TechIV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understand the properties fluid and fluid power systems.
2. Apply accessories and valves in the systems for effective functioning.
3. Design and analyze typical hydraulic circuits.
4. Evaluate the systems with different control units.

UNIT-I

Introduction to Oil Hydraulics and Pneumatics: Structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performance curves and parameters.

UNIT-II

Hydraulic Actuators: Types and constructional details, lever systems, control elements direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

UNIT-III

Control Valves and Servo Valves: Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

UNIT-IV

Meter-in & Meter-out Circuits: Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

UNIT-V

Control Systems: Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time-dependent control, combined control, Program Control, Electro-pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metalworking, materials handling and plastics working.

TEXT BOOKS:

1. Fundamentals of Fluid Power Control, John Watton, 1st Ed. Cambridge University Press,
2. Fluid Power Control, Blackburn J. F., G.Reethof, and J. L.Shearer, New York: Technology Press of M. I.T. and Wiley.

REFERENCES:

1. Hydraulic Operation and Control of Machine Tools, Ian Mencal, Ronald Press.
2. Hydraulic and Pneumatic Power for Production, Sterwart, Industrial Press.
3. Fluid Power with Applications, Anthony Esposito, Pearson Education.
4. Fundamentals of Pneumatics/Electro Pneumatics , Hasebrink J.P., and Kobler R., FESTO
5. Didactic publication No. 7301, Esslingen Germany, 1979.

BASIC AUTOMOBILE ENGINEERING

B.TechIV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding the basic structure of an automobile and its functioning.
2. Applying a mechanical engineering principles and mechanisms in the constructional features of sub systems of an automobile.
3. Develop the sub systems keeping in view of their effective working and improved performance of automobile
4. Appraise the automobile emission levels at national and international standards.

UNIT – I

Introduction: Types of automobile engines.

S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump, filters, carburetor, types, air filters, petrol injection. M.P.F.I system

C.I. engines: Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

UNIT - II

Engine Lubrication System: Splash and pressure lubrication systems.

Cooling System: Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication system, Radiators: Types, Cooling fans.

UNIT – III

Ignition System: Battery ignition system, Magneto coil ignition system, electronic ignition system. Battery, Contact breakers, Spark plugs.

Electrical System: Charging circuit, generator, current, voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge.

UNIT – IV

Transmission System: Clutches, types-cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches gear boxes, types. Propeller shaft, Hotch- Kiss drive, Torque tube drive.

Suspension System: Objects of suspension systems rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

UNIT – V

Steering System: Steering geometry, camber, castor, King pin rake, combined angle toe-in, center point steering.

Braking System: Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes.

Emission from Automobiles: Pollution standards National and international, Pollution control Techniques. Noise pollution and controls.

TEXT BOOKS:

1. Automobile Engineering ,Vol. 1 & Vol. 2,Kirpal Singh,Standard Publishers Distributors Delhi
2. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication

REFERENCES:

1. Automotive Mechanics , G.B.S.Narang, Khanna Publishers
2. Automotive Mechanics , J.Heitner, CBS Publications
3. Automobile Engineering, William Crouse, TMHILL Publishers.
4. Automotive Engines , Srinivasan, MCgraw-Hill Education (India) Ltd

MATERIAL SCIENCE ENGINEERING

B.TechIV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

1. Understanding basic structure of metals and its relation to properties.
2. Applying the phase rules for building equilibrium diagrams.
3. Analyzing the effect of alloying elements on the microstructure and during heat treatment.
4. Evaluation of the properties of different materials used in various engineering applications.

UNIT – I

Structure of Metals: Bonds in Solids Metallic bond crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys determination of grain size. Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II

Equilibrium of Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and $Fe\text{-}Fe_3C$.

UNIT –III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plan carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT – IV

Heat Treatment of Alloys: Effect of alloying elements on $Fe\text{-}Fe_3C$ system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT – V

Ceramic Materials: Crystalline ceramics, glasses, cermets, abrasive materials, Nanomaterials definition, properties and applications of the above.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C C composites.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avener, Mc Graw Hill
2. Material Science & Metallurgy, Kodgire, Everest Publishing House

REFERENCES:

1. Materials Science, Vijendra Singh, Standard Publishers
2. Material Science & Engineering, V. Rahghavan, PHI
3. Science of Engineering Materials, Agarwal
4. An Introduction To Material Science, W.G.vinas & HL Mancini, Princeton University Press

COMPUTER AIDED DESIGN AND MANUFACTURING LAB

B.TechIV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes

1. Understand the usage of relevant software and the syntax of CNC part program.
2. Develop the 2D, 3D models and conduct the analysis.
3. Evaluate the veracity between manual part program and the automated part program.

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric, Representation of dimensioning and tolerances scanning and plotting, study of script DXE and IGES FILES.

2. **Part Modeling**: Generation of various 3D Models through protrusion revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and assembly modeling, study of various standard translators, Design simple components.

3. (a) Determination of deflection and stresses in 2D and 3D trusses and beams.

   (b) Determination of deflections component and principal and von-mises stresses in plane stress, plane strain and axisymmetric components.

   (c) Determination of stresses in 3D and shell structures (at least one example in each case)

   (d) Estimation of natural frequencies and mode shapes harmonic response of 2D beam.

   (e) Steady state heat transfer analysis of plane and axisymmetric components.

4. (a) Development of process sheets for various components based on tooling Machines.

   (b) Development of manufacturing and tool management systems.

   (c) Study of various post processors used in NC Machines.

   (d) Determination of CNC part program for turning components and milling components.

Software Packages: SOLIDWORKS, ANSYS, CAM Software

REFERENCES:

1. CAD/CAM: Computer- Aided Design and Manufacturing, Mikell P.Groover, Emory W.Zimmers, Pearson Education India, 1984.
2. CAD/CAM: Theory and Practice, Ibrahim Zeid, R Sivasubramanian, Mc Graw-Hill.

PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION CONTROL SYSTEMS LAB

B.TechIV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes

1. Understanding the symbols and their representation on drawings.
2. Calibrate the measuring devices and analyze the errors in measurement.
3. Evaluate the instruments in terms of accuracy and precision.

PRACTICE-I

Conventional representation of materials- conventional representation of parts- screw joints, Springs, Gears, Electrical, Hydraulic and Pneumatic circuits – methods of indicating notes on drawings.

PRACTICE-II

Limits and fits: Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables.

PRACTICE-III

Form and positional Tolerances: introduction and indication of the tolerances of form and position on drawings, deformation of run out and total run out and their indication.

PRACTICE-IV

Surface roughness and its indication: Definitions, finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

PRACTICE-V

Heat treatment and surface treatment symbol used on drawings. Detailed and part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

INSTRUMENTATION CONTROL SYSTEMS LAB:

1. Calibration of pressure gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for load measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an Engine bed at various loads.
11. Study and calibration of McLeod gauge for low pressure

REFERENCES:

1. Measurement Systems: Applications & Design, E.O.Doebelin, Mc Graw Hill
2. Instrumentation, Measurement & Analysis by B.C.Nakra & K.K.Choudhary, TMH

INDUSTRY ORIENTED MINI PROJECT

B.TechIV Year I Semester

L	T	P	C
0	0	0	3

Course Outcomes:

1. Apply the engineering principles in the execution of a sub system under mechanical engineering domain.
2. Predict and solve the related issues of the sub system.
3. Evaluate the effectiveness of the sub systems the light of technical, ethical and other standards.

The students in a group of 4 to 5 works on an industry oriented topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

PRODUCTION PLANNING & CONTROL

B.TechIV Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes:
1. Identify the milestones of production planning.
2. Illustrate the forecasting and its importance in production plan preparation and inventory stocking.
3. Analyze the alternate solutions in the execution stage of routing.
4. Estimate and summarize the aggregate plans of a company

UNIT-I
Introduction- Definitions, objectives of production planning and control- functions of production planning and control-elements of production control- types of production- organization of production planning and control, internal organizations department

UNIT-II
Forecasting - Importance of forecasting, types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III
Inventory Management Functions inventory, Relevant inventory cost, ABC analysis, VED Analysis- EOQ model, Inventory control systems, P- Systems and Q-Systems Introduction to MRP and ERP, Line of balance , JIT inventory, Japanese concepts.

UNIT- IV
Routing – Definition, routing procedure, Route sheets, Bill of material, factors affecting routing procedure. Schedule: Definition, difference with loading. Scheduling polices, techniques, standard scheduling methods, job shop, flow shop. Line balancing, aggregate planning, methods for aggregate planning, Chase planning, expediting, control aspects.

UNIT-V
Dispatching: Activities of dispatcher, dispatching procedure, follow up, definition, reasons for existence of functions, types of follow up, applications of computer in production planning and control

TEXT BOOKS:
1. Production and Operations Management R.Panneer Selvam, PHI.
2. Production Planning and Control& Industrial Management: K.C Jain,L.N.Agarwal-Khanna.

REFERENCES:

1. Operations Management(Theory and Practice), Dipak- Orient Blackswan
2. Operations Management, US.N. Chary I, TMH.
3. Production Planning and Control- Text & cases-SK Mukhopadhyaya, PHI
4. Production Planning and Control: M.Mahajan, Dhanpati ral & Co.

UNCONVENTIONAL MACHINING AND PROCESSES

B.TechIV Year II Semester

L	T	P	C
3	0	0	3

Course Outcomes:

1. Understanding the difficulties in traditional machining process and the needs for nontraditional machining.
2. Choose the materials and processes for optimum machining responses.
3. Analyze the basic mechanisms and variables in the unconventional machining processes.
4. Summarize the advantages and feasibility considerations while applying the unconventional machining processes.

UNIT–I

Introduction: Need for non-conventional machining processes, Classification of non-conventional machining processes, considerations in process selection, materials, general characteristics and applications of non-conventional machining processes, Historical development.

UNIT–II

Mechanical Material Removal Processes: Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining: Basic principles, components, process variables, advantages and disadvantages, applications.

UNIT–III

Thermal Material Removal Processes: Electro Discharge Machining, Wire EDM, Laser Beam Machining, Electron Beam Machining, and Ion Beam Machining: Basic principles, components, process variables, advantages, limitations and applications.

UNIT–IV

Chemical Material Removal Processes: Electro Chemical Machining, Electro Chemical Grinding, Electro Chemical Honing, and Electro Chemical Deburring: Basic principles, components, process variables, advantages, limitations and applications.

UNIT-V

Electron Beam Machining: Generation and control, Theory of electron beam machining, Comparison of thermal and non-thermal processes. General principle and application of laser beam machining Thermal features, Cutting speed and accuracy of cut.

Plasma Arc Machining: Application of plasma for machining, metal removal mechanism, Process parameters, Accuracy and surface finish and other applications of plasma in manufacturing industries.

TEXT BOOKS:

1. Advanced Machining Processes, VK Jain, Allied publishers.
2. Modern Machining Process, Pandey P.C. and Shah H.S., TMH

REFERENCES:

1. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGraw Hill
2. New Technology by Bhattacharya A, the Institution of Engineers, India 1984.
3. Non Traditional Manufacturing Processes, Gary F Benedict, CRC Press.
4. Non-Traditional Machining, P.K. Mishra, New Age.

TECHNICAL SEMINAR

B.TechIV Year II Semester

L	T	P	C
3	1	0	2

Course Outcomes

1. Synthesizing information on any one specialized topic from text books, peer revised journals, hand books and other technical resources.
2. Generation a technical seminar report comprising of all relevant information with stipulated standards.
3. Judge the veracity of the topic with various time domains

METHOD OF EVALUATION:

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his/ her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he/ she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

COMPREHENSIVE VIVA VOCE

B.TechIV Year II Semester

L	T	P	C
0	0	0	2

Course Outcomes

1. Revise the mechanical engineering principles postulations and other technical information in order to apply in various conditions.
2. Explain the relevance of a technical note for a given application.
3. Collate and justify the design by the acquired comprehensive technical knowledge and skill.

Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department along with an external examiner. The Comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he/she studied during the B. Tech. course of study. The Comprehensive VivaVoce is evaluated by the Committee. There are no internal marks for the Comprehensive Viva-Voce.

MAJOR PROJECT

B.Tech IV Year II Semester

L	T	P	C
0	0	0	10

Course Outcomes

1. Develop a model comprising of real time application in the industry.
2. Design a system under the domain of mechanical engineering.
3. Evaluate for simulation design, analysis and manufacturing facts of the system.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

MECHANICAL ENGINEERING

I YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits	Total Hours	Total Marks
A11001	English-I	2	0	0	2	2	100
A11002	Mathematics - I	4	1	0	3	4	100
A11003	Engineering Physics-I	3	1	0	3	4	100
A11501	C Programming	3	1	0	3	4	100
A11301	Engineering Graphics-I	2	0	3	3	5	100
A11302	Engineering Mechanics – I	3	1	0	3	4	100
A11581	C Programming Lab	0	0	3	2	3	75
A11081	English Language Communication Skills Lab-I	0	0	3	2	3	75
A11082	Engineering Physics Lab	0	0	3	2	3	75
A11381	Engineering Workshop	0	0	3	2	3	75
	Total	17	07	15	25	35	900

I YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits	Total Hours	Total Marks
A12005	English – II	2	0	0	2	2	100
A12006	Mathematics – II	4	1	0	3	4	100
A12007	Engineering Physics-II	3	1	0	3	4	100
A12008	Applied Chemistry	3	1	0	3	4	100
A12304	Engineering Mechanics – II	3	1	0	3	4	100
A12305	Engineering Graphics – II	2	0	3	3	5	100
A12085	English Language Communication Skills Lab-II	0	0	3	2	3	75
A12086	Engineering Physics and Chemistry Lab	0	0	3	2	3	75
A12087	IT & Engineering Workshop	0	0	3	2	3	75
	Total	17	7	12	23	32	825

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Lecture **T – Tutorial** **P – Practical** **D – Drawing**

II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits	Total Hours	Total Marks
A13013	Numerical Methods	3	1	0	3	4	100
A13207	Electrical and Electronics Engineering	3	1	0	3	4	100
A13308	Mechanics of Solids	4	1	0	4	5	100
A13309	Thermodynamics	4	1	0	4	5	100
A13310	Metallurgy and Material science	4	1	0	4	5	100
A13011	Environmental science	3	1	0	2	4	100
A13283	Electrical and Electronics Engineering Lab	0	0	3	2	3	75
A13383	Metallurgy and Mechanics of solids Lab	0	0	3	2	3	75
A13MC2	Intellectual Property Rights And Cyber Laws	**2**	**0**	**0**	**0**	**2**	**50**
	Total	**23**	**6**	**6**	**24**	35	800

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits	Total Hours	Total Marks
A14312	Production Technology	3	1	0	3	4	100
A14313	Kinematics of Machinery	4	1	0	4	5	100
A14314	Thermal Engineering-I	3	1	0	3	4	100
A14315	Mechanics of Fluids and Hydraulic Machines	4	1	0	4	5	100
A14316	Machine Drawing	0	6	0	3	6	100
A14015	Probability and Statistics	3	0	0	3	3	100
A14384	Production Technology Lab	0	0	3	2	3	75
A14385	Mechanics of Fluids and Hydraulic Machines Lab	0	0	3	2	3	75
A14MC3	Professional Communication	**2**	**0**	**0**	**0**	**2**	**50**
	Total	19	10	6	24	35	800

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Lecture **T – Tutorial** **P – Practical** **D – Drawing**

S. No.	Code	Subject	L	T/P/D	Credits
	III Year I Semester				
1	**A15317**	Design of Machine Members-I	3	1	3
2	**A15318**	Thermal Engineering-II	3	1	3
3	**A15319**	Dynamics of Machinery	3	1	3
4	**A15320**	Machine tools and Metrology	3	1	3
5	**A15321** **A15322** **A15323**	**PROFESSIONAL ELECTIVE – I** **Automobile Engineering** Computational Fluid Dynamics Welding Technology	3	1	3
6	**A15324** **A15348**	**OPEN ELECTIVE – I** Elements of Mechanical Engineering Product Engineering	3	1	3
7	**A15386**	Thermal Engineering lab	-	2	2
8	**A15387**	Metrology and machine Tools Lab	-	2	2
9	**A15TP1**	Personality Development & Behavioral Skills	2	-	2
		Total Credits	**20**	**10**	**24**
	III Year II Semester				
1	**A16326**	Design of Machine Members-II	3	1	3
2	**A16327**	Heat Transfer	3	1	3
3	**A16328**	Finite Element Methods	3	1	3
4	**A16018**	Managerial Economics and Financial Analysis	3	1	3
5	**A16329** **A16330** **A16331**	**PROFESSIONAL ELECTIVE – II** **Refrigeration and Air Conditioning** Renewable Energy Sources Tool Design	3	1	3
6	**A16332** **A16333**	**OPEN ELECTIVE – II** Basic Automobile Engineering Material Science Engineering	3	1	3
7	**A16388**	Heat Transfer Lab	-	2	2
8	**A16090**	Advanced Communication Skills Lab	-	2	2
9	**A16TP2**	Quantitative Methods & Logical Reasoning	2	-	2
		Total Credits	**20**	**10**	**24**

S. No.	Subject Code	Subject Name	L	T	P	Total Credits
B.Tech IV YEAR I SEMESTER						
1	**A17334**	Operation Research	4	1	0	3
2	**A17335**	CAD/CAM	4	1	0	3
3	**A17336**	Mechanical Measurements and instrumentation	3	1	0	3
4	**A17343** **A17344**	**OPEN ELECTIVE – III** Optimization Techniques Maintenance and Safety Engineering	3	1	0	3
5	**A17337** **A17338** **A17339**	**PROFESSIONAL ELECTIVE -III** Robotics Mechatronics Composite Materials	3	1	0	3
6	**A17340** **A17341** **A17342**	**PROFESSIONAL ELECTIVE -IV** CNC Technologies Power plant Engineering Computer Graphics	3	1	0	3
7	**A17389**	Computer Aided Design and Manufacturing Lab	0	0	3	2
8	**A17390**	Production Drawing practice and Instrumentation lab	0	0	3	2
9	**A173P1**	Industry Oriented Mini Project				2
		Total Credits				**24**
B.Tech IV YEAR II SEMESTER						
1	**A18345**	Production Planning And Control	3	1	0	3
2	**A18346**	Plant Layout And Material Handling	3	1	0	3
3	**A18347**	Unconventional Machining Processes	3	1	0	3
4	**A183TS**	Technical Seminar	0	0	6	2
5	**A183CV**	Comprehensive Viva	0	0	0	2
6	**A183P2**	Project work	**0**	**0**	**0**	11
		Total Credits				**24**

I Year B.Tech. – I Sem

L	T/P/D	C
2	0	2

English– I
(COMMON TO ALL BRANCHES)

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc. The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.*

2. OBJECTIVES:
a. To improve the language proficiency of the students in English with emphasis on LSRW skills.

b. To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.

c. To develop the study skills and communication skills in formal and informal situations.

SYLLABUS:
Listening Skills:
Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation

2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:
<u>Objectives</u>

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.
• Oral practice
• Describing objects/situations/people
• Role play – Individual/Group activities (Using exercises from all the nine units of the prescribed text: *LearningEnglish : A Communicative Approach*.)
• Just A Minute(JAM) Sessions.

Reading Skills:
<u>Objectives</u>

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.
• Skimming the text
• Understanding the gist of an argument
• Identifying the topic sentence
• Inferring lexical and contextual meaning
• Understanding discourse features
  Scanning
• Recognizing coherence/sequencing of sentences

Writing Skills:
<u>Objectives</u>

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.
3. To enable them to transfer the intent, style, tone, and expressions of the message from the mother tongue to English.
• Writing sentences
• Use of appropriate vocabulary
• Paragraph writing
• Coherence and cohesiveness
• Narration / description
• Note Making
• Formal and informal letter writing
• Describing graphs using expressions of comparison
.Transcreation

<u>TEXTBOOKS PRESCRIBED</u>:

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Eight Units**, are prescribed:

For Detailed study:

<u>First Textbook</u>: ***"Skills Annexe -Functional English for Success***",

Published by Orient Black Swan, Hyderabad

For Non-detailed study:

<u>Second text book</u> ***"Epitome of Wisdom",*** Published by Maruthi Publications, Guntur

Semester-I

Unit-I: Wit and Humor from “Skills Annexe -Functional English for Success”

L-Listening For Sounds, Stress and Intonation

S-Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)
R- Reading for Subject/ Theme
W- Writing Paragraphs

Unit –II: Mokshagundam Visvesvaraya from “Epitome of Wisdom”

G-Types of Nouns and Pronouns
V-Homonyms, homophones synonyms, antonyms

Unit-III: Cyber Age from “Skills Annexe -Functional English for Success”

L – Listening for themes and facts
S -Apologizing, Interrupting, requesting and making polite conversation
R - For theme and gist
W - Describing People, Places, Objectives, Events,

Unit-IV: Three Days To See from “Epitome of Wisdom”

G- Verb &Verb forms
V- Adjective and Adverb

Unit-V : Human Values & Professional Ethics from “Skills Annexe -Functional English for Success”

Note-Making, Note-Taking

NOTE: Textual exercises are included from the prescribed Text book I & I

MATHEMATICS-I

I YEAR B.Tech, I SEMESTER

L	T/P/D	C
4	1/-/-	4

(COMMON TO CE, EEE, ME, ECE, CSE & IT)

UNIT-I: Matrices and System of Linear Equations

Matrices and Systems of Linear Equations: Real matrices – Symmetric, Skew - symmet*ric*, *O*rthogonal, Complex matrices: Hermitian, Skew – Hermitian and Unitary. Elementary transformations-Rank-Echelon form, Normal form – System of Linear equations – Direct Methods (Gauss Elimination, Gauss Jordan).

UNIT-II: Eigen Values and Eigen Vectors

Eigen values, Eigen vectors – properties, Clayey-Hamilton Theorem (without Proof) - Inverse and powers of a matrix by Clayey-Hamilton theorem – Diagonolization of matrix. Linear Transformation – Orthogonal Transformation, Quadratic forms-Nature, Index and Signature.

UNIT-III: Functions of Single Variable and Functions of several variables

Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) – Geometrical interpretation of Mean value theorems. Functions of several variables – Partial Differentiation and total differentiation (left as an exercise to student) - Functional dependence-Jacobian Determinant- Maxima and Minima of functions of two variables with constraints and without constraints.

UNIT-IV: Improper Integration and Multiple Integrals:

Gamma and Beta Functions-Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions. Multiple integrals - double and triple integrals – change of order of integration-change of variables

UNIT-V: Laplace transform and its applications to Ordinary differential equations:

Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms – Application of Laplace transforms to ordinary differential equations.

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40^{th} Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Engineering Mathematics Vol - I, 10^{th} Revised Edition, New Delhi, S. Chand & Company Limited.
3. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10^{th} Revised Edition, New Delhi, S. Chand & Company Limited.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Srimanta Pal, Subodh C. Bhunia, (2015) ,Engineering Mathematics, 1st Edition, New Delhi, Oxford University Press
2. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House
3. Ramana B.V (2010), Engineering Mathematics, New Delhi, Tata McGraw Hill Publishing Co. Limited
4. Mathematical Methods: S.R.K. Iyengar and R.K. Jain, Narosa Publishing House.

OBJECTIVES:

1. This course helps in translating a physical or other problem in mathematical model.
2. The course intends to provide an overview of Matrices which occur in physical and engineering problems.
3. To provide an overview of discovering the experimental aspect of modern applied mathematics.
4. This course creates the ability to model, solve and interpret any physical or engineering problem.
5. To gain knowledge about Laplace Transforms, Double integrals and Triple integrals to apply in engineering and technologies.

I Year B.Tech. – I Sem

L	T/P/D	C
3	0	2

ENGINEERING PHYSICS – I
(COMMON TO ALL BRANCHES)

UNIT- I

Intereference and Diffraction: Interference in thin films - Newton's rings – Diffraction - Fraunhofer and Fresnel diffraction - Diffraction due to single slit, Diffraction grating (Qualitative) – Polarization, Double refraction-Nicol's Prism - Applications of polarization.

UNIT- II

Crystal Structures: Inter atomic force – Cohesive energy of diatomic molecule – Crystalline and Amorphous solids - Space lattice and unit cell – Lattice parameters – Crystal systems – Bravais lattices, Atomic radius, co-ordination number, packing fractions of Simple Cubic, Body Centered Cubic, Face Centered Cubic lattices.

Crystal directions, planes and X- Ray diffraction: Crystal planes and directions – Miller Indices - Inter planar spacing of Orthogonal crystal systems - Structure of NaCl and Diamond – X-ray Diffraction: Bragg's law – Determination of lattice constant by XRD (Powder method) – Crystal defects: Point and Line defects (Qualitative) – Burger's Vector.

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UNIT – III

Free electron theory of metals Classical Theory, Electrical Conductivity and Ohm's Law – Drawbacks, Sommerfeld theory (Qualitative)

Elements of statistical mechanics Introduction, Phase space, Definition of Ensembles, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics (Qualitative) – Planck's law of black body radiation – Deduction of Wien's law and Rayleigh-Jeans law from Planck's law.

UNIT – IV

Principles of Quantum mechanics Waves and particles – De Broglie hypothesis - Matter waves - Davisson and Germer experiment – Heisenberg's Uncertainity principle – Schrodinger Time independent Wave Equation – Wave function and its Physical Significance - Particle in one dimensional potential box(wave functions, probability densities and energy states) – Density of states.

Band theory of solids Electron in a periodic potential – Bloch Theorem - Kronig-Penney model (Qualitative) – Origin of energy band formation in solids – Classification of materials into conductors, semiconductors & Insulators - Concept of effective mass of an electron.

UNIT- V

Semiconconductor Physics Fermi level in Intrinsic and Extrinsic semiconductors - Intrinsic semiconductor and carrier concentration – Extrinsic semiconductor and carrier concentration – Characteristics of p-n junction diode – Hall effect – LED and Photodiode.

TEXT BOOKS:

(1) Engineering Physics by P K palanisamy :Scietech publication
(2) Solid State Physics by M Armugam; Anuradha Publications

REFERENCE BOOKS:

(1) Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons
(2) Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons
(3) Engineering Physics by V Rajendran; McGraw hill education private ltd.
(4) A Text book of Engineering Physics by M N Avadhanulu, P G Kshirsagar; S Chand
(5) Engineering Physics by K Malik, A K Singh; Tata Mc Graw hill book publishers
(6) Engineering Physics by M.R.Srinivasan, New Age Publishers

I Year B. Tech I Sem	**L**	**T/P/D**	**C**
	3	**1/-/-**	**3**

C PROGRAMMING

(MECH,CIV)

OBJECTIVES:

- To understand the various steps in program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs.
- To learn to write Programs in C to solve programs using structured programming approach.
- To introduce the students the basic concepts as input output statements, loops, functions, arrays and pointers.

OUTCOMES:

- Students will demonstrate a depth of knowledge and apply the methods of C Language to solve the mathematical problems.
- Ability to apply and develop logical skills and problem solving using C Programming Language.

UNIT-I

Introduction to Computers: Computer System, Computing Environment, Generations of Computer Languages, Software Development Life Cycle, Algorithms and Flowchart.

Data Representation: Decimal, Binary, Octal, Hexadecimal number systems and Inter-Conversions, ASCII values.

UNIT-II

Introduction to C language: Background, Structure of C program, Creating and Running a C-Program, Input/ Output statements, C tokens, Data types, Operators, Operator Precedence and Associativity, Expression evaluation, Type Casting and Type Conversion, C Programming examples.

UNIT-III

Control Structures: Selection Statements: if and switch statements, Iterative Statements/Loops: while, for, do-while statements, goto, break and continue statements, C Programming examples.

UNIT-IV

Arrays: Introduction to one dimensional and two dimensional Arrays- Declaration, Initialization and Accessing array elements, Array applications, C programming examples.

Strings: Introduction, String Input/output functions, Declaration, Initialization and Accessing Strings, Array of Strings, String Manipulation functions- strlen, strcat, strcmp, strcpy, strrev, C programming examples.

UNIT- V

Functions: Introduction to functions, Types of functions, Categories of functions, Recursion, Scope and Extent, Storage classes- auto, register, static, extern, Parameter passing techniques, Functions and pointers, Type Qualifiers, Preprocessor Directives, C programming examples.

TEXT BOOKS

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F.Gilberg, Third Edition, Cengage Learnimng.
2. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.
3. Let Us C, Yashavant P. Kanetkar, BPB Publications.

REFERENCE BOOKS

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. The C Programming Language by Brain WKernighan, Dennis M.Ritchie.
3. Absolute beginners guide to C, Greg M. Perry, Edition 2, publishers :SamsPub.,1994

I YEAR B TECH I SEM

ENGINEERING GRAPHICS-1

(Mech & Civil)

Objectives:

1. To know about different types of Drawing Instruments and about different types of lines.
2. To know about different types of curves and projections.
3. To know projections of points, straight lines, solids etc.

Outcomes:

1. Student gets knowledge on various drawing instruments and its usage.
2. Students capable to draw various curves like conic curves, cycloid curves and involutes.
3. Student can understand about orthographic projection and able to draw points, lines, planes and solids according to orthographic projections.

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning.
Construction of polygons Practice only.
Curves used in Engineering Practice and their Constructions.
Conic Sections: Ellipse, Parabola, Hyperbola including the Rectangular Hyperbola - General method only.
Cycloidal curves - Cycloid, Epicycloid and Hypocycloid

UNIT – II

Introduction to Scales: Construction of Plain, Diagonal, and Vernier Scales.
Involutes of Circle & Regular Polygons.

UNIT – III

Drawing of Projections or Views (Orthographic Projection in First Angle Projection Only): Principles of Orthographic Projections – Conventions – First and Third Angle Projections, Projection of Points, Projection of Lines - inclined to both planes, True lengths. (**Traces, Mid points** can be removed)

UNIT – IV

Projections of Planes: Projections of regular Planes, traces, Projections of Planes on Auxiliary lanes.

UNIT –V

Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, Axis inclined to both planes – Change of position and Auxiliary plane method.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Scietech publishers.

REFERENCES:

1. Engineering Graphics,P.I. Varghese, TMH
2. Engineering Drawing, N.S. Parthasarathy/Vela Murali, Oxford University Press.
3.Engineering Graphics for Degree,K.C. John,PHI learning.

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B.Tech. I Year I semester

ENGINEERING MECHANICS – I

(Common to ME, CE)

L	T/P/D	C
3	1/-/-	2

UNIT-I

Introduction to Engineering Mechanics - Basic Concepts
System of Forces: Coplanar Concurrent Forces -Resultant - Moment of Force and its Application - Couples and Resultant of Force Systems, Forces in space.

UNIT-II
Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Conditions of Equilibrium of Coplanar forces and Spatial System of forces

UNIT-III
Friction: Basic concepts, Types of Friction, cone of friction,
Applications of Friction: Ladder friction, Wedge friction, and Screw friction

UNIT-IV
Centroid: Centroids of simple figures (from basic principles),Centroids of Composite Figures.

Centre of Gravity: CG of simple bodies (from basic principles), CG of composite bodies, Pappus theorem.

UNIT - V
Area Moment of Inertia: Definition - MI of Plane figures & Composite Figures, Polar Moment of Inertia, Product of Inertia and Transfer Formula for Product of Inertia.

Mass Moment of Inertia: MI of Masses, Transfer Formula for MMI, MMI of composite bodies.

TEXT BOOKS:

1) Engineering Mechanics by Ferdinand. L. Singer
2) Engineering Mechanics by basudeb Bhattacharyya Oxford University Press.

REFERENCE BOOKS:

1) Engineering Mechanics by Timoshenko & Young.
2) Engineering Mechanics by S.S.Bhavikatti J.G.Rajasekharappa.
3) Engineering Mechanics by Pakhirappa
4) Engineering Mechanics by A. K. Tayal.

I Year B.Tech – I Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

C PROGRAMMING LAB

(MECH, CIVIL)

OBJECTIVE:

- To provide and understanding the concept of programming Languages.
- To write programs in C to solve the mathematical problems.
- To understand how to use the input output statements, loops, functions, arrays and pointers.
- To learn debugging concepts.

OUTCOME:

- Understand and analyze different syntax of C.
- Design a program for a given Problem.
- To analyze and design C Program for a particular problem.

Week 1:

Familiarity with Basic Linux Commands

Week 2:

Using vi editor – Creation of text files

Week 3:

Write simple programs using scanf and printf functions and familiarity with format strings.

Week 4:

Write programs to illustrate Operators

Week 5:

Write programs to illustrate If statements

a) To find largest and smallest of given numbers

b) To find the roots of the quadratic equation.

Week 6:

a) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

b) Write a C program to calculate the following Sum:
$SUM = 1 - X^2/2! + X^4/4! - X^6/6! + X^8/8! - X^{10}/10!$

Week 7:

Write programs on while and do..while loops

a) Program to find the sum of the individual digits of a given positive integer.
b) Program to generate the first n terms of the Fibonacci sequence
c) Program to check the given no is Palindrome or not

Week 8:

Write programs on for loop and nested loops.

- **a)** To generate sum of n natural numbers
- **b)** To generate Pascal triangle
- **c)** To generate all the prime numbers between 1 and n

Week 9 & 10:

- **a)** Program to find the minimum and maximum element of an array.
- **b)** Program to search for given element in an array.
- **c)** Program to convert Binary no to Decimal no and vice-versa.

Week 11:

- **a)** Program to perform Addition of Two Matrices
- **b)** Program to perform Multiplication of Two Matrices
- **c)** Program to perform a Transpose of a given Matrix

Week 12:

1. Implement string manipulation functions
2. Write a C program to accept a string of any characters and display the number of vowels in that string
3. Display numbers words and characters in a string.

Week 13 & 14:

- a) Implement categories of user defined functions
- b) Implement recursive and non recursive functions
    - i. To find the factorial of a given integer.
    - ii. To find the GCD (greatest common divisor) of two given integers.

Week 15:

Implementation of parameter passing Techniques

- a) Call by value
- b) Call by reference

Week 16:

Review and Revision

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Data Structures Using C (Paperback) by Aaron M. Tenenbaum
3. Advanced UNIX Programming/N.B Venkateswarlu.
4. Let Us C, Yashavant P. Kanetkar, BPB Publications.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2 .Let Us C: Yashvant Kannetkar, BPB.
3. C Programming & Data Structures, E. Balagurusamy, TMH.

I Year B.Tech. I Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

English Language Communication Skills Lab-I

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

1. To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
2. To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
4. To improve the fluency in spoken English and neutralize mother tongue influence
5. To train students to use language appropriately for interviews, group discussion and public speaking

Learning Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities

2. Neutralization of accent for intelligibility

3. Speaking with clarity and confidence thereby enhancing employability skills of the students

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

The following course content is prescribed for the English Language Communication Skills Lab:

Exercise-I

CALL Lab: Introduction to Phonetics
Speech Sounds
Vowels and Consonants

Exercise-II

ICS Lab: Ice-Breaking activity and JAM session
Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise-III

CALL Lab: Structure of Syllables
Past Tense Marker and Plural Marker
Weak Forms and Strong Forms
Consonant Clusters.

Exercise-IV

ICS Lab: Situational Dialogues -Role-Play- Self-introduction and introducing others-Greetings- Apologies- Requests.

Exercise-V

ICS Lab: Social and Professional Etiquette and Telephone Etiquette-Tenses-Non-Verbal Communications.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab :

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories.

New Delhi: Foundation

2. **Strengthen Your Steps -** Dr. M. Hari Prasad and others, Maruthi Publications

3. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011.

Macmillan Publishers India Ltd. Delhi.

4. Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata

McGraw Hill

5. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

6. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison.

2013. Orient Blackswan. Hyderabad.

7. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP

8. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP

9. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi : Foundation

10. Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan

11. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.

12. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.

13. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)

14. **Lab Manual:** A Manual entitled "**English Language Communication Skills (ELCS) Lab Manual- cum- Work Book**", published by Cengage Learning India Pvt. Ltd, New Delhi. 2013

I Year B.Tech – I Sem

L	T/P/D	C
0	-/3/-	2

ENGINEERING PHYSICS LAB

(Mech and Civil)

1. Torsional Pendulum Experiment – Determination of rigidity modulus of material of a wire
2. Melde's experiment
3. Newton's Rings
4. Dispersive Power of the material of a Prism using Spectrometer
5. Stewart & Gee's experiment
6. LED Characteristics
7. Diffraction Grating – Determination of wavelength of laser
8. RC Circuit – Decay of Charge

B.Tech I Year I semester

ENGINEERING WORKSHOP - I

(Common to MECH, CE)

L	T	P/D	C
---	---	3	2

Objective: To impart basic knowledge of various tools and their use in different sections of manufacture such as fitting, carpentry, Tin-smithy and house wiring

1. TRADES FOR EXERCISES:

At least THREE exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-smithy and development of jobs carried out and soldering.
4. House-wiring

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine shop

TEXT BOOKS:

1. Work shop manual - P.Kannaiah/K.L Narayana/scitech publishers.
2. Workshop manual by Venkat Reddy

English– II
(COMMON TO ALL BRANCHES)
Semester II

Unit –I: **Last Leaf** by O Henry

G –Tense & Aspect
V – Synonyms and Antonyms
Unit-II G: **Risk Management** from Skills Annex -Functional English for Success L
-Listening for specific details and information

S- Narrating, expressing opinions and telephone interactions R
-Reading for specific details and information
W- Writing formal letters and CVs
Unit-III: The Secret of Work by Swami Vivekananda from "Epitome of Wisdom"
G- Prepositions and Concord, Voice and Reported Speech
V-Collocations and Technical Vocabulary
Unit-IV : Sports and Health from "Skills Annex -Functional English for Success

Critical Listening and Listening for speaker's tone/ attitude
S- Group discussion and Making presentations
R- Critical reading, reading for reference
W-Project proposals; Technical Reports, Project Reports and Research Papers

Unit-V: Convocation Speech by Narayan Murthy, from "Epitome of Wisdom"

G- Writing Memos, Minutes of Meeting, Transcreation (Translating from the mother tongue to English), V-Vocabulary - idioms and Phrasal verbs, One-Word Substitutes

REFERENCES:

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi. 2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.
11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.
16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers.

w.e.f. 2015-2016 Academic year

MATHEMATICS-II

I YEAR B.Tech, II SEMESTER

L	T	P	C
4	1	0	4

(COMMON TO CE, EEE, ME, ECE, CSE & IT)

Pre Requisites: Nil

OBJECTIVES:

1. This course creates the ability to model, solve and interpret any physical or engineering problem
2. To gain knowledge about vector calculus, Fourier series and Fourier transforms to apply in engineering and technologies
3. The course intends to provide an overview of Matrices which occur in physical and engineering problems.
4. This course enhances the conceptual understanding of the learners about the solutions of engineering problems
5. Acquire knowledge about different methods of solution to solve a physical problem.

OUTCOMES:

At the end of the course, the student will be able to:

1. Gains the knowledge to tackle the engineering problems using the concepts of Fourier series, various transforms and partial differential equations.
2. Become familiar with the application of ordinary differential equations and vector calculus to engineering problems.
3. Verify the integral theorems.

UNIT-I: Differential Equations of first order and their Applications:
Differential equations of first order and first degree: exact, linear and Bernoulli, Applications to Newton's law of cooling, law of natural growth and decay, orthogonal trajectories.

UNIT-II: Higher Order Linear Differential Equations and their Applications:
Linear differential equations of second and higher order with constant coefficients, RHS term of the type f(X) $= e^{ax}, \sin ax, \cos ax \; and \; x^k, e^{ax}V(x), x^kV(x)$.Method of variation of parameters. Equations reducible to constant coefficients- Cauchy's and Lagrange's differential equations. Applications - Bending of beams, Electrical circuits, simple harmonic motion.

UNIT-III: Fourier Series:
Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

UNIT-IV: Fourier Transforms:
Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT-V: Vector Calculus:
Gradient- Divergence- Curl and their related properties - Potential function - Laplacian and second order operators. Line integral – work done —- Surface integrals - Flux of a vector valued function and Volume integral. Vector integrals theorems: Green's – Stoke's and Gauss's Divergence Theorems (Only Statements & their Verifications).

TEXT BOOKS:

1. Grewal B.S (2007), Higher Engineering Mathematics, 40th Edition, New Delhi, Khanna Publishers.
2. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Mathematical Methods, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
3. Iyengar T.K.V., Krishna Gandhi B. & Others (2011), Engineering Mathematics Vol - I, 10th Revised Edition, New Delhi, S. Chand & Company Limited.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley.

REFERENCE BOOKS:

1. Srimanta Pal, Subodh C. Bhunia, (2015), Engineering Mathematics, 1st Edition, New Delhi, Oxford University Press.
2. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3rd Edition, New Delhi, Narosa Publication House.
3. Integral Transforms by A.R.Vasista,Krishana Prakashan Private Limited
4. Schaum's outline series on Vector Analysis; Linear Algebra.
5. Larry C. Andrews and Bhimsen K. Shivamoggi, Integral Transforms for Engineers, Prentice – Hall of India Private Limited, New Delhi.

I Year B.Tech. – II Sem

L	T/P/D	C
2	1	2

ENGINEERING PHYSICS – II

(COMMON TO ALL BRANCHES)

UNIT – I

Magnetism and Magnetic materials: Introduction – Basic definitions – Origin of magnetic moment, Bohr magneton – Properties of Dia, Para ,Ferro, Antiferro and Ferri magnetic materials – Domain theory of ferromagnetism, Hysteresis curve – Soft and Hard magnetic materials and their applications.

UNIT II

Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector – Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities: Ionic and Electronic – Internal Fields in Solids, Clausius – Mossotti Equation – Piezo, Pyro and Ferro electricity – Applications of ferroelectric materials.

UNIT III

Laser and **Fiber optics**: Characteristics of Lasers – Spontaneous and Stimulated Emission of radiation, meta stable state, population inversion, lasing action, Einstein's coefficients and relation between them – Ruby Laser – Helium-Neon Laser –Semiconductor Laser – Applications of lasers - Basic principle of optical fiber, Acceptance angle, Numerical aperture (Quantitative) – Types of optical fiber – Attenuation in fiber – Applications of optical fiber.

UNIT - IV

Superconductivity: Properties of Superconductors – Heat capacity – Isotopic effect - Persistent currents – Critical fields – Meissner effect –Type I and Type II superconductors – BCS Theory – Flux quantization – Josephson effect – SQUIDS – Basics of High Temperature superconductors - Applications of superconductors.

UNIT V

Fundamental of Nanoscience: Introduction – Basic definitions: Nanoscale, Nanoscience and Nanotechnology – Types of Nanomaterials – Synthesis of Nanomaterials – Top down & Bottom up approaches: sol-gel, Ball milling and CVD methods, Techniques for characterization: TEM, SEM – Properties – Surface to volume ratio, Quantum confinement – Applications.

TEXT BOOKS:

(1) Engineering Physics by P K palanisamy :Scietech publication

(2) Solid State Physics by M Armugam; Anuradha Publications

REFERENCE BOOKS:

(1) Introduction to Solid State Physics by Charles Kittel : John Wiley & Sons

(2) Engineering Physics by R.K.Gaur and S.L.Gupta; Dhanpat Rai and Sons

(3) Engineering Physics by V Rajendran; McGraw hill education private ltd.

(4) A Text book of Engineering Physics by M N Avadhanulu, P G Kshirsagar; S Chand

(5) Engineering Physics by K Malik, A K Singh; Tata Mc Graw hill book publishers

(6) Engineering Physics by M.R.Srinivasan, New Age Publishers

I Year B.Tech. CIVIL – II Sem	L	T/P/D	C
	3	1	2

APPLIED CHEMISTRY

(CIVIL & MECH)

Course objectives:

1. To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.
2. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
3. To provide the students with the necessary knowledge to solve the problems and make decisions with regards to the application of materials in a variety of engineering disciplines.
4. To equip the students with the required fundamentals of engineering chemistry to carry out in the interdisciplinary research such that the findings benefit the common man.
5. After the completion of the course, the student would understand about the important chemistry of water, electrochemistry, batteries and surface chemistry.

Course Outcomes:

1. At the end of the course the students will be able to

2. Perform laboratory experiments related to various functions of chemistry.

3. List the basic materials to be used as engineering materials for various applications in their respective Engineering disciplines.

4. Analyze the results and communicate these results in safe, professional and ethical manner.

UNIT I : ELECTROCHEMISTRY & BATTERIES

Conductance-types (electronic and electrolytic), Types of electrolytic conductance: specific, equivalent and molar conductance. Electrode, electrode potential, galvanic cell, cell reactions and cell notation, cell EMF, electrochemical series & is applications, types of electrodes (Normal Hydrogen Electrode, calomel electrode, glass electrode and quinhydrone electrode), Nernst equation and its applications,. Potentiometric titrations.

Introduction to cell and battery, characteristics of a cell. Primary (lithium cell) and secondary cells, (lead-Acid cell, Ni-Cd cell and Lithium ion cells,). Engineering applications of batteries, Solar battery, Fuel cells – Hydrogen – Oxygen fuel cell, advantages and engineering applications of fuel cells.

UNIT II: CORROSION AND ITS CONTROL:

Corrosion and its types: chemical and electrochemical corrosion, mechanism of chemical and electrochemical corrosion , galvanic , water line and pitting corrosion, factors affecting the rate of corrosion : nature of the metal , galvanic series, purity of metal, nature of corrosion product , nature of environment : effect of temperature, effect of pH, humidity. Corrosion control methods: Cathodic protection:
sacrificial anode method and impressed current cathode method. Protective coatings : metallic coatings (anodic and cathodic), methods of application on metals , hot dipping (galvanizing), cladding, cementation, electroplating(of copper) electro less plating (of nickel) . Organic coatings – paints, its constituents and their functions.

UNIT III: SURFACE CHEMISTRY

Adsorption , types - physical and chemical adsorption, Langmuir adsorption isotherm, application of adsorption, Colloids, classification of colloids, Electrical, mechanical & optical properties of colloids applications of colloids in industry. Micelles- Introduction, formation, structure, critical micellar concentration, uses.

Nano materials: Introduction, basic methods of preparation (co-precipitation method, chemical vapour deposition method and sol gel method) and applications of nano materials.

UNIT IV: FUELS & LUBRICANTS

Classification, Characteristics, Liquid fuels- petroleum-refining of petroleum ,Cracking(thermal and catalytic) ,Knocking- octane number and cetane number. synthetic petrol - (Fischer Tropsch's and Bergius process), Gaseous fuels – LPG and CNG. Calorific value (HCV and LCV).

Lubricants: Classification of lubricants, mechanisms of lubrication, properties of lubricants: Viscosity and viscosity index, cloud point, pour point, flash & fire point,

UNIT V: ADVANCED ENGINEERING MATERIALS
Biodegradable polymers, types, examples: Polyhydroxy butyrate (PHB) ,Poly-Hydroxybutyrate-co-b-Hydroxy valerate (PHBV) ,Polyglycolic acid (PGA) , Polylactic acid (PLA) ,Poly (Î-caprolactone) (PCL). Applications of biodegradable polymers.

Composite materials: Constituents of composite materials. Types of composite materials. Advantages and engineering applications of composite material

Biofuels – biodiesel, general methods of preparation and advantages

Text Books:
1. Engineering Chemistry by NYS.Murthy, Pearson, India.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company

Reference Books:
1. Text Book of Engineering Chemistry by Shasi Chawla, Dhantpat Rai publishing Company,
2. Engineering Chemistry by C.Daniel Yesudian , Anuradha publications

B.Tech. I Year II semester

ENGINEERING MECHANICS – II

(Common to CIVIL & MECH)

L	T/P/D	C
3	1/-/-	2

UNIT-I

Analysis of perfect frames (Analytical Method) – Types of Frames – Assumptions for forces in members of a perfect frame, Method of joints, Method of sections, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

UNIT-II

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

UNIT-III

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

UNIT-IV

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse-momentum method.

UNIT-V

Mechanical Vibrations : Definitions and Concepts – Simple Harmonic Motion – Free vibrations, simple and Compound Pendulums – Torsion Pendulum – Free vibrations without damping: General cases.

TEXT BOOKS:

1) Engineering Mechanics by Ferdinand. L. Singer
2) Engineering Mechanics by basudeb Bhattacharyya Oxford University Press.

REFERENCE BOOKS:

1) Engineering Mechanics by Timoshenko & Young.
2) Engineering Mechanics by S.S.Bhavikatti J.G.Rajasekharappa.
3) Engineering Mechanics by Pakhirappa
4) Engineering Mechanics by A. K. Tayal.

I YEAR B TECH II SEM

ENGINEERING GRAPHICS-2

(CIVIL & MECH)

Objectives:

1. To know how to draw the solids when they are sectioned and their developments.
2. To understand to draw the solids when they are interpenetrated with each other.
3. To analyze the conversion of isometric projection to orthographic projection and vice versa.
4. To know how to draw the Perspective projections.
5. To know the basics of CAD.

Outcomes:

1. Student able to draw, when the simple solids are sectioned and their developments of surfaces.
2. Student can imagine and construct the interpenetration of simple solids.
3. Student can convert and draw the given orthographic view to isometric view and vice versa.
4. Student can draw the Perspective projections of simple planes and solids.
5. Student can able to draw in CAD.

UNIT – I

Sections of Solids: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views

Development of Surfaces: Development of Surfaces of Right Regular Solids – Prisms, Cylinders, Pyramids, Cones and their parts.

Intersection of Similar Solids: Line method - Intersection of Prism Vs Prism, Cylinders Vs Cylinder Simple treatment only. **(Dissimilar category- this part can be removed.)**

UNIT – II

Isometric Projections/views: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines.

UNIT –III

Transformation of Projections: Conversion of Orthographic Views to Isometric Views and Isometric views to orthographic views.

UNIT –IV

Perspective Projection: Principle, Perspective elements, Perspective View of Points, Lines, Plane Figures and Simple Solids; Vanishing Point Method, Visual Ray Method.

UNIT –V

Introduction to Computer Aided Drafting: Generation of points, lines, curves, polygons, simple solids, dimensioning. (Simple treatment only) – 2 experiments instead of sheets.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Scietech publishers.

REFERENCES:

1. Engineering Graphics,P.I. Varghese, TMH
2. Engineering Drawing, N.S. Parthasarathy/Vela Murali, Oxford University Press.
3.Engineering Graphics for Degree,K.C. John,PHI learning.

I Year B.Tech. ECE – II Sem	**L**	**T/P/D**	**C**
	0	**-/3/-**	**2**

English Language Communication Skills Lab-II

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Objectives

1. To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
4. To improve the fluency in spoken English and neutralize mother tongue influence
5. To train students to use language appropriately for interviews, group discussion and public speaking

Learning Outcomes:

1. Better Understanding of nuances of language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking with clarity and confidence thereby enhancing employability skills of the students

Syllabus: English Language Communication Skills Lab shall have two parts:

1. **Computer Assisted Language Learning (CALL) Lab**
2. **Interactive Communication Skills (ICS) Lab**

The following course content is prescribed for the English Language Communication Skills Lab

Exercise-I

CALL Lab: Minimal Pairs

Word accent and Stress Shifts

Listening Comprehension

Exercise-II

ICS Lab: Descriptions- Narrations- Giving Directions and Guidelines

Question Tags and One-Word Substitutes

Concord (Subject in agreement with verb) and Words often misspelt- confused/misused

Exercise-III

CALL Lab: Intonation and Common Errors in Pronunciation.**-**Neutralization of Mother Tongue Influence and Conversation Practice.

Exercise-IV

ICS Lab: Extempore- Public Speaking

Active and Passive Voice,

Common Errors in English,

Idioms and Phrases

Exercise-V

ICS Lab: Information Transfer

Oral Presentation Skills

Reading Comprehension

Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor

a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories.

   New Delhi: Foundation

2. **Strengthen Your Steps -** Dr. M. Hari Prasad and others, Maruthi Publications

3. Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011.

   Macmillan Publishers India Ltd. Delhi.

4. Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews.

   Tata McGraw Hill

5. Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

6. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison.

   2013. Orient Blackswan. Hyderabad.

7. Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP

8. Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP

9. Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication.

   New Delhi : Foundation

I Year B.Tech. – II Sem

L	T/P/D	C
0	-/3/-	2

ENGINEERING PHYSICS AND APPLIED CHEMISTRY LAB - II

(Mech and Civil)

ENGINEERING PHYSICS:

Any Five Experiments from the following:

1. Numerical Aperture of an Optical Fibre
2. Single slit diffraction – Measurement of wavelength of monochromatic light
3. To determine the diameter of a thin wire by interference in a wedge shape air film.
4. Moment of inertia of fly wheel.
5. Frequency of A.C. mains using sonometer.
6. Characteristics of Photodiode
7. LCR circuit – Series and Parallel resonance
8. Energy gap of semiconductor

I YEAR B.Tech, II SEMESTER

ENGINEERING WORKSHOP - II & IT Workshop

(Common to MECH, CE)

L	T	P/D	C
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Objective: To impart basic knowledge of various tools and their use in different sections of manufacture such as Black smithy, Foundry and welding

ENGINEERING WORKSHOP – II: -

1. **TRADES FOR EXERCISES:**

At least two exercises from each trade:

1. Black smithy
2. Foundry
3. Welding

IT WORKSHOP:-

1. **IT Workshop-I:** Computer hardware, identification of parts, disassembly, assembly of computer to working condition, sample diagnostic exercises.
2. **IT Workshop-II:** Installation of operating system windows and Linux simple diagnostic exercises.

TEXT BOOKS:

1. Work shop manual - P.Kannaiah/K.L Narayana/scitech publishers.
2. Workshop manual by Venkat Reddy

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

(Accredited by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad)

(Aziz Nagar, C.B.Post, Hyderabad -500075)

MECHANICAL ENGINEERING

II YEAR I SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits	Total Hours	Total Marks
A13013	Numerical Methods	3	1	0	3	4	100
A13207	Electrical and Electronics Engineering	3	1	0	3	4	100
A13308	Mechanics of Solids	4	1	0	4	5	100
A13309	Thermodynamics	4	1	0	4	5	100
A13310	Metallurgy and Material science	4	1	0	4	5	100
A13011	Environmental science	3	1	0	2	4	100
A13282	Electrical and Electronics Engineering Lab	0	0	3	2	3	75
A13383	Metallurgy and Mechanics of solids Lab	0	0	3	2	3	75
MC-I	Mandatory Course –I	**2**	**0**	**0**	**0**	**2**	**50**
	Total	**23**	**6**	**6**	**24**	35	800

II YEAR II SEMESTER **COURSE STRUCTURE**

Subject Code	Subject Name	L	T	P/D	Total Credits	Total Hours	Total Marks
A14312	Production Technology	3	1	0	3	4	100
A14313	Kinematics of Machinery	4	1	0	4	5	100
A14314	Thermal Engineering-I	3	1	0	3	4	100
A14315	Mechanics of Fluids and Hydraulic Machines	4	1	0	4	5	100
A14316	Machine Drawing	0	6	0	3	6	100
A14015	Probability and Statistics	3	0	0	3	3	100
A14384	Production Technology Lab	0	0	3	2	3	75
A14385	Mechanics of Fluids and Hydraulic Machines Lab	0	0	3	2	3	75
MC-II	Mandatory Course –II	**2**	**0**	**0**	**0**	**2**	**50**
	Total	19	10	6	24	35	800

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Lecture **T – Tutorial** **P – Practical** **D – Drawing**

II Year B.Tech Mech - I Sem

NUMERICAL METHODS
(COMMON TO ME& CE)

L	T	P	C
3	1	0	3

Course Objectives:

1. The objective is to find the relation between the variables x and y out of the given data (x,y).
2. The aim to find such relationships which exactly pass through data or approximately satisfy the data under the condition of least sum of squares of errors.
3. The aim of numerical methods is to provide systematic methods for solving problems in a numerical form using the given initial data.
4. This topic deals with methods to find roots of an equation and solving a differential equation.
5. The numerical methods are important because finding an analytical procedure to solve an equation may not be always available.

Course Outcomes:

At the end of the course, the student will be able to

1. Apply the numerical methods to find a root of algebraic and transcendental equations.
2. Apply the numerical methods to find the solutions of ordinary differential equations.
3. Find the solutions of one dimensional wave equation, two dimensional wave equation and one dimensional heat conduction equation.

UNIT-I

Solution of Non- Linear Equations and System of Linear Equations

Solution of Algebraic and Transcendental Equations – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method. Solving system of non-homogeneous equations by L-U Decomposition method (Crout's Method) Jacobi's and Gauss-Seidel Iteration method,

UNIT-II

Interpolation

Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols- Newton's formulae for interpolation – Central difference interpolation Formulae – Gauss Central Difference Formulae – Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

UNIT-III

Curve Fitting & Numerical Integration

Curve Fitting: Fitting a straight line – Second degree curve – exponentional curve-power curve by method of least squares.
Numerical Integration: Generalized Quadrature (Newton's Cote's formula), Trapezoidal, Simson's and Weddle's rules and problems.

UNIT – IV

Numerical Solution of Initial Value Problems in Ordinary Differential Equations

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods.

UNIT-V

Boundary Value and Eigen Value Problems

Shooting method, Finite difference method and solving Eigen Value problems-Power method.

TEXT BOOKS

1. Grewal B.S (2007), Higher Engineering Mathematics, 40^{th} Edition, New Delhi, Khanna Publishers.
2. Jain R. K., and Iyengar S. R. K (2008), Advanced Engineering Mathematics, 3^{rd} Edition, New Delhi, Narosa Publication House.
3. Numerical Methods for Scientific & Engineering computation M.K.Jain,S .R.K.Iyengar,R.K.Jain,New Age Intenational Pvt.Ltd.
4. Advanced Engineering Mathematics: Erwin Kreyszig, Wiley Publications.
5. Introductory Methods of Numerical Analysis. S.S. Sastry, Prentice Hall.

REFERENCE BOOKS

1. Srimanta Pal, Subodh C. Bhunia, (2015), Engineering Mathematics, 1^{st} Edition, New Delhi, Oxford University Press.
2. Mathematical Methods of Science and Engineering (Aided with Matlab) Kanti B.Datta (2012), Seventh Edition, CENGAGE Learning.

II Year B.Tech Mech - I Sem

ELECTRICAL AND ELECTRONICS ENGINEERING

	L	T	P/D	C
	3	1	0	3

Course Objectives:

This course introduces the fundamental concepts of DC and AC circuits, basic law's of electricity, instruments to measure the electrical quantities, different methods to solve the electrical networks, construction and operational features of energy conversion devices i.e. DC and AC machines, transformers. It also emphasizes on basics of electronics, semiconductor devices and their characteristics and operational features.

Course Outcomes:

After going through this course the student gets a thorough knowledge on basics of electrical and electronics devices,circuits,machines and their measuring instruments with which he/she can able to apply the above conceptual things to real-world electrical and electronic problems and applications.

UNIT-I:

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations.

Instruments: Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments

UNIT-II:

DC Machines: Principle of operation of DC Generator – EMF equation - DC motor types torque equation – applications – three point starter.

UNIT-III:

Transformers: Principle of operation of single phase transformers –EMF equation – losses – efficiency and regulation.

AC Machines: Principle of operation of alternators – regulation by synchronous impedance method – Principle of operation of induction motor – slip – torque characteristics – applications.

UNIT–IV:

Diodes: P-n junction diode, symbol, V-I Characteristics, Diode Applications, and Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems).

Transistors: PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

UNIT-V:

Cathode Ray OscilloScope: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

EEE: TEXT BOOKS:

1. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications
2. Basic Electrical Engineering, S.N. Singh, PHI.

EEE: REFERENCE BOOKS:

1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudipta nath, Chandrakumar Chanda, Tata-McGraw-Hill..
2. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.
3. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
4. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

ECE: TEXT BOOKS:

1. Electronic Devices and Circuits, S.Salivahanan, N.Suresh Kumar, A.Vallavaraj,Tata McGraw-Hill companies..
2. Electronic Devices and Circuits, K. Lal Kishore,BS Publications.

ECE: REFERENCE BOOKS:

1. Millman’s Electronic Devices and Circuits,J. Millman, C.C.Halkias, and Satyabrata Jit, Tata McGraw-Hill companies.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky,PEI/PHI.
3. Introduction to Electronic Devices and Circuits, Rober T. Paynter,PE.
4. Integrated Electronics, J. Millman and Christos C. Halkias, Tata McGraw-Hill companies.
5. Electronic Devices and Circuits, Anil K. Maini, Varsha Agarwal,Wiley India Pvt. Ltd.

II Year B.Tech Mech - I Sem

MECHANICS OF SOLIDS

L	T	P/D	C
4	1	0	4

Course Objectives:

The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanics course.

This course will advance the students' development of the following broad capabilities:

I. Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
II. Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
III. Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations.

Course Outcomes:

1. Analyze the behavior of the solid bodies subjected to various types of loading;
2. Apply knowledge of materials and structural elements to the analysis of simple structures;
3. Undertake problem identification, formulation and solution using a range of analytical methods.
4. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
5. Expectation and capacity to undertake lifelong learning.

UNIT – I

Simple Stresses & Strains:

Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic module & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force And Bending Moment:

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F.,B.M and rate of loading at a section of a beam.

UNIT – III

Flexural Stresses:

Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

Shear Stresses:

Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

Deflection Of Beams:

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

UNIT – V

Thin Cylinders:

Thin seamless cylindrical shells – Derivation of formula for, longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

Thick Cylinders:

Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

TEXT BOOKS

1. Strength of materials – R.S Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of materials – Ryder, G.H, Macmillan long man publications.
4. Strength of materials – W.A Nash , TMH

REFERENCES

1. Strength of materials by R.Subramanian/oxford.
2. Strength of materials – by Jindal, Umesh Publications.
3. Analysis of structures by Vazirani and Ratwani.
4. Mechanics of structures Vol-III, by S.B. Junnarkar.
5. Strength of materials by S. Timshenko

II Year B.Tech Mech-I Sem

THERMODYNAMICS

L T P/D C

4 1 0 4

Course Objective:

To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes:

At the end of the course, the student should be able to Understand and differentiate between different thermodynamic systems and processes. Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis. Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

UNIT – I

Introduction : Basic concepts: System, Control volume, Surrounding boundaries, Universe, Types of systems, Macroscopic and Microscopic view points, Concept of Continuum, Thermodynamics Equilibrium, state, Property, Process, Cycle – Reversibility – Quasi – static Process irreversible process, Causes of irreversibility – Energy in state and Transition, Types , Work and heat, Point and path function. Zeroth Law of Thermodynamics – Concept of quality of temperature – Principles of Thermometry – Reference points – Const. Volume gas thermometer – Scales of temperature, Ideal gas scale

UNIT – II

PMM I – Joule's experiments – First law of thermodynamics – Corollaries – First law applied to a process – applied to a flow system – Steady flow energy equation. Limitations of the first law – Thermal Reservoir, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvin planck and Clausius Statements and their Equivalence/ Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialities, Thermodynamic scale of temperature, Clausius inequality, Entropy, Principle of Entropy increase – Energy equation, Availability and irreversibility – Thermodynamic Potentials, Gibbs and Helmhoultz functions, Maxwell Relations – Elementary Treatment of the third law of thermodynamics.

UNIT – III

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables, Mollier charts – Various thermodynamic processes and energy transfer – Steam calorimetry.

UNIT –IV

Perfect Gas Laws – Equation of State, specific and universal Gas constants – various Non-flow processes, properties, end states, Heat and work Transfer, changes in internal energy – Throttling and free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander walls Equation of State – Compressibility charts – variable specific Heats – Gas tables.

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases

UNIT – V

Power Cycles : Otto Diesel, Dual combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, **Lenoir Cycle** – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

TEXT BOOKS

1. Engineering Thermodynamics / PK Nag/TMH, III Edition
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Engineering thermodynamics –P.Chattopadhyay/Oxford University press

REFERENCES:

1. An introduction to Thermodynamics – YVS Rao / University press
2. Solution Manual to introduction to Thermodynamics, YVC Rao/ University press
3. Engineering Thermodynamics – Jones & Dugan
4. Thermodynamics – Robert Balmer /Jaico pub.
5. Thermodynamics – J.P Holman/ McGrawHill
6. Engineering Thermodynamics – K.Ramakrishna/Anuradha publishers.
7. Fundamentals of thermodynamics – Sonntag, Borgnakke and van wylen,/John wiley & sons (ASIA) Pte Ltd

<u>II Year B.Tech. Mech-I Sem</u>

METALLURGY AND MATERIAL SCIENCE

L	T	P/D	C
3	1	0	3

<u>Course Objectives:</u>

1. To equip the students with basic knowledge of various types of materials that are formed from various elements in the Periodic Table of Elements .
2. To gain very clear knowledge of different phases in any material with the knowledge of equilibrium phase diagrams
3. To gain an ability to predict micro structural changes taking place in materials during heat treatment and resulting properties.
4. To prepare the students to the adventurous materials with reduced dimensions and expose them to nanomaterials with remarkable properties.

<u>Course Outcomes:</u>

1. Students will be able to know types of metals and alloys and their various phases and microstructures and their influence on various properties.
2. Students will have gained knowledge of changing the properties of materials by various alloying methods and different heat treatment techniques.
3. Students will have various ways and means to reduce overall weight and size of the product / component of any device /equipment with the knowledge of nanomaterials.
4. With the knowledge of exotic materials with less dimensions, students will be able to design new devices, sensors, robots and other host of products which function with high accuracy and better efficiency than weighty and bulky equipments/devices, that are presently used.
5. Students will have gained enough back ground ultimately to undertake innovative projects/works not only to improve performance of existing products but also develop new materials exhibiting exotic properties with the acquired knowledge of phase transformations and varying concentration , size and shape of various phases and heat treatment. This will directly contribute to the progress of the society and overcome the scarcity of metals in the earth's crust.

UNIT-I

Structure Of Metals: Crystals and microstructures, Slip systems, Allotropy, Crystallization, Single and polycrystalline metals, Grains , Defects in metals and their influence on properties, Determination of grain size, Hall-Petch relation.

Alloys: Necessity of alloying, Solid solutions-types with examples, Hume-Ruthery rules , Formation of intermediate phases and electron compounds, Different methods of strengthening metals.

UNIT-II

Equilibrium Phase Diagrams : Reasons for studying diagrams, Heating and cooling curves, Construction of phase diagrams with one or more components, Phase rule, Isomorphous systems, Different types of liquid and solid phase transformations, Coring , Miscibility gaps, Congruent and incongruent melting, Spinoidal decomposition , Estimation of various phases by Lever rule. Detailed study of Iron-Carbon phase diagram and different phases with microstructures. Identification of zones of steel and cast iron in the diagram.

UNIT-III

Steels : Influence of alloying elements on stability of different phases and mechanical properties,. Hot-shortness and cold-shortness –remedies , Classification of steels- Plain, low-alloy and high –alloy steels including stainless steels, Hadfield steel, tool-steels and die steels . High-entropy alloys, Applications.
Cast-Iron: Role of carbon and its equivalent on microstructure and properties of cast iron, Various types of cast irons-white, grey, malleable, ductile and spheroidal, Microstructures and properties. Uses of cast iron.

Heat Treatment (HT) Of Steels & Other Metals &Alloys: Principles of HT and different methods-Normalizing, Annealing, Quenching, Hardening, Tempering, TTT and CCC-diagrams , Austempering, Martempering, Intercritical annealing, Quenching and partitioning, Cryogenic treatment and Age hardening and Hardening and Hardenability: Effect of alloying elements , Surface hardening methods –carburizing , nitriding, chromizing, siliconizing,boronizing .

UNIT-IV

Non-Ferrous Metals: Structure and properties of copper and its alloys-brass and bronzes and applications.

Light-Weight Metals: Aluminium, titanium, magnesium, beryllium and lithium and their alloys and applications in modern age.

Ceramic Materials: Crystalline and amorphous materials-ceramics, glass, cermets, abrasive..High entropy oxides

Plastics: Polymers and their properties, Production of plastic components

UNIT-V

Nanomaterials: Reasons for their extraordinary properties, Production and applications.

Composite Materials: Rule of mixing, Salient features, Advantages and disadvantages, Classification : Metal matrix composites(MMC), Ceramic matrix composites(CMC) and Polymer matrix composites(PMC), Production of composite materials. Carbon-carbon composites Biomaterials.

TEXT BOOKS

1.V.Raghavan “Material Science and Engineering-A First Course”, 5th Edition, 2011.Prentice-Hall of India(P) Ltd, New Delhi.
2.H.Sidney H.Avener,”Introduction to Physical Metallurgy”,2nd Edition 2007, Tata-McGraw hill Education(P) Ltd, , New Delhi.
3.V.D Kodgiri, “ Material Science and Metallurgy for Engineers”,1st Edition, 2006 , Everest , Pune.
4. R.Askeland Donald, “Essentials of Material Science and Engineering”, 5th Edition,2000, Congage, New Delhi

REFERENCE

1. William D.Callister & D.G.Rethwisch, “Material science and Engineering An Introduction”, 8th Edition, John Wiley and Sons Inc

<u>II Year B.Tech Mech-I Sem</u>

ENVIRONMENTAL SCIENCE

Common To All Branches

L	T	P/D	C
3	1	0	2

<u>Course Objectives:</u>

- Develop an understanding on the importance of environmental protection.
- Understanding the significance of ecological balance for sustainable development.
- The ability to apply quantitative reasoning and practical skills to environmental problems.

<u>Course Outcomes:</u>

At the end of the course, the student will be able to:

- To enable the students to realize the importance of the sustainable use of natural resources.
- To make the students aware of the impacts of human actions on environment and measures to minimize and mitigate them.
- To enable the students to become aware of the current issues and problems pertaining to the environment.

UNIT I:

Ecosystems:
Definition, Scope and Importance of ecosystem; Classification of ecosystems, Structure and Functions of ecosystem: Food chains, Food Web and Ecological Pyramids, Flow of energy; Bioaccumulation and Biomagnification; Ecosystem Value services and Carrying Capacity. **BIODIVERSITY AND BIOTIC RESOURCES**: Introduction, Definition, levels of Biodiversity, Value of biodiversity, Hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity: In-Situ and Ex-situ conservation.

UNIT II:
Natural Resources: Classification of Resources, **Water resources**: use and over utilization of surface and ground water, Floods and Droughts, Dams: benefits and problems. **Energy resources**: growing energy needs, Renewable Energy Sources – Solar, Hydro-Power, Wind, Tidal, Geo-Thermal, Biomass, Bio-fuels, Hydrogen as a fuel and Biogas and Non Renewable Energy – Coal, Petroleum, LPG, Natural Gas, SNG, CNG. **Land resources**: land as a resource, land degradation – Landslide and Soil Erosion; **Forest Resources – Uses and Exploitation.**

UNIT III:
Environmental Pollution And Control: Types of Pollution, Sources, Effects and Control measures and Quality Standards for

1. Air Pollution
2. Water Pollution
3. Soil Pollution
4. Noise Pollution

Solid, Hazardous, Biomedical and e-Waste Management and Handling Rules, Nuclear Hazards – Case Studies. **Waste water treatment methods**: Effluent treatment plants (ETP), Sewage treatment plants (STP), Common and combined effluent treatment plants (CETP).

UNIT IV:
Global Environmental Problems And Global Efforts: Green house effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change and their impacts on human environment; Ozone depletion and Ozone depleting substances (ODS); Aid Rains, Deforestation and Desertification.
Environmental Impact Assessment (EIA): Definition of Impact: classification of impacts, Methods of baseline data acquisition. Impacts on different environmental components; Environmental Impact Statement (EIS). Environmental Management Plan (EMP) - Rain Water Harvesting, Water Shed Management and Bioremediation.

UNIT V:

Environmental Policy, Legislation, Rules And Regulations: Environmental Protection act, Legal aspects Air (Prevention and Control of pollution) Act- 1981, Water (Prevention and Control of pollution) Act-1974, Forest Conservation Act, Wildlife Act 1972. **Towards Sustainable Future**: Concept of Sustainable Development, Threats to Sustainability: Population and its explosion, Crazy Consumerism, Over-exploitation of resources; Environmental Education, Role of Civil Societies, Role of IT in Environment, Smart Cities, Concept of Green Building, Low Carbon Lifestyle, Life cycle assessment and Ecological Foot Print.

TEXT BOOKS:

1. Text Book of Environmental Studies by Anubha Kaushik (4^{th} Edition), New age International Publishers.
2. Environmental studies by Erach Bharucha 2005, University Grants Commission, University Press.
3. Environmental studies, From crisis to cure by R.Rajagopalan, 2005

REFERENCE BOOKS:

1. Environmental Science: Towards a Sustainable Future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Science by Daniel B. Botkin & Edward A. Keller, Willey INDIA Edition.
3. Text book of Environmental Science and Technology by M.Anji Reddy 2007

II Year B.Tech Mech-I Sem

ELECTRICAL AND ELECTRONICS ENGINEERING LAB

L	T	P	C
0	0	3	2

SECTION A: ELECTRICAL ENGINEERING:

1. Verification of KCL and KVL.
2. Magnetization characteristics of D.C. Shunt generator.
3. Speed control of DC motor.
4. Swinburne's Test on DC shunt machine.
5. Brake test on DC shunt motor.
6. OC and SC tests on Single-phase transformer.
7. Brake test on 3-phase Induction motor.
8. Regulation by an alternator by synchronous impedance method.

SECTION B: ELECTRONICS ENGINEERING:

1. PN Junction Diode Characteristics (Forward bias, Reverse bias)
2. Transistor CE Characteristics (Input and Output)
3. Study of CRO.
4. Class A Power Amplifier
5. Zener Diode Characteristics
6. Transistor CE Characteristics
7. Rectifier without Filters (Full wave & Half wave)
8. Rectifier with Filters (Full wave & half wave).

Note: Total 12 experiments are to be conducted.
(Six experiments from PART-A, Six experiments from PART-B)

<u>II Year B.Tech Mech-I Sem</u>

METALLURGY AND MECHANICS OF SOLIDS LAB

L	T	P/D	C
0	0	3	2

(A) METALLURGY LAB:

1. Preparation and study of the Micro Structure of pure metals like iron, Cu and Al.
2. Preparation and study of the Micro Structure of Mild steel, low carbon steels, high – C steels.
3. Study of the Micro Structure of Cast irons.
4. Study of the Micro Structure of Non-Ferrous alloys.
5. Study of the Micro Structure of Heat treated steels.
6. Hardenability of steels by Jominy End Quench test.
7. To find out the hardness of various treated and untreated steels.

(B) MECHANICS OF SOLIDS LAB:

1. Direct tension test
2. Bending test on a) simple supported, b) cantilever beam
3. Torsion test
4. Hardness test a) Brinells hardness test, B) Rockwell hardness test.
5. Test on springs
6. Comprission test on cube
7. Impact test
8. Punch shear test

NOTE: Any 10 experiments from the above are to be performed taking atleast 4 from each section.

II Year B.Tech Mech-I Sem

INTELLECTUAL PROPERTY RIGHTS AND CYBER LAWS
(MANDATORY COURSE)

L	T	P/D	C
2	0	0	0

Course Objectives:

1. To make students familiar with Intellectual Property Rights.
2. To understand innovations in engineering and other domains.
3. To be familiar with patents, copyrights and various acts related to innovations.

Course Outcomes:

Upon completion of the course, the students are expected to:

1. To define various terms related to Intellectual Property Rights.
2. To understand the process of patent, copyrights and related procedures.
3. To analyse the situation of IPR in the Indian context with that of global scenario.
4. To understand the patenting process through various case studies.

UNIT - I:

Introduction to Intellectual property Rights (IPR):

Introduction, Types of Intellectual Property Rights , International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.

UNIT - II:

Trade Marks:

Purpose and Function of Trademarks, Acquisition of Trade Mark Rights, Protectable Matter, Selecting and Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT - III:

Copy rights Law :

Fundamental of Copy Right Law, Originality of Material, Rights of Reproduction, Rights to Perform the Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice of Copy Right, International Copy Right Law.

Patents Law:

Foundation of Patent Law, Patent Searching Process, Ownership Rights and Transfer

UNIT - IV:

Trade Secrets:

Trade Secrete Law, Determination of Trade Secrets Status, Liability for Misappropriations of Trade Secrets, Protection for Submission, Trade Secret Litigation.

Unfair competition: Misappropriation Right of Publicity, False Advertising.

UNIT - V:

Cyber Law:

Cyber Crime, Information Security, Cyber Criminals, Classification .Legal Perspectives- Indian Perspectives- Cyber Crimes and Indian ITA 2000, Global Perspective on Cyber Crime- Cyber Crime Era.

TEXT BOOKS & REFERENCES:

1. Deborah, E. Bo Choux, Intellectual Property Right, Cengage Learning
2. Prabuddha Ganguli, Intellectual Property Right - Unleashing The Knowledge Economy, Tata Mc Graw Hill Publishing Company Ltd..
3. Nina Godbole And Sunitha Belapure, “Cyber Security” Wiley India 2012.

II Year B.Tech. Mech-II Sem

PRODUCTION TECHNOLOGY

L	T	P/D	C
3	1	-	3

Course Objectives:

Production technology is a subject composed of descriptive basic manufacturing process that can be helpful for a mechanical engineer .it comprises basics of casting welding and metal forming process. The product of industrial use assembled with many elemental components. These components can be manufactured by various production processes. The subject reveals the information about basic manufacturing processes.

Course Outcomes:

- An ability to contrast the different types of manufacturing process and apply the Technology Systems Model to manufacturing
- Ability to identify, illustrate, solve, formulate, distinguish & compare different working process
- An Ability to understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability ,economic ,environmental, safety & sustainability etc..,
- An ability to apply knowledge of mathematics, science and engineering, to Identify, define, and clearly state a manufacturing design problem
- An ability to identify, formulates, analyzes and solves Engineering Problems in Optimum time.
- An ability to demonstrate an ability to welding and conduct experiments, analyze and interpret data.
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice with the concept of virtual work.
- Recognition of the need for, and an ability to engage in self education and life-long learning.

UNIT-I

Casting: Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types, function and design, special casting processes 1) Centrifugal 2)Die, 3) Investment, Fettling of Castings

UNIT – II

Welding: Classification of welding process types of welds and welded joints and their characteristics, Types of Welding :ARC welding, Gas welding, Resistance welding, Solid state welding, Thermit welding Radiant Energy welding and Plasma (Air and water) welding.

Application Of Welding Processes: Inert Gas welding, TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive nondestructive testing of welds

UNIT – III

Forging: Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts.

Forging Processes: Principles of forging, Tools and dies, Types Forging, Smith forging, Drop Forging, Roll forging, Rotary forging, forging defects.

UNIT – IV

Sheet Metal Operation: Stamping, Forming and other cold working processes: Blanking and piercing, simple die, compound die & progressive die-Bending and forming-Drawing and its types-wire drawing

Extrusion Of Metals: Basic extrusion process and its characteristics, Hot extrusion and cold extrusion, Forward extrusion and backward extrusion, Impact extrusion, Hydrostatic extrusion.

UNIT-V

Processing of Plastics: Types of Plastics, Properties, Applications and their Processing methods and Equipments (blow and injection modeling).

TEXT BOOKS:

1. Manufacturing Processes for Engineering Materials – Serope Kalpakjian and Steven R Schmid, Pearson Publication.
2. Manufacturing Technology – P.N Rao, TMH
3. Production Technology – Sarma P.C, S.Chand publication.

REFERENCES:

1. Production Technology / R.K Jain
2. Process and materials of manufacturing – Lindberg/PE
3. Principles of metal Castings – Roenthal.
4. Welding Process – Paramar
5. Production Engineering – Suresh Dalela & Ravi Shanker / Galgotia Publications Pvt. Ltd.
6. Manufacturing Engineering and Technology / Kalpakjin. S / Pearson Edu.

II Year B.Tech. Mech-II Sem

KINEMATICS OF MACHINERY

L	T	P/D	C
4	1	0	4

Course Objectives:

The objective is to study the relative motion, velocity and accelerations of the various elements in a mechanism. In mechanical Engineering we come across number of mechanisms such as four bar/slider crank/double slider crank/straight line motion mechanism etc. Mechanism deals with only relative motions. Once we make a study considering for us also there it is called kinetics. The first course deals with mechanisms, their inversions straight line motion mechanisms steering mechanisms etc. Also study of cams/gears& gear trains & belts is also introduced.

Course Outcomes:

The main purpose is to give an idea about the relative motions obtained in all the above type of components used in mechanical Engineering

UNIT-I

Mechanisms: Elements or links – Classification – Rigid Link, Flexible and fluid link – Types of kinematics pairs – Types of constrained motion – kinetic chain. Mechanism - machine – Structure – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical advantage – Grubler's Criterion.

Straight-Line Motion Mechanism: Exact and approximate copied and generated types – Peaucellier- -Hart – Scott Russel – Grasshopper – Watt – Tchebicheff's and Robert Mechanism – Pantographs

UNIT-II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane Motion of Body: Instantaneous center of rotation – centrodes and axodes – Three centers in the theorem - Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction – Coriolis acceleration – Determination of Coriolis component of acceleration.

UNIT-III

Steering Gears: Conditions for correct steering – Davis Steering gear, Ackermann's Steering gear.

Hooke's joint: Single and double Hooke's joint – velocity ration – application – problems

UNIT-IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases.

Analysis of Motion of Followers: Tangent cam with Roller follower.

UNIT-V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.

Gear Trains: Introduction – Types – Simple – Compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box – Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines by Thomas Bevan, CBS
2. Theory of Machines – R.K Bansal
3. Theory of Machines R.S Khurmi & J.K Gupta
4. Theory of Machines and mechanisms 4th edition / Shigley / Oxford.

REFERENCES:

1. Theory of Machines – Rattan .S.S, TMH, 2009 Edition
2. Theory of Machines – PL. Ballaney / kharina publishers,
3. Theory of Machines Sadhu Singh Pearsons Edn
4. Mechanism and Machine Theory / JS Rao and RV Dukkipati / NewAge

II Year B.Tech Mech-II Sem

THERMAL ENGINEERING – I

L	T	P/D	C
3	1	-	3

Pre-requisite: Thermodynamics

Course Objective:

To apply the laws of Thermodynamics to analyse air standard cycles and to understand and evaluate the perform analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

Course Outcomes:

At the end of the course, the student should be able to Evaluate the performance of IC engines and compressors under the given operating conditions.Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles.Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance

UNIT – I
ACTUAL CYCLES AND THEIR ANALYSIS
Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust blow down, Loss due to Gas exchange process, Volumetric Efficiency, Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of I.C. Engines.

UNIT – II
I. C. ENGINES
Classification, Working principles, Valve and Port Timing Diagrams, Air Standard, air-fuel and actual cycles, Engine systems; Fuel Systems, Simple Carburetor, Solex carburetor, Fuel Injection Systems; Ignition systems, Battery ignition, Magneto ignition, Modern ignition systems; Transistorized coil ignition (TCI) system, Capacitive Discharge Ignition (CDI) System, Cooling and Lubrication systems.

UNIT – III
COMBUSTION IN S. I. ENGINES
Homogeneous mixture, Heterogeneous mixture, Stages of combustion, Flame front propagation, Factors influencing the flame speed, Rate of pressure rise, Abnormal combustion, Phenomenon of Knock, Types of Combustion chambers, Fuel requirements and fuel rating
COMBUSTION IN C.I ENGINES
Combustion process, stages of combustion, Delay period and its importance, Factors affecting Delay period, Diesel Knock, Comparison of Knock in C.I and S.I engine, Combustion chambers in C.I. Engine, Fuel requirements and fuel rating

UNIT – IV
TESTING AND PERFORMANCE
Measurement and Testing; Friction power, Indicated power, Brake power, Fuel consumption, Air consumption, Emissions Performance parameters; Engine power, Engine efficiencies, Engine performance characteristics, Heat Balance

UNIT-V
AIR COMPRESSORS: Reciprocating Compressor: classifications, Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance, Multi stage compression with inter cooling, saving of work, Minimum work condition for stage compression.
Rotary air compressor: roots blower, vanes blower, centrifugal compressor, axial air compressor.

TEXT BOOKS:

1. I.C Engines – V. GANESAN, TMH
2. IC Engines – Ramalingam, Scietech publishers
3. Thermal Engineering / Rajput / Lakshmi Publications.

REFERENCES:

1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek / Pearson / PHI
3. Thermal Engineering / Rudramoorhty – TMH
4. Thermodynamics & Heat Engines / B.Yadav / Central Book Depot, Allahabad.
5. I.C Engines / Heywood / McGrawHill.
6. Thermal Engineering – R.S Khurmi & J.K Gupta – S.Chand
7. Thermal Engineering data book – B. Srinivasulu Reddy / JK international.

II Year B.Tech. Mech-II Sem

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

L	T	P/D	C
4	1	-	4

Course Objective:

I. Understanding the properties of fluids and Calculating forces on a submerged structure in a static fluid.
II. Applying the mass conservation, Energy and Momentum principle, using the control volume approach, to engineering problems
III. Calculating surface resistance in laminar, turbulent flows and lift and drag forces on moving bodies.
IV. Students should know the inter relationship between thermodynamics and fluid mechanics in context to their respective departments.
V. To prepare students, will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
VI. To train the students will be familiar in applying software methods to analyze mechanical engineering problems.

Course Outcomes:

1. Solving numerical problems related to pressure measuring instruments, identifying and solving forces on submerged and floating bodies.
2. Practical application of Bernoulli's equation and principles in various disciplines including pressure variation study in atmospheric science.
3. Ability to apply conservation laws for mass, momentum and mechanical energy in combination to control volumes in ideal fluids and hence calculate hydraulic and energy grade lines.
4. Calculation of local and overall skin friction drag in laminar and turbulent flat plate boundary layers, using approximate empirical formula (only basic knowledge).
5.An ability to use the techniques, skills and modern engineering tools necessary for engineering practice with the concept of Hydraulic Machinery and Systems.

UNIT – I

Fluid Properties And Fluid Statics: Density, Specific weight, Specific gravity, viscosity, Vapourpressure, compressibility, Surface tension Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Hydro static law, Piezometer, Simple and differential manometers.

UNIT - II

Fluid Kinematics : Stream line, path line, streak line, stream tube, classification of flows, steady,unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrigational flows, one, two and three dimensional flows.

Fluid Dynamics: Surface and Body forces, Euler's and Bernoulli's equation derivation, Application of Bernoulis Equation: Venturimeter, Orifice meter, Pitot tube, Navier stokes equation (explanation only), Momentum equation – applications.

UNIT - III

Close Conduit Flow: Reynolds Experiment, Darcy's equation, Minor losses - pipes in series, pipes in parallel, total energy line and hydraulic gradient line, numerical problems.

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent layers (No Derivation) boundary layer in transition, separation of boundary layer submerged objects drag and lift.

UNIT – IV

Impact Of Water Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and a tip-velocity triangles at inlet and outlet expressions for work done and efficiency, Series vanes, Radial flow turbines.

Hydraulic Turbines: Overshot and undershot water wheels, classification of Water turbines, Pelton Wheel, work done and working proportions, Francis, Kalpan turbines, draft tubes, types & its efficiency.

Performance Of Turbines: Performance under unit head, unit quantities, performance under specific conditions, specific speed, performance characteristic curves, model testing of turbines, cavitation, governing of turbines, surge tanks. Water hammer.

UNIT – V

Centrifugal Pumps : Types Component parts and working, work done by the impeller, Manometric head losses and efficiencies, minimum starting speed, loss of head due to reduced or increased flow, diameters of impeller and pipes, Specific speed, Model testing of pumps, Multistage Pumps, Pumps in parallel, performance of pumps, characteristics curves, NPSH, Cavitation, priming devices, pump troubles and remedies.

Reciprocating Pumps: Main components and working of a reciprocating pump, types of reciprocating pumps, power required driving the pump, coefficient of discharge and slipping indicator diagram.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hyraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCES:

1. Fluid Mechanics and fluid power Engineering by D.S Kumar, Kotaria & sons.
2. Fluid Mechanics and machinery by D. Rama Durgaiah, New Age international.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

II Year B.Tech Mech-II Sem

MACHINE DRAWING

L	T	P/D	C
0	6	0	3

Machine drawing conventions: Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views, Parts not usually sectioned.
c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details – common abbreviations & their liberal usage.
e) Types of Drawings – working drawings for machine parts.

I. Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cottered joints and knuckle joint.
c) Rivetted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings.

II. Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts – stuffing boxes, cross heads, Eccentric, Petrol Engine connecting rod, piston assembly.
b) Other machine parts – Screws jacks, Machine vices Plummer block tailstock.
c) Valves : Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS:

1. Machine Drawing – Ajeet Singh, TMH Publications
2. Machine Drawing – K.L Narayana, P.Kannaiah & K.Venkata Reddy/ New Age/publishers.
3. Machine Drawing – N.D Bhatt.

REFERENCES:

1. Machine Drawing – P.S. Gill.
2. Machine Drawing – Luzzader
3. Machine Drawing – Rajput

II Year B.Tech Mech-II Sem

PROBABILITY AND STATISTICS
(COMMON TO CSE, IT, ME& CE)

L	T	/P/D	C
3	0	0	3

Course Objectives:

- To revise elementary concepts and techniques of probability & statistics
- To extend and formalize knowledge of the theory of probability and random variables
- To introduce new techniques for carrying out probability calculations and identifying probability distributions
- To motivate the use of statistical inference in practical data analysis
- To study elementary concepts and techniques in statistical methodology
- To provide a introduction to subsequent statistics courses

Course Outcomes: At the end of the course, the student will be able to

- Demonstrate an understanding of the basic concepts of probability and random variables.
- construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance
- Understand the concept of the sampling distribution of a statistic, and in particular describe the behavior of the sample mean.
- compute probabilities based on practical situations using the binomial and normal distributions
- use the normal distribution to test statistical hypotheses and to compute confidence intervals
- Application of Regression Analysis to analyze a problem

UNIT – I

Random Variables: Random variables – Discrete and continuous- Expectation- Properties ,Moment Generating Function and Fitting of Binomial, Poisson & Normal distributions

UNIT – II

Testing of Hypothesis I: Sampling Distribution-Definition of Sample, Population, and Types of Sampling. Estimation- Point estimation, Interval estimation, Testing of Hypothesis- Null hypothesis – Alternative hypothesis, Type I, & Type II errors – critical region confidence interval for mean, testing of hypothesis for single mean and difference between the means for large samples.

UNIT – III

Testing of Hypothesis II : Confidence interval for the proportions, Tests of hypothesis for the proportions- single and difference between the proportions for large samples.
Small Samples - t-distribution, F-Distribution, χ^2 distribution

UNIT –IV

Correlation and Regression: Coefficient of correlation – The Rank correlation, Regression Coefficients – Properties of regression coefficients, The two lines of regression, Multi Linear Regression.

UNIT –V

Quality Control: Control Charts-Control lines, determination of control limits, Types of Control Charts- Control Charts for variables (mean chart, Range chart)-charts for attributes (fraction defective, no. of defectives and defects for unit).
Time Series: Components of Time Series-Measurement of Trend.

TEXT BOOKS:

1. Probability & Statistics by Dr. T.K.V.Iyengar, Dr.B.Krishna Gandhi et.al S.Chand Publications.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.
3. Probability & Statistics for Engineers by Miller and John E Freund, Prentice Hall of India.
4. R.C.Gupta: Statistical Quality Control.
5. Fundamentals of Applied Statistics by S C Gupta ,Sultan Chand and Sons

REFERENCES:

1. Fundamentals of Mathematical Statistics by S.C. Gupta & V.K. Kapoor, S-Chand & Sons.
2. Srimanta Pal, Subodh C. Bhunia, (2015) ,Engineering Mathematics, 1st Edition, New Delhi, Oxford University Press
3. Probability, Statistics and Queueing Theory,2nd Edition,Trivedi, John Wiley and sons
4. Probability and Statistics by E.Rukmangadachari , Pearson Education; First edition (2012)
5. Probability and Statistics for Engineering and the Sciences, 8th Edition, Jay L Devore , Cengage Learning.
6. Willam Feller : Introduction to Probability theory and its applications. Volume –I, Wiley
7. Statistical Quality Control ,M.Mahajan,Dhanpat Rai & Sons

II Year B.Tech. Mech-II Sem

PRODUCTION TECHNOLOGY LAB

L	T	P/D	C
0	0	3	2

I. Metal Casting Lab:

1. Pattern Design and making – for one casting drawing.
2. Sand properties testing – Exercise for strengths and permeability – 1
3. Moulding Melting and Casting – 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint – 2 Exercises
2. Spot Welding – 1 Exercises
3. Gas Welding – 1. Exercise
4. Soldering and Brazing – 2 Exercises

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending operations.

IV. Processing of Plastics:

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F Nayer, Jaico publishing.

II Year B.Tech Mech-II Sem

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

L	T	P/D	C
0	0	3	2

1. Impact of jets on Vanes
2. Performance test on Pelton wheel
3. Performance test on Francis Turbine.
4. Performance test on Kaplan Turbine.
5. Performance test on single stage centrifugal pump.
6. Performance test on Multi stage centrifugal pump.
7. Performance test on Reciprocating pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice mater.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's theorems.

NOTE: Any 10 of the above experiments are to be performed.

B.TECH MECH III YEAR COURSE STRUCTURE

S. No.	Code	Subject	L	T/P/D	Credits
		III Year I Semester			
1	**A15317**	Design of Machine Members-I	3	1	3
2	**A15318**	Thermal Engineering-II	3	1	3
3	**A15319**	Dynamics of Machinery	3	1	3
4	**A15320**	Machine tools and Metrology	3	1	3
5	 **A15321** **A15322** **A15323**	**PROFESSIONAL ELECTIVE – I** Automobile Engineering Computational Fluid Dynamics Welding Technology	3	1	3
6	 **A15324** **A15325**	**OPEN ELECTIVE – I** Elements of Mechanical Engineering Industrial Engineering	3	1	3
7	**A15386**	Thermal Engineering lab	-	2	2
8	**A15387**	Metrology and machine Tools Lab	-	2	2
9	**MC-III**	Training and Placement Cell Course-I	2	-	2
		Total Credits	**20**	**10**	**24**
		III Year II Semester			
1	**A16326**	Design of Machine Members-II	3	1	3
2	**A16327**	Heat Transfer	3	1	3
3	**A16328**	Finite Element Methods	3	1	3
4	**A16018**	Managerial Economics and Financial Analysis	3	1	3
5	 **A16329** **A16330** **A16331**	**PROFESSIONAL ELECTIVE – II** Refrigeration and Air Conditioning Renewable Energy Sources Tool Design	3	1	3
6	 **A16332** **A16333**	**OPEN ELECTIVE – II** Basic Automobile Engineering Material Science Engineering	3	1	3
7	**A16388**	Heat Transfer Lab	-	2	2
8	**A16090**	Advanced Communication Skills Lab	-	2	2
9	**MC-IV**	Training and Placement Cell Course-II	2	-	2
		Total Credits	**20**	**10**	**24**

III Year B. Tech. MECH - I Sem

	L	T / P / D	C
	3	1 / - / -	3

(A15317) DESIGN OF MACHINE MEMBERS-I

NOTE: Design Data books are not permitted in the Examinations.

UNIT – I

INTRODUCTION: General considerations in the design of Engineering, Materials and their properties – selection – Manufacturing consideration in design.

STRESSES IN MACHINE MEMBERS: Simple stresses – Complex stresses – impact stresses – stress strain relations – static theories of failure – factor of safety – Design for strength and rigidity. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II

STRESSES DUE TO FATIGUE LOADING: Stress concentration – Theoretical stress – Concentration factor – Fatigue stress concentration factor notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Fatigue theories of failure – Goodman and Soderberg.

UNIT – III

RIVETED AND WELDED JOINTS:

Riveted joints: Modes of failure of riveted joints – Strength equations – efficiency of riveted joints– eccentrically loaded riveted joints.

Welded joints: Design of Fillet welds – axial loads – Circular fillet welds – bending and torsion – eccentrically loaded joints.

UNIT – IV

BOLTED JOINTS: Design of bolts with pre-stresses – Design of joints under eccentric loading – bolt of uniform strength, Cylinder cover joints.

AXIALLY LOADED JOINTS: Keys, cotters And Knuckle joints: Design of keys-stresses in keys – Cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

UNIT – V

DESIGN OF SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for complex loads – Shaft sizes – BIS code – Design of shaft for a gear and belt drives.

DESIGN OF SHAFT COUPLINGS: Rigid couplings – Muff, split muff and flange couplings, Flexible couplings – Pin – Bush coupling.

TEXT BOOKS:

1. Machine Design by Pandya & shah.
2. Mechanical Engineering Design by Bahi and Goel, Standard Publications.

REFERENCES:

1. Machine Design by V.Bandari, TMH Publishers
2. Machine Design by R.L.Norton, Mc Graw Hill
3. Machine design by Khurmi
4. Machine Design by S. MD Jalaluddin, Anuradha Publishers.
5. Design of Machine Elements by Kulkarni, Mc Graw Hill.
6. Machine Design, by T.V.Sundarajan Murthy and N,Shanmugam – Anuradha Publications.
7. Mech. Engg. Design / JE Shigley

III Year B. Tech. MECH - I Sem

	L	T / P / D	C
	3	1/ - / -	3

(A15318) THERMAL ENGINEERING – II

UNIT – I

BASIC CONCEPTS of RANKINE CYCLE: Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating, Combustion, fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, fuel gas analysis.

UNIT – II

BOILERS: Classification – Working principles – with sketches including H.P Boilers – Mountings and Accessories – Working principles, Boiler horse power, equivalent evaporation, efficiency and heat balance – Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

STEAM NOZZLES: Function of nozzle – applications – types, flow through nozzles, thermodynamic analysis– velocity of nozzle at exit-ideal and actual expansion in nozzle, condition for maximum discharge, critical pressure ratio, super saturated flow, degree of under cooling – Wilson line.

UNIT – III

STEAM TURBINES: Classification – impulse turbine, Mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency.
De-Laval Turbine – its features, Methods to reduce rotor speed-velocity compounding and pressure compounding - impulse turbine.

REACTION TURBINE: Principle of operation, thermodynamic analysis of a stage, degree of reaction – velocity diagram – parson's reaction turbine – condition for maximum efficiency.

UNIT – IV

STEAM CONDENSERS: Requirements of steam condensing plant – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects air pump – cooling water requirement.

GAS TURBINES: Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration inter cooling and reheating – Closed and semi-closed cycles.

UNIT – V

JET PROPULSION: Principle of operation – classification of jet propulsive engines – Working principles with schematic diagrams and representation on T-S diagram – Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and demands met by Turbo jet – Schematic Diagram, Thermodynamic cycle, Performance Evaluation Thrust Augmentation – Methods.

ROCKETS: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific impulse – solid and liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering / R.K Rajput / Lakshmi Publications
2. Gas Turbines – V. Ganesan / TMH

REFERENCES:

1. Thermodynamics and Heat Engines / R.Yadav / Central Book Depot.
2. Gas Turbines and Propulsive Systems – P. Khajuria & S.P.Dubey Dhanpatrai.
3. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman.
4. Thermal Engineering – R.S.Khurmi / JS Gupta / S.Chand.
5. Thermal Engineering – P.L Bellaney / Khanna publishers.
6. Thermal Engineering M.L. Mathur & Mehta / Jain Bros.

III Year B. Tech. MECH - I Sem

L	T / P / D	C
3	1/ - / -	3

(A15319) DYNAMICS OF MACHINERY

UNIT – I

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

STATIC AND DYNAMIC FORCE ANALYSIS OF PLANAR MECHANISMS: Introduction – Free Body Diagrams – Conditions for equilibrium – Two, three and four force Members – Inertia forces and D' Alembert's Principle – planar rotation about a fixed center.

UNIT – II

CLUTCHES: Friction clutches – Single Disc or plate clutch, Multiple Disc clutch, Cone clutch, Centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle, Dynamometers – absorption and transmission types.

UNIT – III

TURNING MOMENT DIAGRAM AND FLY WHEELS: Turning moment – inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – fly wheels and their design.

GOVERNERS: Watt, Porter and Proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs, Sensitiveness, isochronisms and hunting.

UNIT – IV

BALANCING: Balancing of rotating masses Single and multiple – single and different planes. Balancing of Reciprocating Masses, Primary and secondary balancing of reciprocating masses. Analytical and graphical methods – Unbalanced forces and couples –Multi cylinder in line and radial engines, balancing of locomotive.

UNIT – V

VIBRATION: Free Vibration of mass attached to vertical spring – Forced damped vibration, Vibration isolation & Transmissibility – Whirling of shafts, critical speeds, Torsional vibrations of two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines by T. Beven, Pearson Education
2. Theory of Machines by SS. Ratan, Mc Graw Hill.

REFERENCES:

1. Theory of machines and Mechanisms by P.L. Ballaney, Khanna publishers.
2. Kinematics and Dynamics of Machinery by R.L.Norton, Mc Graw Hill.
3. Theory of Machines, R.S.Khurmi
4. Theory of Machines, Shigley, Mc Graw Hill Publishers
5. Theory of Machines, Thomas Bevan, CBS Publishers
6. Theory of Machines, R.K.Bansal (Lakshmi publications)
7. Mechanism and Machine Theory / JS Rao and RV Dukkipati / Newage

III Year B. Tech. MECH - I Sem **L T / P / D C**
3 1 / - / - 3

(A15320) MACHINE TOOLS AND METROLOGY

UNIT – I

METAL CUTTING: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips.

ENGINE LATHE: Principle of working, types of lathe, specifications.Taper turning– Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

UNIT – II

DRILLING AND BORING MACHINES: Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines - Principles of working – machining time calculations.

UNIT – III

MILLING MACHINES: Principles of working – Types of milling machines – Geometry of milling cutters – methods of indexing.

GRINDING: Theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing, comparison and Constructional features, machining time calculations

UNIT – IV

LIMITS, FITS AND TOLERANCES: Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

LIMIT GAUGES : Taylor's principle, Design of GO and NO GO gauges

Measurement of angles, Bevel protractor, Sine bar.

UNIT – V

SURFACE ROUGHNESS MEASUREMENT: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

COORDINATE MEASURING MACHINES: Types and Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology / I C Gupta./ Danpath Rai
2. Engineering Metrology / R.K. Jain / Khanna Publishers
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.
4. Production Technology by R.K. Jain and S.C. Gupta.

REFERENCE BOOKS:

1. Production Technology by H.M.T. (Hindustan Machine Tools)
2. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
3. Fundamentals of Dimensional Metrology 4e / Connie Dotson / Thomson
4. Workshop Technology – Vol.-II, B.S. Raghui Vamsi
5. Elements of Work Shop Technology – Vol. II, Hajra Choudry, Media Promoters.
6. Fundamentals of Metal Machining and Machine Tools, Geofrey Boothroyd, McGraw Hill

III Year B. Tech. MECH - I Sem

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(A15321) AUTOMOBILE ENGINEERING
(PROFESSIONAL ELECTIVE-I)

UNIT – I

INTRODUCTION ABOUT EVOLUTION OF MODERN AUTOMOBILES- Components of four wheeler automobile – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines.

ENGINE LUBRICATION SYSTEM: Splash and pressure lubrication systems, Lubrication Systems.

COOLING SYSTEM: Cooling requirements, Air cooling, Liquid cooling, Thermo, Water and forced lubrication system—Radiators- Types- Cooling fans- Water pump—Thermostat—Evaporating cooling- Pressure cooling.

UNIT--II

S.I. ENGINES: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. M.P.F.I system

C.I. ENGINES: Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

UNIT – III

IGNITION SYSTEM: Function of an ignition system, battery ignition system, auto transformer, Magneto coil ignition system, electronic ignition system, spark advance and retard mechanism.

ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – IV

TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive, torque converter. Propeller shaft – Hotch- Kiss drive, Torque tube drive, universal joint, differential, gear axles – types – wheels and tyres.

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, independent suspension system. Chassis-Types-Body of automobile

UNIT – V

STEERING SYSTEM: Steering geometry – camber, castor, King pin rake, combined angle toe-in, center point steering. Steering gears – types, steering linkages.

BRAKING SYSTEM: Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes- Master cylinder, wheel cylinder, Requirements of brake fluid, Pneumatic and vacuum brakes.

EMISSION FROM AUTOMOBILES – Pollution standards National and international – Pollution control – Techniques. Noise pollution and controls.

TEXT BOOKS:

1. Automobile Engineering ,Vol. 1 & Vol. 2/ Kripal Singh
2. Automobile Engineering , Vol. 1 & Vol. 2 ,by K.M Gupta, Umesh publication
3. Automobile Engineering / William Crouse, TMHILL Publishers.
4. A systems Approach to Automobile Technology, Jack Erjavec, YESSDEE Publishers Pvt. Ltd. New Delhi.

REFERENCES:

1. Automotive Mechanics / G.B.S.Narang
2. Automotive Mechanics / Heitner
3. Automotive Engines / Srinivasan
4. Automobile Engineering – K.K Ramalingam / Scitech Publications
5. Automotive Engineering / Newton steeds & Garrett.

III Year B. Tech. MECH - I Sem **L T / P / D C**

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(A15322) COMPUTATIONAL FLUID DYNAMICS

UNIT – I

ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

APPLIED NUMERICAL METHODS: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix inversion, Direct methods for Matrix inversion, Direct methods for banded matrices.

UNIT – II

Finite Difference Applications in Heat conduction and convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT – III

Finite Differences, discretization, consistency, stability and Fundamentals of fluid flow modeling, introduction, elementary finite difference quotients, implementation aspects of finite – difference equations, consistency, explicit and implicit methods.

UNIT – IV

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

Review of Equations Governing fluid flow and heat transfer, introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier – stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

UNIT – V

Steady flow, dimensionless form of Momentum and energy equations, Stokes equation, conservative body force fields, stream function – Vorticity formulation.

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow/Suhas V.Patankar Hema shava Publishers coporation & Mc Graw Hill.
2. Computational fluid flow and heat transfer/Muralidharan Narosa Publications

REFERENCES:

1. Computational Fluid Dynamics; Basics with applications John D. Anderson/Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.

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(A15323) WELDING TECHNOLOGY

UNIT I

INTRODUCING- Welding as a Production Process its advantages and limitations. Gas Welding Process, Types of fuels, Actylene, Indane, Butane, etc. Gas welding equipment, Gas welding technique. Electric arc welding Manual metal arc welding Power suplies, cables and other accessories for arc welding, Welding technique atomic, hydrogen welding, Thermit welding, soldering, Brazing and braze welding.

UNIT II

SPECIAL WELDING PROCESSES – Power sources, equipments and accessories, application, limitation and other characteristics of: (a) Gas tungsten arfc (TIG) welding (b) Gas metal arc (MIG) welding (c) Submerged arc welding (d) Electro slag welding processes. Resistance welding processes- principle- Types (spot, seam, projection, flash), Equipment required for each application.

UNIT III

MODERN WELDING PROCESSES – Electron beam welding, plasma arc welding, Friction welding, Explosive welding, Ultrasonic welding, Stud welding, Under water welding, Diffusion bonding, Cold welding, Welding of dissimilar metals.

UNIT IV

WELDMENT TESTING- Defects in welding in various processes-Causes and remidies; Destructive testing of weldments – strength, hardness, ductility, fatigue, creep properties etc. Non-destructive testing of weldments; Ultrasonic dye penetrant, magnetic particle inspection. X ray testing procedures and identification of defects – case studies. Weld thermal cycle – Redidual stressed distortion in welding stress relieving techniques.

UNIT V

Weldability, Automation and Design in Welding-Weldability definition. Temperature Distribution in welding – heat affected zone weldability of steel, cast iron. Aluminum, Pre heating and post heating of weldments. Estimation of transition tempareture. Automation in welding – Seam tracking vision and arc sencing welding robots. Design opf weldments- Welding symbols positions of welding joint and groove design. Weld stress – Calculations – Design of weld size.

TEXT/REFERENCE BOOKS:

1. Abbott,J & smith, K.M. Welding technology; Texas State Technical College Publishing.
2. Radhakrishnan. V.M. welding Technology and Design, New age International Pub. Ltd.,
3. Little R.L. , Welding Technology Tata Mcgraw – hill
4. Partmer R.S. Welding Process and Technology, Khanna Publishers.
5. Lancaster J.F., Metallurgy of Welding, Georgy Allen Unwin.
6. “AWS Welding hand Book”, Volume 1 to 4, AWS

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(A15386) THERMAL ENGINEERING LAB

PERFORM ANY 10 OUT OF THE 12 EXERCISES

1. I.C. Engines valve / Port Timing Diagrams.
2. I.C. Engines Performance test (4 – Stroke Diesel Engines)
3. I.C. Engines Performance test on 2 – stroke petrol.
4. Evaluate of engine friction by conducting Morse test on 4 stroke Multi cylinder petrol engine.
5. Evaluate of engine friction by conducting motoring / retardation test on 4 stroke diesel engine.
6. Heat balance on IC Engines.
7. Determination of A/F Ratio and volumetric efficiency on IC ENGINES.
8. Determination of Economical speed test for fixed load on 4-stroke engine.
9. Determine optimum cooling water temperature on IC engine.
10. Disassembly / assembly of engines.
11. Performance test on reciprocating air-compressor unit.
12. Study of boilers.

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(A15387) METROLOGY AND MACHINE TOOLS LAB

SECTION – A:

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and choral height of spur gear.
4. Machine tool alignment test on the lathe.
5. Tool maker's microscope.
6. Angle and taper measurements by Bevel protractor & sine bars.
7. Use of spirit level in finding the flatness of surface plate.
8. Thread measurement by two wire / three wire method or Tool makers' microscope.

SECTION – B

1. Introduction of general purpose machines – Lathe, Drilling machine, Milling machine, shaper.
2. Planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
3. Step turning and taper turning on lathe machine.
4. Thread cutting and knurling on lathe machine.
5. Drilling and tapping
6. Shaping and planning
7. Slotting
8. Milling
9. Cylindrical surface grinding

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(A16327) DESIGN OF MACHINE MEMBERS – II

NOTE: Design Data books are permitted in the Examinations.

UNIT – I

SLIDING CONTACT BEARINGS: Types of Journal bearings – basic modes of Lubrication – Bearing construction – bearing design – bearing materials – Selection of lubricants.

ROLLING CONTACT BEARINGS: Types of rolling contact bearings – selection of bearing type – selection of bearing life – Design for cyclic loads and speeds – Static and dynamic loading of ball & roller bearings.

UNIT – II

DESIGN OF IC ENGINE PARTS: Design of Connecting Rod; Thrust in connecting rod – stress due to whipping action on connecting rod ends –Pistons, Forces acting on piston – Construction, Design and proportions of piston, Cylinder, Cylinder liners.

UNIT – III

DESIGN OF BELT AND ROPE DRIVES: Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types – Ropes – Pulleys for belt and rope drives.

MECHANICAL SPRINGS: Stresses and deflections of helical springs – Extension – compression springs – Springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs.

UNIT – IV

DESIGN OF SPUR AND HELICAL GEAR DRIVES: Spur and Helical gears – Load concentration factor – Dynamic load factor, Surface compressive strength – Bending strength – Design analysis of Spur and Helical gears –check for plastic deformation, Check for dynamic and wear considerations.

UNIT – V

DESIGN OF BEVEL GEAR DRIVES: Bevel gears – Load concentration factor – Dynamic load factor, Surface compressive strength – Bending strength – Design analysis of Bevel gears –check for plastic deformation, Check for dynamic and wear considerations.

DESIGN OF POWER SCREWS: Design of screw, Square ACME, Buttress screws, design of nut.

TEXT BOOKS:

1. Machine Design by Pandya & shah.
2. Mechanical Engineering Design by Bahi and Goel, Standard Publications.

REFERENCES:

1. Machine Design by V.Bandari, TMH Publishers
2. Machine Design by R.L.Norton, Mc Graw Hill
3. Machine design by Khurmi
4. Machine Design by S. MD Jalaluddin, Anuradha Publishers.
5. Design of Machine Elements by Kulkarni, Mc Graw Hill.
6. Machine Design, by T.V.Sundarajan Murthy and N,Shanmugam – Anuradha Publications.
7. Mech. Engg. Design / JE Shigley

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(A16328) HEAT TRANSFER

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – Basic laws of heat transfer – General discussion about applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

SIMPLIFICATION AND FORMS OF THE FIELD EQUATION – steady, unsteady and periodic heat transfer – initial and boundary conditions.

UNIT – II

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANSFER: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation.
Variable thermal conductivity – systems with heat sources or Heat generation, Extended surface (Fins) Heat Transfer – Long Fin, Fin with insulated tip and short Fin, Application to error measurement of temperature.

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers – Chart solutions of transient conduction systems – Concept of Functional body.

UNIT – III

CONVECTIVE HEAT TRANSFER: Classification of systems based on causation of flow, condition of flow, medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem and method , application for developing semi – empirical non – dimensional correlation for convection heat transfer – Significance of non – dimensional numbers – Concepts of Continuity, Momentum and Energy equations.

FORCED CONVECTION: EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer - Flat plates and cylinders.

INTERNAL FLOWS: Concepts of hydrodynamic and thermal entry lengths – Division of internal flow based on this – Use of empirical relations for Horizontal Pipe Flow and annulus flow.

FREE CONVECTION: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.

UNIT – IV

BOILING AND CONDENSATION: Boiling - Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods – Problems using LMTD and NTU methods.

UNIT – V

RADIATION HEAT TRANSFER: Emission characteristics and laws of black-body radiation – irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefen and Boltzmann – heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

TEXT BOOKS:

1. Fundamentals of Engg. Heat and Mass Transfer / R.C. SACHDEVA / New Age International.
2. Heat Transfer – P.K.Nag / TMH

REFERENCE BOOKS:

1. Heat Transfer / HOLMAN / TMH
2. Heat Transfer – Ghoshdastidar – Oxford University Press – II Edition
3. Heat and Mass Transfer – Cengel – McGraw Hill.
4. Heat and Mass Transfer – R.K.Rajput – S.Chand & Company Ltd.
5. Heat and Mass Transfer – Christopher A Long / Pearson Education.
6. Heat and Mass Transfer – D. S Kumar / S.K.Kataria & Sons
7. Heat and Mass Transfer – Kondandaraman
8. Fundamentals of Heat Transfer & Mass Transfer – incropera & Dewitt / John Wiley Pub.

NOTE: HEAT AND MASS TRANSFER DATA BOOK IS PERMITTED.

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(A16329) FINITE ELEMENT METHODS

UNIT – I

INTRODUCTION TO FEM: Basic concepts, Historical back ground, application of FEM, general description, comparison of FEM with other methods. Basic equations of elasticity, Stress Strain and strain displacement relations. Rayleigh Ritz method, weighted residual methods.

UNIT – II

ONE DIMENSIONAL PROBLEMS: Stiffness equations for a axial bar element in local co-ordinates using Potential Energy approach and Virtual energy principle Finite element analysis of uniform, stepped and tapered bars subjected to mechanical and thermal loads Assembly of Global stiffness matrix and load vector Quadratic shape functions properties of stiffness matrix.

UNIT – III

ANALYSIS OF TRUSSES: Stiffness equations for a truss bar element oriented in 2D plane Finite Element Analysis of Trusses Plane Truss and space Truss elements methods of assembly.

ANALYSIS OF BEAMS: Hermite shape functions Element stiffness matrix Load vector Problems.

UNIT – IV

2-D STRUCTURAL PROBLEMS: CST Stiffness matrix and load vector Isoparametric element representation Shape functions convergence requirements problems.

Two dimensional four noded isoparametric elements Numerical integration Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements – Introduction to 3 D problems with Tetrahedron Brick elements.

UNIT – V

ANALYSIS OF HEAT TRANSFER PROBLEMS: 1D Heat conduction 1D fin elements 2D heat conduction analysis of thin plates Composite slabs problems.

DYNAMIC ANALYSIS: Dynamic equations Lumped and consistent mass matrices Eigen Values and Eigen Vectors mode shapes modal analysis for bars and beams.

TEXT BOOKS:

1. The finite element methods in Engineering S.S.Rao Elsevier 4th edition.
2. Introduction to finite elements in engineering Tirupathi K. Chandrupatla and Ashok D. Belagundu.

REFERENCES:

1. Finite Element Methods/ Alavala/ TMH
2. An introduction to Finite Element Methods J.N. Reddy Mc Grawhill.
3. The Finite element method in engineering science O.C. Zienkoitz, McGrawhill.
4. Concepts and applications of finite element analysis Robert Cook Wiley.
5. Introduction of Finite Element Analysis S. Md. Jalaludeen Anuradh publications.

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(A16330) REFRIGERATION AND AIR CONDITIONING
(PROFESSIONAL ELECTIVE –II)

UNIT – I

INTRODUCTION TO REFRIGERATION: Necessity and applications Unit of refrigeration and C.O.P. Mechanical Refrigeration Types of Ideal cycle of refrigeration.

AIR REFRIGERATION: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems Actual air refrigeration system Refrigeration needs of Air crafts Air systems Actual Air refrigeration system Refrigeration needs of Air crafts Application of Air Refrigeration, Justification Types of systems Problems.

UNIT – II

VAPOUR COMPRESSION REFRIGERATION: Working principle and essential components of the plant Simple Vapour compression refrigeration cycle COP Representation of cycle on T-S and p-h charts effect of sub cooling and super heating cycle analysis Actual cycle Influence of various parameters on system performance Use of p-h charts Problems.

UNIT III:

SYSTEM COMPONENTS: Compressors General classification comparison Advantages and Disadvantages. Condensers classification Working Principles, Evaporators classification Working Principles, Expansion devices Types Working Principles, Refrigerants Desirable properties common refrigerants used Nomenclature Ozone Depletion Global Warming Azeotropes and Zeotropes.

UNIT IV:

VAPOR ABSORPTION SYSTEM: Calculation of max COP description and working of NH3 water system Li Br system. Principle of operation Three Fluid absorption system, salient features.

STEAM JET REFRIGERATION SYSTEM: Working Principle and Basic Components, Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT – V:

INTRODUCTION TO AIR CONDITIONING: Psychometric Properties & Processes Sensible and latent heat loads Characterization Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.

CONCEPT OF HUMAN COMFORT AND EFFECTIVE TEMPERATURE: Comfort Air conditioning Industrial air conditioning and Requirements Air conditioning Load Calculations.

AIR CONDITIONING SYSTEMS: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers. Heat Pump – Heat sources – different heat pump circuits – Applications.

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai

REFERENCES:

1. Refrigeration and Air Conditioning/ Manohar Prasad/ New Age.
2. Principles of Refrigeration Dossat/ Pearson Education.
3. Refrigeration and Air Conditioning P.L. Bellaney
4. Basic Refrigeration and Air Conditioning Ananthanarayanan / TMH.
5. Refrigeration and Air Conditioning R.S. Khurmi & J.K Gupta S.Chand Eurasia Publishing House (P) Ltd.

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(A16331) RENEWABLE ENERGY SOURCES
(PROFESSIONAL ELECTIVE –II)

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar pondsm Solar Applications – solar heating / cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT – III

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

BIO-MASS: Principles of Bio-Conversion, Anaerobic. aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking I.C.Engine operation and economic aspects.

UNIT – IV

GEO THERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles, Tidal and wave energy, Potential and conversion techniques, mini – hydel power plants and their economics.

UNIT – V

DIRECT ENERGY CONVERSION: Need for DEC, Carnot Cycle, Limitations, principles of DEC, Thermo – electric generators, seebeck, peltier and joule – Thomson effects, Figure of merit, materials, applications, MHD generators, principle, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects, Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable energy resources / Tiwari and Ghosal / Narosa.
2. Non – Conventional Energy Sources / G.D.Rai.

REFERENCES:

1. Renewable Energy Sources / Twidell & Weir
2. Solar Energy / Sukhatme
3. Solar Power Engineering / B.S Magal Frank Kreith & J.F Kreith.
4. Principles of solar Energy / Frank Krieth & John F. K reider.
5. Non-Conventional Energy / Ashok V.Desai / Wiley Eastern
6. Non-Conventional Energy Systems/ K.Mittal / Wheeler
7. Renewable Energy Technologies / Ramesh & Kumar / Narosa

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(A16332) TOOL DESIGN
(PROFESSIONAL ELECTIVE –II)

UNIT - I

DESIGN OF CUTTING TOOLS: Metal cutting process - Selection of tool materials - Design of single point and multipoint cutting tool - Form tools, Drills, Milling cutters, broaches and chip breakers – Problems on design of single point cutting tools only.

UNIT - II

LOCATING AND CLAMPING METHODS: Basic Principles of Location - Locating methods and devices - Principles of clamping - Mechanical, Pneumatic and Hydraulic actuation - Clamping force analysis – Simple Design problems.

UNIT - III

DESIGN OF JIGS: Types of drill jigs - General considerations in the design of drill jigs - Drill bushings - Types, methods of construction - Simple designs of Plate, Channel, Boxes, Post, Angle plate, Turnovers and Pot Jigs.

UNIT - IV

DESIGN OF FIXTURES: Design principles - Types of fixtures - Fixtures for machine tools: Lathe, Milling, Boring, Broaching and grinding - Assembly fixtures - Inspection and Welding fixtures.

UNIT - V

DESIGN OF DIES: Press tools - Fundamentals of die-cutting operations - Cutting action in punch and die operations - Die clearance - Blanking and Piercing Die construction – Pilots - Strippers and

Pressure Pads - Press work materials - Strip layout - Design of simple progressive and compound die sets - Forging Die – Flow lines, parting lines, open and close die forging; Materials for die block.

TEXT BOOKS:

1. Donaldson C., Lecain G.H. and Goold V.C. (2007), Tool Design, 3rd edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

REFERENCES:

1. Joshi P. H., (2004) Jigs and Fixtures, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Edward G. Hoffman (2004) Jigs and Fixtures Design, Thomson - Delmar Learning Series, Singapore.
3. Jeff Lantrip, David A. Smith and John G. Nee, (2003) Fundamentals of Tool Design, 5th Edition, Society of Manufacturing Engineers.

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(A16388) HEAT TRANSFER LAB
(Consider Performance in Any 12)

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat Transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere.
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin.
6. Experiment on Transient Heat Conduction.
7. Heat Transfer in forced convection apparatus.
8. Heat Transfer in natural convection.
9. Parallel and counter flow heat exchanger.
10. Emissive apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of two – Phase flow.

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

PRE REQUISITES:

- Probability and statistics
- Operation research
- Mathematics-I
- Environmental studies

Course Objectives: To enable the student to understand, with a practical insight,

- The importance of certain basic issues governing the business operations namely demand and supply, production function, cost analysis,
- analysis of markets, forms of business organizations,
- Significance of capital budgeting and financial accounting and financial analysis.

UNIT –I:

Introduction to Managerial Economics& Demand Analysis:

Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT –II:

Production & Cost Analysis:

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts (Opportunity cost vs outlay costs, Fixed, variable and semi variable costs, marginal cost vs average cost, out of pocket vs book cost, imputed cost, implicit & explicit cost, incremental and decremental cost, sunk vs future cost, separable and joint costs) Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT –III:

Markets & New Economic Environment:

Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organization: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

UNIT-IV: Introduction to Financial Accounting & Financial Analysis:

Accounting concepts and Conventions Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis: Analysis and Interpretation of Liquidity Ratios (current ratio, quick ratio), Activity Ratios(inventory turnover ratio, debtors turnover ratio), and Capital structure Ratios(debt equity ratio, interest coverage ratio) and Profitability ratios(gross profit ratio, net profit ratio, operating profit ratio, P/E ratio, EPS). Du Pont Chart.

UNIT –V: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital, Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), Net Present Value Method (simple problems), IRR and PI method.

Outcomes: At the end of the course the students is expected

- To understand and enhance the knowledge regarding managerial economics concepts and obtaining optimal solutions.
- To get an idea of analysis of firm's financial position with the techniques of financial analysis and ratio analysis.

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
2. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
3. J.V.Prabhakar Rao & P.V.Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

REFERENCE BOOKS:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012
4. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting—A Managerial Perspective, Pearson, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Kasi Reddy, Saraswathi, MEFA, PHI Learning, 2012.
10. Shailaja & Usha : MEFA, University Press, 2012.

L	T / P / D	C
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ADVANCED COMMUNICATION SKILLS (ACS) LAB
(Common to all branches)

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.
The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.

Objectives:
This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educational English speakers and respond appropriately in different socio-cultural and professional contexts.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) lab:

1. **Activities on Fundamentals of inter-personal Communication and Building Vocabulary –** Starting a conversation – responding appropriately and relevantly – using the right body language - Role Play in different situations & Discourse Skills – using visuals – Synonyms and antonyms, word roots, one word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** – General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills –** Structure and presentation of different types of writing – letter writing/ Resume writing/ e-correspondence/ Technical report writing / Portfolio writing – planning for writing – improving one's writing.

4. **Activities on Presentation Skills –** Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/e-mails/assignments etc.
5. **Activities on Group Discussion and interview Skills –** Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation. Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video – conference and Mock Interviews.

Books Recommended:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D. Pearson Education 2011.
3. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
5. The Basics of Communication: A Relational Perspective. Steve Duck & David T. Mc Mahan. Sage South Asia Edition. Sage Publications. 2012.
6. English Vocabulary in Use series, Cambridge University Press. 2009
7. Management Shapers Series by Universities Press (India) Pvt. Ltd. Himayatnagar, Hyderabad. 2008.
8. Handbook for Technical Communication by David A. McMurrey & Joanna Buckley. 2012. Cengage Learning.
9. Communication Skills by Leena Sen.PHI Learning Pvt. Ltd. New Delhi. 2009.
10. Handbook for Technical Writing by David A McMurrey & Joanna Buckley Cengage Learning. 2008.
11. Job Hunting by Colm Downess, Cambridge University Press 2008.
12. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill. 2009.
14. Books on TOEFL/GRE/GMAT/ICAT/IELTS by Barron's/DELTA/Cambridge University Press.
15. International English for Call Centres by Barry Tomalin and Suhashini Thomas Macmillan Publishers. 2009.

L T P C
2 0 0 2

PERSONALITY DEVELOPMENT AND BEHAVIOURAL SKILLS

Course Objectives

- To enable students to communicate with outside and peer group members in an effective manner.
- To enable the students to give better presentation and explanation on their projects, posters and assignments - this makes them industry ready.
- To perform better during Campus Recruitment and various interviews they face in their career.

Course Outcomes

At the end of the course a student is expected:

- To communicate with more confidence using better spoken and written English
- To give better presentation and explanation with the use of digital inventions
- To perform well during Campus Drives and different Interviews

Course Outcomes

Unit – I

Personality Development: Definition - Various Aspects of Personality Development - Behavioural Traits. Importance of Soft skills-Soft skills for a future Entrepreneur - Qualities of a good leader - Stress Management - Success stories.

Unit – II

Non Verbal Communication: Kinesics Haptics Proxemics Vocalics Oculesics Body Language in Interviews.

Unit - III

Team Dynamics: Different Types of Teams-role of an individual - Communicating as a group or team leader - Individual Presentations/Team Presentation. Case Studies: Project Presentations.

UNIT-IV

Technical Report Writing: Formats - Effective Resume Preparation - Covering Letter - Statement of Purpose (SoP).

UNIT-V

Role of Multimedia in Communication: Communication in a Digital Edge (Video Conference Etc.)

E-Correspondence: Recent Trends in Professional Communication - Social Networking: Importance, Effects.

Blogging: Creating of Blogs - Technical and Non – technical blogs – Success Stories and Case Studies.

Reference Books

1. Barun, K Mitra, Personality Development and Soft Skills, Oxford University Press, 2nd Edition, 2016.
2. Gopalaswamy Ramesh, the Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education, 2013.
3. Krishna Mohan & Meera Banerji, Developing Communication Skills, Macmillan India Ltd, 2008.
4. Krishna Mohan & Meenakshi Raman, Effective English Communication, Tata McGraw-Hill Publishing Company Ltd, 2008.
5. Arati Gurav, 50 Mantra's of Personality Development, Buzzingstock Publishing House, 2013.
6. P. Kiranmai Dutt & Geetha Rajeevan, Basic Communication Skills, Cambridge University Pvt. Ltd2007.
7. S.C. Sood, Mita Bose, Naresh Jain, Developing Language Skills, Manohar Publications, 2007, T.M. Farhathullah, Communication Skills for Technical Students, Orient Longman Pvt Ltd, 2002.

L T P C
2 0 0 2

QUANTITATIVE METHODS & LOGICAL REASONING

Course Objectives:

1. The objective of this course is to enhance the problem solving skills in the areas of **'Quantitative Aptitude'** and **'Reasoning'** which will enable the students to better preparation for **Campus Placements** and competitive examinations.
2. To improve the logical thinking and mathematical ability of the students.

Course Outcomes:

At the end of the completion of the course a student is expected

1. To solve basic and complex mathematical problems in short time.
2. To perform well in various competitive exams and placement drives.

Quantitative Aptitude and Reasoning:

Unit – I

1. Number System:
Speed math's, Numbers, Factors, prime & Co primes, LCM & HCF, Divisibility rules, finding unit place digit and last two digits of an expression

2. Simple Equations:
Definition of Linear equation, word problems

3. Ratio, Proportion and Variations:
Definition of ratio, ratio of Proportion, Comparison of ratios, Compound ratio, Direct and indirect proportion

4. Percentages:
Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings

5. Profit and loss:
Relation between Cost price and selling price, Discount and Marked price, Gain or Loss percentages on selling price

6. Simple and Compound Interest:
Problems on interest (**I**), amount (**A**), Principal (**P**) and rate of interest(**R**)
Difference between the simple interest and compound interest for 2 and 3 years.

Unit-II

1. Partnership:
Relation between partners, period of investment and shares

2. Averages and Ages:
Average of different groups, change in averages by Adding, deleting and Replacement of objects, problems on ages.

3. Allegation and mixtures:
Allegation rule, Mean value of the mixture, Replacement of equal amount of quantity.
Time and Work:
Men and Days, Work and Wages, pipes and cisterns, hours and work, Alternate day's concept,
Time and Distance:
Difference between the average and Relative speeds, reaching the destination late and early, Stoppage time per hour, time and distance between two moving bodies
Trains, Boats and Streams:
Train crossing man, same and opposite directions, Speed of boat and stream,

Unit-III
1. Progressions:
Arithmetic, Geometric and Harmonic Progressions, Arithmetic Mean, Geometric Mean and Harmonic Mean and their relations.

2. Quadratic Equations:
General form of Quadratic equation, finding the roots of Quadratic equation, Nature of the Roots.

3. Mensurations:
2D geometry- perimeter, areas, 3D geometry - surface areas, volumes

4. Permutation and Combination:
Fundamental rules, problems on permutations & combinations.

5. Probability
Definition of probability, notations and formulae, problems on probability.

6. Data Interpretation and Data Sufficiency:
Tabular and Pie-charts, Bar and Line graphs, Introduction to data sufficiency, problems on data sufficiency.

Unit-IV
1. Deductions:
Statements and conclusions using Venn diagram and Syllogism method

2. Connectives:
Definition of simple and compound statements, Implications and negations for compound statements.

3. Series completion:
Number series, Alphabet series, letter series.

4. Coding and Decoding:
Letter coding, Number coding, Number to letter coding, Matrix coding, Substitution, Mixed letter coding, Mixed number coding, Deciphering individual letter codes by analysis.

5. Analytical Reasoning Puzzles:
Problems on Linear, Double line-up and Circular arrangements, Selections and Comparisons.

6. Blood Relations:
Defining the various relations among the members of a family, Solving Blood Relation Puzzles by using symbols and notations. Problems on Coded relations.

Unit-V

1. Direction sense test:
Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets.

2. Clocks:
Relation between minute-hour hands, angle vs time, exceptional cases in clocks

3. Calendars:
Definition of a Leap Year, Finding the Odd days, Finding the day of any random calendar date, repetition of calendar years.

4. Cubes and Dices:
Finding the minimum and maximum number of identical pieces and cuts, painting of cubes and cuts, problems on dice.

5. Venn diagrams:
Circular representation of given words, Geometrical representation of certain class, set theory based problems.

6. Number, Ranking and Time sequence test:
Number test, Ranking test, Time sequence test.

Text Books:

1. GL Barrons, Mc Graw Hills, Thorpe's verbal reasoning, LSAT Material
2. R S Agarwal, S.chand, 'A modern approach to logical reasoning'
3. R S Agarwal, S.Chand, 'Quantitative Aptitude'

Reference Books:

1. Quantitative Aptitude-G.L BARRONS
2. Quantitative Aptitude-Abhijit Guha Mc Graw Hills.
3. Quantitative Aptitude-U.Mohan Rao SCITECH.

(A15324) ELEMENTS OF MECHANICAL ENGINEERING
(OPEN ELECTIVE-I)

UNIT-I

THERMAL ENGINEERING BASIC CONCEPTS: Zeroth Law of Thermodynamics- First law of Thermodynamics- Second Law of Thermodynamics- Boyles Law- Charles Law- Thermodynamic processes- Otto cycle - Diesel cycle- Four stroke petrol and diesel engines. Brake power, Indicated power, Mechanical efficiency, Air refrigeration, Vapour compression refrigeration.

UNIT-II

THEORY OF MACHINES : Types of Gears and Gear trains – Transmission of power by Belts, Ropes and Chain drives- Cams and Followers. Free Vibration of mass attached to vertical spring – Oscillation of pendulums – Transverse loads.

UNIT-III

PRODUCTION TECHNOLOGY : Metal Casting - Sand casting, metal moulding, Welding - Arc welding, Gas welding, Brazing, Soldering. Metal forming – forging, drawing, extrustion. Metal cutting – lathe, drilling, milling operations.

UNIT-IV

INTRODUCTION TO DESIGN : Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain –Temperature stresses.

UNIT-V

AUTOMOBILE ENGINEERING : Battery ignition system in petrol engine, Injection system in diesel engine, Cooling of engines, Electrical system, Braking system. Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

TEXT BOOKS:

1. Fundamentals of Mechanical Engineering by Sawhmey PHI Publications.
2. Elements of Mechanical Engineering by M.L. Mathur
3. Elements of Mechanical Engineering by F.S. Mehta

REFERENCES:

1. Machine design by Khurmi
2. Theory of Machines by SS. Ratan, Mc Graw Hill.
3. Automobile Engineering , Kripal Singh
4. Production Technology by R.K. Jain and S.C. Gupta
5. Thermal Engineering / R.K Rajput / Lakshmi Publications

(A15325) INDUSTRIAL ENGINEERING
(OPEN ELECTIVE-I)

UNIT – I

CONCEPTS OF INDUSTRIAL ENGINEERING: Productivity, Production, Productivity Improvement. Work Study: Method Study and Time Study. Flow Process Chart, multiple activity chart, Standard time computation, work sampling.

UNIT – II

PLANT LOCATION FACTORS: Quantitative and qualitative methods; types of production - Mass, batch, job. Types of plant layout - product, process and fixed position layouts, cellular layouts, Group Technology – Flexible Manufacturing systems.

UNIT – III

PRODUCTION PLANNING AND CONTROL: Production plan, loading, scheduling, Production planning by line of Controls. Materials Requirement Planning (MRP), Manufacturing Resource Planning (MRP II) Network scheduling – CPM and PERT.

UNIT – IV

INVENTORY CONTROL: ABC analysis, FSN analysis, VED Analysis, P System, Q System. Economic ordering quantity, Lead time, Buffer Stock, ASRS, Stores management.

UNIT – V

QUALITY ENGINEERING: X, R, p, C charts, Acceptance Sampling, Kaizen, JIT, ISO-9000, Deming, Juran, Philip Crosby Concepts, Taguchi Quality loss function.

TEXT BOOKS:

1. Industrial Engineering & Management/ SK Hajra Choudhury, Nirjhar Roy, AK Hajra Choudhury
2. Industrial Engineering and Management/ Banga and Sharma

REFERENCE BOOKS:

1. PERT and CPM Principles and Applications /L S Srinath
2. Industrial Management/K.K.Ahuja
3. Production Systems - Planning Analysis And Control/ Riggs.
4. Modern Production / Operations Management/Elwood S Buffa/ Rakesh K Sarin.

BASIC AUTOMOBILE ENGINEERING

L	T	P	C
3	0	0	3

UNIT – I

Introduction: Types of automobile engines.

S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump, filters, carburetor, types, air filters, petrol injection. M.P.F.I system

C.I. engines: Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

UNIT - II

Engine Lubrication System: Splash and pressure lubrication systems.

Cooling System: Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication system, Radiators: Types, Cooling fans.

UNIT – III

Ignition System: Battery ignition system, Magneto coil ignition system, electronic ignition system. Battery, Contact breakers, Spark plugs.

Electrical System: Charging circuit, generator, current, voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge.

UNIT – IV

Transmission System: Clutches, types-cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches gear boxes, types. Propeller shaft, Hotch- Kiss drive, Torque tube drive.

Suspension System: Objects of suspension systems rigid axle suspension system, torsion bar, shock absorber, independent suspension system.

UNIT – V

Steering System: Steering geometry, camber, castor, King pin rake, combined angle toe-in, center point steering.

Braking System: Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes.

Emission from Automobiles: Pollution standards National and international, Pollution control Techniques. Noise pollution and controls.

TEXT BOOKS:

1. Automobile Engineering ,Vol. 1 & Vol. 2,Kirpal Singh,Standard Publishers Distributors Delhi
2. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication

REFERENCES:

1. Automotive Mechanics , G.B.S.Narang, Khanna Publishers
2. Automotive Mechanics , J.Heitner, CBS Publications
3. Automobile Engineering, William Crouse, TMHILL Publishers.
4. Automotive Engines , Srinivasan, MCgraw-Hill Education (India) Ltd

MATERIAL SCIENCE ENGINEERING

L	T	P	C
3	0	0	3

UNIT – I

Structure of Metals: Bonds in Solids Metallic bond crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys determination of grain size. Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II

Equilibrium of Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

UNIT –III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plan carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT – IV

Heat Treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT – V

Ceramic Materials: Crystalline ceramics, glasses, cermets, abrasive materials, Nanomaterials definition, properties and applications of the above.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C C composites.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H. Avener, Mc Graw Hill
2. Material Science & Metallurgy, Kodgire, Everest Publishing House

REFERENCES:

1. Materials Science, Vijendra Singh, Standard Publishers
2. Material Science & Engineering, V. Rahghavan, PHI
3. Science of Engineering Materials, Agarwal
4. An Introduction To Material Science, W.G.vinas & HL Mancini, Princeton University Press

B.TECH MECH IV YEAR COURSE STRUCTURE

S. No.	Subject Code	Subject Name	L	T	P	Total Credits
B.Tech IV YEAR I SEMESTER						
1	***A17334***	Operation Research	4	1	0	3
2	***A17335***	CAD/CAM	4	1	0	3
3	***A17336***	Mechanical Measurements and instrumentation	3	1	0	3
4	***A17343*** ***A17344***	**OPEN ELECTIVE – III** Optimization Techniques Maintenance and Safety Engineering	3	1	0	3
5	***A17337*** ***A17338*** ***A17339***	**PROFESSIONAL ELECTIVE -III** Robotics Mechatronics Composite Materials	3	1	0	3
6	***A17340*** ***A17341*** ***A17342***	**PROFESSIONAL ELECTIVE -IV** CNC Technologies Power plant Engineering Computer Graphics	3	1	0	3
7	***A17389***	Computer Aided Design and Manufacturing Lab	0	0	3	2
8	***A17390***	Production Drawing practice and Instrumentation lab	0	0	3	2
9	***MP-I***	Industry Oriented Mini Project				2
		Total Credits				**24**
B.Tech IV YEAR II SEMESTER						
1	***A18345***	Production Planning And Control	3	1	0	3
2	***A18346***	Plant Layout And Material Handling	3	1	0	3
3	***A18347***	Unconventional Machining Processes	3	1	0	3
4	***SM***	Seminar	0	0	6	2
5	***CVV***	Comprehensive Viva	0	0	0	2
6	***PW***	Project work	**0**	**0**	**0**	11
		Total Credits				**24**

IV YEAR B.Tech. MECH - I Sem

L	T	P	C
4	1	0	3

OPERATION RESEARCH-(A17334)

Course Objectives

- To familiarize with the quantitative tools and techniques, which are frequently applied to business decision-making of real systems.
- To analyze which scientific approach is chosen in timely management decisions for the purpose of improving its performance.
- To develop problem modeling and solving skills and learn how to make intelligent business decisions by optimizing the resources.
- To provide a formal quantitative approaches in problem solving and acquire substantial experience in taking corrective measures.

Course Outcomes

- To Model the real life situations with mathematical models.
- To understand the concept of linear programming.
- To solve transportation and assignment problems.
- To formulate the sequencing of jobs on machines.
- To understand the various replacement concepts.
- To Identify and apply various inventory models. Apply queuing and dynamic programming models.

UNIT-I

Introduction: Development – Definition – Characteristics and phases – Types of operation Research models – applications. Allocation.

Linear Programming Method: Problem formulation – Graphical solution – Simplex method – Two – phase method, Big-M method – Duality principle - Effect of changing coefficients in objective function.

UNIT-II

Transportation Problem

Formulation – Optimal solution – unbalanced transportation problem – Degeneracy, Assignment problem – Formulation – Optimal solution – Variants of Assignment Problem – Travelling salesman problem - Transshipment problem.

UNIT-III

Theory of Games

Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – dominance principle – m X 2 & 2 X n games – graphical method.

Waiting Lines

Introduction – Single Channel – Poisson arrivals exponential service times – with infinite population and finite population models – Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

Sequencing

Introduction – Flow – Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

UNIT–IV

Replacement

Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

Inventory

Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – instantaneous production, instantaneous demand and continuous demand and no set up cost – Single period model.

UNIT–V

Non-linear-Programming

Kuhn Tucker conditions – Hessian Matrix for optimality condition.

Simulation

Definition – Types of simulation models – phases of simulation – applications of simulation – inventory and Queuing problems – Advantages and Disadvantages – Brief introduction of simulation languages.

TEXT BOOKS

1. Hamdy, A. Taha, Operations Research-An Introduction, Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997.
2. S.D. Sharma, Operations Research, Kedarnath, Ramnath & Co., Meerut,2009
3. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi, 2004

REFERENCE BOOKS

1. Harvey M. Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, Operations Research, PHI Learning Private Limited, 2013

IV YEAR B.Tech. MECH - I Sem

L	T	P	C
4	1	0	3

CAD/CAM-(A17335)

Course objectives

- Understand the basic fundamentals of computer aided design and manufacturing.
- To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
- To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
- To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control.

Course Outcomes

- To Appreciate CAD/CAM principles and know the various input and output peripherals of computers. Understand geometric modeling principles.
- To develop mathematical models to represent surfaces and solids. Understand numerical control systems and develop CNC part programs.
- To understand the elements of group technology and computer aided process planning To Acquire knowledge of Flexible Manufacturing Systems, Computer Aided Quality Control and Computer Integrated Manufacturing Systems.

UNIT – I

Introduction

Computers in industrial Manufacturing, Product cycle, CAD/CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices and storage devices.

Computer Graphics

Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

Geometric Modeling

Requirements, geometric models, curve representation methods, surface representation methods, modeling facilities desired.

Drafting and Modeling Systems

Basic geometric commands, layers, display control commands, editing, dimensioning, and solid modeling.

UNIT – III

Numerical Control

NC, NC modes, NC elements, NC machine tools structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

Group Technology

Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Panning, Retrieval type and Generative type.

UNIT – IV

Computer Aided Quality Control

Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods – optical, noncontact, inspection methods – nonoptical, computer aided testing, integration of CAQC with CAD/CAM.

Computer Integrated Manufacturing Systems

Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

UNIT – V

Reverse Engineering Technology

Introduction to Reverse Engineering, Reverse Engineering–Hardware and Software, Applications of Reverse Engineering, Reverse engineering process, Fundamental Reverse Engineering Operations, Reasons for using reverse engineering.

TEXT BOOKS:

1. Mikell P. Groover, Emory W. Zimmers, "CAD/CAM: Computer-Aided Design and Manufacturing", Pearson Education India, 1984.
2. Ibrahim Zeid, R Sivasubramanian "CAD / CAM: Theory and Practice", Second Edition, McGraw-Hill, 2009.
3. Vinesh Raja, Kiran J. Fernandes, "Reverse Engineering: An Industrial Perspective", Springer, 2008.

REFERENCE BOOKS:

1. P. Groover, "Automation, Production systems & Computer integrated Manufacturing", Fourth Edition, Pearson Education, 2016
2. Warren S. Seames , "Computer Numerical Control Concepts and programming", Cengage Learning, 2007.
3. WEGO WANG, "Reverse Engineering: Technology of Reinvention", First Edition, CRC Press, 2010.

IV YEAR B.Tech. MECH - I Sem

L	T	P	C
3	1	0	3

MECHANICAL MEASUREMENTS AND INSTRUMENTATION-(A17336)

Course Objectives

- To understand the Functional Elements of the Measuring System and Standards of the Measuring System for Calibration .
- To study the Static and Dynamic Characteristics of the measuring Instruments and to study the Errors occurring in the measuring system and to eliminate them.
- To study the principle, working advantages limitations and applications of Displacement, pressure, flow, liquid level, temperature measuring instruments.
- To study the concepts of feedback control mechanism in process control systems.

Course Outcomes

- To define basic terms related to measurements, understand measurement techniques. Understand working principles of various displacements, pressure and temperature measuring instruments.
- To describe the working, advantages, disadvantages and applications of various flow, level, speed, acceleration and vibration measuring instruments.
- To model and analyze various stress, strain, humidity, force, torque and power measuring instruments.
- To understand control systems and their applications.

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, classification and elimination of error.

Measurement of Displacement

Theory and construction of various transducers to measure displacement – Piezoelectric, inductive capacitance, resistance, ionization and Photo electric transducers Calibration procedures.

UNIT – II

Measurement Of Temperature

Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance Thermistor – Thermocouple – Pyrometers – Temperature indicators.

Measurement Of Pressure

Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

Measurement of Level

Direct method – indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators.

Flow Measurement

Rotameter, magnetic, ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement Of Speed

Mechanical Tachometers – Electrical tachometers – Stroboscope, Non – contact type of tachometer.

UNIT – IV

Measurement of Acceleration and Vibration

Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

Stress Strain Measurements

Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, strain gauge Rosettes.

UNIT – V

Measurement Of Humidity

Moisture content of gases, Sling psychrometer, Absorption psychrometer, Dew point meter.

Measurement Of Force, Torque And Power

Elastic force meters, load cells, Torsion meters, Dynamometers.

TEXT BOOKS

1. B.C.Nakra & K.K.Choudhary, "Instrumentation, measurement & analysis", Fourth Edition, TMH, 1999.
2. D.S Kumar, "Measurement Systems: Applications & Design", Sixth Edition, Metropolitan, 2002.
3. BeckWith, Marangoni, Linehard, "Mechanical Measurements", Sixth Edition, Pearson Publisher, 2006.

REFERENCE BOOKS

1. A.K. Sawhney, "Mechanical Measurement and Instrumentation", Third Edition, Dhanpat Rai, 2004.
2. Holman, "Experimental Methods for Engineers", Third Edition, McGraw-Hill, 2000.
3. A.K. Tayal, Akash Tayal, "Instrumentation & Mech. Measurements", Galgotia Publications Pvt Ltd, Second Edition, 1999.

IV YEAR B.Tech. MECH - I Sem

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3	1	0	3

ROBOTICS-(A17337)
(PROFESSIONAL ELECTIVE-III)

Course Objectives

- To acquire the knowledge on basics of robots those are used in industrial and service applications. To provide proficiency in kinematics and dynamics and calculate predictive paths.
- To emphasize the programming concepts and path planning to follow a particular path. Incorporate the knowledge about various actuators and sensors for specific applications.
- To be able to use the learned concept for design and analysis of robotic devices.
- To familiarize the current application of robots in manufacturing industry.

Course Outcomes

- To understand the basic concepts of robotics and know the components of industrial robots.
- To analyze the motion of robots with respect to position and orientation.
- To Model forward and inverse kinematics of robot manipulators.
- To Model differential kinematics of robot manipulators.
- To formulate dynamic analysis equations for robotic manipulators.
- To Plan the trajectory of robot. Know principles of different actuators and feedback components (sensors).
- To appreciate the industrial applications of robots.

UNIT – I
Introduction
Automation and Robotics – An overview of Robotics – classification by coordinate system and control systems – Components of the industrial Robotics: Degrees of freedom – End effectors; Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design.

UNIT – II
Motion Analysis
Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics

D-H notations – joint coordinates and world coordinates – Forward and inverse kinematics – problems.

UNIT – III

Differential Kinematics

Differential kinematics of planar and spherical manipulators – Jacobians – Problems.

UNIT – IV

Robot Dynamics

Lagrange – Euler formulations – Newton - Euler formulations – Problems on planar two link manipulators.

Trajectory Planning

Joint space scheme – cubic polynomial fit – Avoidance of obstacles – Types of motion: Slew motion – joint interpolated motion – straight line motion – problems.

UNIT – V

Robot Actuators and Industrial Applications

Actuators; Pneumatic and Hydraulic actuators, Electric Actuators: DC servo motors – stepper motors.

Feedback components

position sensors – potentiometers, resolvers and encoders – velocity sensors – Tactile sensors- Robot Application in Manufacturing: Material handling – Assembly inspection.

TEXT BOOKS:

1. Spong and Vidyasagar, Robot Dynamics and Control, John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, Robotics and control, Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, Industrial Robotics, Mcgraw-Hill Publishing Company Ltd. 2003

REFERENCES:

1. Asada and Siotine, Robot analysis and Intelligence, Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., IEEc.S.G., Robotics, Control Sensing Vision and Intelligence, McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, Robot Manipulators: Mathematics, Programming, and Control, MIT Press (MA)

IV YEAR B.Tech. MECH - I Sem

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3	1	0	3

MECHATRONICS-(A17338)
(PROFESSIONAL ELECTIVE-III)

Course Objectives

- To develop an ability to identify, formulate, and solve engineering problems.
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes

- To be able to model and analyze electrical and mechanical systems and their interconnection.
- To be able to integrate mechanical, electronics, control and computer engineering in the design of mechatronics systems.
- To be able to do the complete design, building, interfacing and actuation of a mechatronic system for a set of specifications. To Be proficient in the use of Lab VIEW software for data acquisition.
- To be proficient in the programming of microcontrollers.

UNIT – I

Introduction

Definition – Trends – Control Methods; Stand alone, PC Based (Real Time Operating Systems, Graphical User interface, simulation) – Applications; SPM, Robot, CNC, FMS, CIM.

Signal Conditioning

introduction – Hardware – Digital I/O, Analog input – ADC, resolution, speed channels filtering noise using passive components – Resistors, capacitors – Amplifying signals using OP amps – Software – Digital Signals Processing – Low pass, high pass, notch filtering.

UNIT – II

Precision Mechanical Systems

Pneumatic Actuation Systems – Electro – pneumatic Actuation Systems – Timing Belts – Ball Screw and Nut – Linear Motion Guides – Linear Bearing – Harmonic Transmission – Bearings – Motor / Drive selection.

UNIT – III

Electronic interface sub systems

TTL, CMOS interfacing – Sensor interfacing – Actuator

Interfacing – solenoids, motors isolation schemes – opto-coupling, buffer IC's- Protection schemes – circuit breakers, over current sensing, reset able fuses, thermal dissipation – Power Supply – Bipolar transistors / mosfets

Electromechanical Drives
Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4 quadrant servo drives, PWM's – Pulse width Modulation – Variable Frequency Drives, Vector Drives – Drive system load calculation.

UNIT – IV
Microcontrollers Overview
8051 Microcontroller, micro processor structure – Digital interfacing – Analog interfacing – Digital to analog convertors – Analog to Digital convertors – Applications, Programming – Assembly, C (LED Blinking, Voltage measurement using ADC)
Programmable Logic Controllers
Basic structure programming; Ladder diagram – Timers internal Relays and counters – Shift registers – Master and jump controls – Data handling – Analog input / output – PLC Selection – Application.

UNIT – V
Programmable Motion Controllers
introduction – system transfer function – Laplace transform and its application in analyzing differential equation of a control system – feedback devices; Position velocity sensors – optical incremental encoders – Proximity sensors; inductive, capacitive, infrared – continuous and discrete processes – control system performance & turning – digital controllers – P, PI, PID control – control modes – position, velocity and torque – velocity profiles – Trapezoidal – S.Curve – electronic gearing – controlled velocity profile – multi axis interpolation, PTP, Linear, Circular – Core functionalities – home, record position, Go to position – applications; SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, Third edition, 2005.
2. "Introduction to Mechatronics" / Appukuttan /Oxford-2007
3. "Designing intelligent machines", open university, London. Michel B.Histand and David G. Alciatore.

REFERENCES:

1. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers-2009.
2. Mechatronics System Design / Devdas shetty/Richard/Thomson-Cengage Learnig second edition
3. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill-First edition 2003.

IV YEAR B.Tech. MECH - I Sem

L	T	P	C
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COMPOSITE MATERIALS-(A17339)
(PROFESSIONAL ELECTIVE-III)

Course objectives

- The Objective of this course is to provide the student the concepts of composite materials.
- Application of composite materials, manufacturing processes for materials.
- Impart knowledge of selection and design of composite materials.
- Inculcate the selection of best methods to manufacture.
- To know about process optimization of composite materials

Course Outcomes

- To Use the Knowledge of composite materials for component design .
- To Select the most appropriate manufacturing process for fabrication.
- To Design criteria and which processes are likely to be used. Testing of composites.

UNIT-I

Introduction to Composite Materials

Introduction, classification, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon-carbon composites, fiber, reinforced composites and nature-made composites and applications.

Reinforcements

Fibers Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide, fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosets , Metal matrix and ceramic composites.

UNIT – II

Manufacturing methods

Autoclave, tape production, moulding methods, filament winding, hand lay-up, pultrusion, RTM.

Macromechanical Analysis of a " Lamina"

Introduction, Definitions: stress, strain, Elastic Moduli, strain Energy. Hooke's Law for different types of materials, Hooks Law for a two dimensional unidirectional lamina, plane stress assumption, reduction of Hooks Law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of a lamina.

UNIT – III

Hooke's Law for a Two-Dimensional Angle Lamina, Engineering constants of an Angle Lamina. Invariant Form of Stiffness and compliance Matrices for an Angle Lamina Strength Failure. Envelops, Maximum Strain Failure Theory, Tsai-Hill Failure Theory, Tsai-Wu Failure Theory Comparison of Experimental Results with Failure Theories.

Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress-Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress-Strain Relationships for a Angle Lamina.

UNIT – IV

Micro Mechanical Analysis of a Lamina

Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion .

UNIT- V

Macro Mechanical Analysis of Laminates

Introduction, Laminate Code, Stress- Strain Relations for a Laminate, In-Plane and Flexural Moduls of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates.

Failure Analysis and Design of Laminates: Introduction Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

TEXT BOOKS:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
2. R. M. Jones Mechanics of Composite Materials, McGraw Hill Company, New York, 1975.
3. B. D. Agarwal and L.J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.

REFERENCES:

1. 3.L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.
2. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2009.
3. Krishan K. Chawla, Composite Materials Science and Engineering, Springer, 2009, Ed. 6. Robert M. Jones, Mechanics of Composite Materials, 1999, Ed. 2.

IV YEAR B.Tech. MECH - I Sem

L	T	P	C
3	1	0	3

CNC TECHNOLOGIES-(A17340)
(PROFESSIONAL ELECTIVE-IV)

Course Objectives

- To understand the concepts of numerical control machines and their advantages over conventional machines.
- To appreciate the method of operating the NC machines by NC Part Programming's.
- To understand the direct numerical control systems in the application of machine tools.
- To access of extent of usage of PLC's in the NC machines for their effectiveness.

Course Outcomes

- The ability to develop the numerical control machines and operating with various part programming usage of PLC's in the overall improvement of CNC technologies.

UNIT – I

Features of NC Machines

Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, features of NC machine tools, design consideration of NC machine tool, methods of improving accuracy.

CNC Machines and elements

Machine structure – guide ways – feed drives – spindles – spindle bearings – measuring systems – tool monitoring systems.

UNIT – II

Tooling for CNC machines

interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

NC Part Programming

Manual programming – Basic concepts, point to point contour programming, canned cycles, parametric programming.

UNIT – III

Computer Aided Programming

General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors, introduction to CAD/CAM software, Automatic Tool Path generation.

DNC Systems and Adaptive Control

Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control of optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

UNIT – IV

Micro controllers

Introduction, Hardware components, I/O pins, ports external memory, counters, timers and serial data I/O interrupts, selection of micro controllers, embedded controllers, Applications and programming of micro controllers.

UNIT – V

Programming logic controllers (PLC's)

Introduction, hardware components of PLC, system, basic structure, principle of operations, Programming mnemonics timers, internal relays and counters applications of PLC's in CNC Machines.

TEXT BOOKS

1. Computer control of manufacturing systems / Yoram koren / Mc Graw Hill intl. 1983.
2. CAD/CAM – Michel P.Groover, TMH Third edition 2012.
3. Foley, Van Dam, Feiner and Hughes, "Computer Graphics Principles and Practice", Third edition, Addison – Wesley, 2000.

REFERENCES

1. Machining tools hand book Vol-3, (Automation & control) Manfred Weck / John Wiley and sons, 1984.
2. E. Micheal, "Geometric Modelling", John Wiley & Sons, 1995.
3. Hill Jr, F.S., "Computer Graphics using open GL", Pearson Education, 2003.

IV YEAR B.Tech. MECH - I Sem

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POWER PLANT ENGINEERING-(A17341)
(PROFESSIONAL ELECTIVE-IV)

Course Objectives

- To get the knowledge about different types of power plants and its working procedure with the complete plant layout.
- To identify & apply fundamentals to solve problems like performance of internal combustion engine plant and gas turbine power plant. To design the components of steam power plant, gas turbine power plant, I.C plant, and hydroelectric power plant.
- To design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, and safety manufacturability and sustainability related to different types of power plants.

Course Outcomes

- To understand the layout of steam power plant and know different handling systems.
- To appreciate the working principles of various components responsible for combustion.
- To understand the layout of diesel power plant with detailed emphasis on its auxiliaries.
- To know the working of hydro electric power plants and characteristics of hydrographs.
- To know the advantages, disadvantages & applications of nuclear power plants.
- To Analyze and estimate different power plant economic factors and environmental considerations.

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, Electrostatic precipitators, cooling towers and heat rejection, corrosion and feed water treatment. Binary Cycles and co-generation systems

Steam Power Plant

Plant layout, working of different circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, and Ash handling systems

UNIT – II

Diesel Power Plant

Introduction – IC Engines, types, construction – Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

Gas Turbine Plant

Introduction – classification – construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines, Combined cycle Power plants –Different types—Gas & Steam and other combinations - Comparison.

UNIT III

Hydro Electric Power Plant

Water power – Hydrological cycle – Hydrographs – storage and Pondage – Numerical examples of construction of Hydrograph, Load duration curves -classification of dams and spill ways.

Hydro Projects and Plant

Classification – Typical layouts – Turbines and Generator-Types-plant auxiliaries – plant operation pumped storage plants.

UNIT – IV

Nuclear Power Plant

Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types of Reactors

Pressurized Water Reactor (PWR), Boiling water reactor(BWR), sodium-graphite reactor, Fast Breeder Reactor(FBR), Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

Power from Non-Conventional Sources

Utilization of solar – Collectors – Principle of working, Wind energy – Types – HAWT, VAWT – Tidal energy.

UNIT – V

Direct energy conversion

solar energy, Fuel cells, Thermo electric and thermo ionic, MHD generation.

Power Plant Economics and Environmental Considerations

Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve, Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related numerical exercises, Effluents from power plants and impact on environment – pollutants and pollution standards – Methods of Power plant Pollution control.

TEXT BOOKS:

1. P.K.Nag, "Power Plant Engineering", Fourth Edition, TMH, 2014.
2. P.C.Sharma, "Power Plant Engineering", S.K.Kataria Publications, 2013.
3. Arora and S.Domkundwar, "A Course in Power Plant Engineering", Dhanpat Rai, 2001.

REFERENCES:

1. K.K. Ramalingam, “Power plant Engineering”, Scitech Publications, 2010.
2. G.D. Rai, “An introduction to Power Plant Technology”, Khanna Publishers, 1995.
3. C. Elanchezhian, L. Sravanakumar & B. Vijaya Ramnath, “Power plant Engineering”, First Edition, I.K international Publications, 2010.

IV YEAR B.Tech. MECH - I Sem

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(PROFESSIONAL ELECTIVE-IV)

Course Objectives:

- Giving the importance of and describing the diversity of application areas of computer graphics and exploring basic features of graphics hardware components and software packages.
- Giving introduction about output primitives (point, line, circle etc) and describing fundamental algorithms to display 2-D shapes. To illustrate methods for filling of an object with colours. Demonstrate 2-D and 3-D geometric transformations with their respective transformation matrices and exploring the composite transformations.
- Demonstrate 2-D and 3-D viewing system by exploring various algorithms. Explore the need of visible surface area detection by examining the various algorithms.
- Illustrating different methods for detection of visible surface areas.
- Giving importance and need of animation in different fields, exploring the animation techniques.

Course Outcomes:

- To Reproduce the fact that display line and curve having finite width and can adjust the pixel dimensions of objects.
- Generate realistic display by identifying visible surfaces, without eliminating the hidden surfaces.
- Able to change the orientation size and shape which are accomplished with geometric transformation. Able to identify the wider usage of computer graphics as well as can grab the knowledge of input output devices which can be used in graphics workstations.
- Able to displays different types curves and surface in 2D and 3D and also able represent the surfaces.
- Able to fill the surface with color. (Transportation) Student can map 2D and 3D world coordinate to a display devices and can able to manipulate any 2D and 3D object by means of procedures to delete and magnify the selected area.
- Able to create 2D and 3D viewing coordinates. Generation of animation scene with flash players can be applied.

UNIT -I

Introduction

Application area of Computer graphics, overview of graphic system, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices.

Output primitives

Points and lines, line drawing algorithms, mid-point circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood-fill algorithm.

UNIT - II

2-D geometrical transformations

Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates.

2-D viewing

The viewing pipe-line, viewing coordinat4 reference frame, window to view-port co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland Hodgman polygon clipping algorithm

UNIT – III

3-D object representation

Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curve, Bezier and B-spline surfaces, Basic illumination models, shading algorithms.

3-D geometric transformations

Translation, rotation, scaling, reflection and shear transformation and composite transformations.

UNIT – IV

Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting.

UNIT - V

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation language, key frame system, motion specification.

TEXT BOOKS:

1. Computer Graphics C version Donald Hearn and M. Pauline Baker, Pearson/PHI,Second edition.
2. Computer Graphics Principles & practice, in C, Foley, VanDam, Feiner and Hughes, Pearson Education, Third edition.
3. Ibrahim Zeid, "CAD/CAM, Theory and Practice", McGraw Hill, 1998.

REFERENCES:

1. Computer Graphics, Zhigand xiang, Roy Plastock, Schaum's outlines, Tata McGraw hill Second edition.
2. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, Second edition.
3. Principles of Interactive Computer Graphics, Newman and Sproul, TMH, Second edition.

IV YEAR B.Tech. MECH - I Sem

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COMPUTER AIDED DESIGN AND MANUFACTURING LAB-(A17389)

Course objectives

- To Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings.
- To Model complex shapes including freeform curves and surfaces.
- To Implement CNC programs for milling and turning machining operations.
- To Create a computer aided manufacturing (CAM) model and generate the machining codes automatically using the CAM system.

Course Outcomes

- To Design 2D drawings using solid edge software
- To Develop 3D cad models as per given dimensions
- To Assemble of sub components in their working positions.
- To Perform Finite Element Analysis and obtain results to any given problem.
- To Prepare CNC programs and simulate the manufacturing process

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric, Representation of dimensioning and tolerances scanning and plotting, study of script DXE and IGES FILES.

2. **Part Modeling**: Generation of various 3D Models through protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and assembly modeling, study of various standard translators, Design simple components.
3. (a) Determination of deflection and stresses in 2D and 3D trusses and beams.
   (b) Determination of deflections component and principal and von-mises stresses in plane stress, plane strain and Axisymmetric components.
   (c) Determination of stresses in 3D and shell structures (at least one example in each case)
   (d) Estimation of natural frequencies and mode shapes, harmonic response of 2D beam.
   (e) Steady state heat transfer analysis of plane and Axisymmetric components.

4. (a) Development of process sheets for various components based on tooling Machines.
   (b) Development of manufacturing and tool management systems.
   (c) Study of various post processors used in NC Machines.
   (d) Determination of CNC part program for turning components and milling components.

   Software Packages to be used: SOLIDWORKS, ANSYS,CAM Software

IV YEAR B.Tech. MECH - I Sem

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PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB-(A17390)

A) Production Drawing Practice

Course Objectives:

- To provide knowledge on the fundamentals of measurement science and measuring instruments.
- To provide a knowledge on the basics of control system theory.
- To learn to use standard practices and standard data.

Course Outcomes:

- Represent limits, fits, tolerances, surface roughness, heat and surface treatment symbols.
- Generate detailed and part drawings from assembly drawings.
- Calibrate pressure, flow, strain and displacement measuring instruments.
- Use magnetic and speed pickups for speed measurement.
- Calibrate different instruments used for temperature measurement

PRACTICE – I
Conventional representation of materials – conventional representation of parts – screw joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

PRACTICE – II
Limits and Fits: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

PRACTICE – III
Form and Positional Tolerances: introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

PRACTICE – IV
Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

PRACTICE – V
Heat treatment and surface treatment symbol used on drawings.

PRACTICE – VI
Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, from and position errors etc.

TEXT BOOKS:

1. Production drawing – K.L.Narayana & P.Kannaiah / New Age-2010
2. Machine Drawing with AutoCAD – Pohit and Ghosh,PE/ Pearson/First edition-2004

REFERENCE BOOKS:

1. Geometric dimensioning and tolerancing – James D.Meadows / Tylor&Francis First edition-1995.
2. R.L. Murthy, Precision Engineering in Manufacturing, New Age International Private Ltd., 1996

(B) INSTRUMENTATION LAB

1. Calibration of pressure gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for strain measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

TEXT BOOKS:

1. W.Bolton "Instrumentation and Control Systems", 1st Edition Elsevier, 2004
2. B.C.Nakra & K.K.Choudhary, "Instrumentation, measurement & analysis", Fourth Edition, TMH, 1999.

REFERENCE BOOKS:

1. A.K. Sawhney, "Mechanical Measurement and Instrumentation", Third Edition, Dhanpat Rai, 2004.
2. A.K. Tayal, Akash Tayal, "Instrumentation & Mech. Measurements", Galgotia Publications Pvt Ltd, Second Edition, 1999.

IV YEAR B.Tech. MECH - II Sem

L	T	P	C
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PRODUCTION PLANNING AND CONTROL-(A18345)

Course objectives:

- To ensure safe and economical production process.
- To effectively utilize plant to maximize productivity.
- To maximize efficiency by proper coordination in production process.
- To ensure proper delivery of goods.
- To place the right man for the right job, at right time for right wages.
- To minimize labor turnover.
- To reduce the waiting time

Course outcomes:

- To Describe and determine the effect of product, process, inventory costs, product forecasting, and operations strategies.
- To Apply and analyze forecasting models to develop business enterprise forecasts for products.
- To Develop and analyze production and inventory planning/control systems, and scheduling techniques by using engineering techniques for a complete production facility.
- To Perform and analyze methods of evaluating operations location alternatives.
- To Develop and analyze the capacity planning process.
- To Design, develop, and analyze a Master Production Schedule.

UNIT-I
Introduction

Definitions — objectives of production planning and control- functions of production planning and control-elements of production control- types of production- organization of production planning and control — internal organizations department

UNIT-II
Forecasting

Importance of forecasting — types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III
Inventory management

Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model — Inventory control systems — P- Systems and Q — Systems Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

UNIT- IV

Routing

Definition — routing procedure- Route sheets — Bill of material- factors affecting routing procedure. Schedule — definition — difference with loading. Scheduling polices — techniques, standard scheduling methods- job shop, flow shop,. Line balancing, aggregate planning- methods for aggregate planning- Chase planning, expediting, control aspects.

UNIT-V

Dispatching: Activities of dispatcher- Dispatching procedure – follow up — definition — reasons for existence of functions — types of follow up, applications of computer in production planning and control

TEXT BOOKS

1. Production Planning and Control: M.Mahajan/ Dhanpati ral & Co.Third edition-2006
2. Production Planning and Control&Industrial Management:K.C Jain,L.N.Agarwal-Khanna publications-Eighth edition -1999
3. Production Planning and Control- Text & cases-SK Mukhopadhyaya/PHI- Second edition-2007.

REFERENCE BOOKS

1. Production and operations Management R.Panneer Selvam/PHI-Third edition-2012.
2. Operations management(Theory and Practice)/Dipak- Orient Blackswan - 2012
3. Operations Managemen US.N. Chary ITMH Third edition-2006.

IV YEAR B.Tech. MECH - II Sem

L	T	P	C
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PLANT LAYOUT AND MATERIAL HANDLING-(A18346)

Course Objectives

To understand the concepts of locating the machines in the industry with a view to reduce overall material handling of the product in process. It analyses various material handling equipment for their cost effectiveness.

Course Outcomes

Various types of layouts and their designs both conventionally and computerized are understood. Material handling equipment to suit various types of layouts are compared for their cost effective handling.

UNIT-I

Introduction to plant layout

Classification of Layout, Advantages and Limitations of different layouts, Layout design procedures, Overview of the plant layout. Process layout & Product layout: Selection, specification, Implementation and follow up, comparison of product and process layout.

UNIT-II

Heuristics for Plant layout

ALDEP, CORELAP, CRAFT, Group Layout, Fixed position layout- Quadratic assignment model. Branch and bound method

UNIT-III

Introduction to Material Handling

Material Handling systems, Material Handling principles, Classification of Material Handling Equipment, Relationship of material handling to plant layout.

UNIT-IV

Basic Material Handling systems

Selection, Material Handling method- path, Equipment, function oriented systems.

UNIT-V

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments, Safety in handling Ergonomics of Material Handling equipment. Design, Miscellaneous equipments.

TEXT BOOKS

1. Operations Management: PB Mahapatra/PHI-2010.
2. Plant Layout and Materials Handling/James M. Apple/ John Wiley & Sons; Third Edition-1978
3. Aspects of Material handling: Dr. KC Arora & Shinde/ Lakshmi Publications-2007.

REFERENCES

1. Facility Layout & Location an analytical approach: RL Francis, LF Mc Linnis Jr, White- PHI Second edition-1991.
2. Introduction to Material handling: Ray, Siddhartha- New Age First Edition - 2007.
3. Plant Layout and Material Handling: RB Chowdary- Khanna Publishers Second Edition-1986.

IV YEAR B.Tech. MECH - II Sem

L	T	P	C
3	1	0	3

UNCONVENTIONAL MACHINING PROCESSES-(A18347)

Course Objectives

- To identify the classification of modern machine processes.
- To understand the mechanism of Abrasive jet machining, Water jet machining, electro chemical machining, Grinding, honing and deburring processes.
- To understand the electro chemical and Thermal metal removal process.
- To understand the applications of plasma process for machine processes.

Course Outcomes

- To understand the need, importance and classification of various unconventional machining processes. Gain a thorough understanding of ultrasonic machining.
- To appreciate basic principles and process parameters of water jet, abrasive jet machining and electro-chemical machining processes.
- To appreciate thermal energy based machining processes with emphasis on surface finish and accuracy.
- To understand electron beam machining and laser beam machining along with applications.
- To know the advanced unconventional processes like plasma machining, chemical machining, magnetic abrasive finishing and abrasive flow finishing.

UNIT – I

Introduction

Need for non-traditional machining methods – classification of modern machining processes – considerations in process selection materials applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT – II

Abrasive jet machining, water jet machining and abrasive water jet machine: Basic principles, equipments process variables, mechanics of metal removal, MRR, application and limitations. Magnetic abrasive finishing, Abrasive flow finishing, electro stream drilling, shaped tube electrolytic machining.

UNIT – III

Electro – chemical Processes

Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate.

Fundamentals of chemical machining
Principle – maskants – etchants, advantages and applications.

UNIT – IV

Thermal Metal Removal Processes
General Principle and applications of Electric Discharge Machining, Electric discharge grinding and electric discharge wire cutting processes – Power circuits for EDM, mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection, wire EDM, principle applications.

UNIT – V

Electron Beam Machining
Generation and control electron beam for machining theory of electron beam machining, comparison of thermal and non-thermal processes. General principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

Plasma Arc Machining
Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

Powder Metallurgy Technology
Concepts of PM Technology, Production process & Applications.

TEXT BOOKS

1. Manufacturing engineering and Technology, serope kalpakjian and steven R. Schmid, pearson publications, Seventh edition 2013.
2. Unconventional Machining Processes / C. Elanchezhian, B.vijaya Ramnath and M. vijayan/ Anuradha publications / 2005.

REFERENCES

1. Modern machining process / Pandey P.C and shah H.S / TMH-2017.
2. New Technology / Bhattacharya A / The institution of engineers, india, 1984.

L	T	P	C
3	1	0	3

OPTIMIZATION TECHNIQUES-(A17343)
(Open Elective-III)

Course Objectives

- To familiarize with the quantitative tools and techniques, which are frequently applied to business decision-making of real systems.
- To analyze which scientific approach is chosen in timely management decisions for the purpose of improving its performance.
- To develop problem modeling and solving skills and learn how to make intelligent business decisions by optimizing the resources.
- To provide a formal quantitative approaches in problem solving and acquire substantial experience in taking corrective measures.

Course Outcomes

- To Model the real life situations with mathematical models.
- To Understand the concept of linear programming.
- To Solve transportation and assignment problems.
- To Formulate the sequencing of jobs on machines.
- To Understand the various replacement concepts.
- To Identify and apply various inventory models.
- To Apply queuing and dynamic programming models.

UNIT – I
Introduction
Development – Definition – Characteristics and phases – Types of operation Research models – applications. Allocation:
Linear Programming Method
Problem formulation – Graphical solution – Simplex method – Artificial variables Techniques – Two – phase method, Big-M method – Duality principle.

UNIT – II
Transportation Problem
Formulation – Optimal solution – unbalanced transportation problem – Degeneracy, Assignment problem – Formulation – Optimal solution – Variants of Assignment Problem – Travelling salesman problem.

UNIT – III
Theory of Games
Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – dominance principle – m X 2 & 2 X n games – graphical method.

Waiting Lines

Introduction – Single Channel – Poisson arrivals exponential service times – with infinite population and finite population models – Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT – IV

SEQUENCING

Introduction – Flow – Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

Replacement

Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

Inventory

Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – instantaneous production, instantaneous demand and continuous demand and no set up cost – Single period model.

UNIT – V

Dynamic Programming

Introduction – Terminology – Bellman's Principle of optimality – Applications of dynamic programming – shortest path problem – linear programming problem.

Simulation

Definition – Types of simulation models – phases of simulation – applications of simulation – inventory and Queuing problems – Advantages and Disadvantages – Brief introduction of simulation languages.

TEXT BOOKS:

1. "OperationsResearch" S.D.Sharma, , Kedarnath,Ramnath & Co., Meerut,2009
2. "Operations Research" / J.K . Sharma 5e / MacMilan Fifth edition-2012
3. "Operations Research" / R.Pannerselvam 2e, PHI Publications Second edition-2006

REFERENCE BOOKS:

1. "Operations Research" / A.M. Natarajan, P.Balasubramani, A.Tamilarasi / Pearson Education-2012.
2. "Operations Research: Methods & Problems" / Maurice Saseini, Arhur Yaspan & Lawrence Friedman/ Literary Licensing- 2013.
3. "Operations Research-An Introduction", Hamdy, A. Taha, Eighth Edition, Prentice Hall of India Pvt. Ltd., 1997

L	T	P	C
3	1	0	3

MAINTENANCE AND SAFETY ENGINEERING-(A17344)
(OPEN ELECTIVE-III)

Course Objectives

- To understand the need for maintenance and safety in industry and organizations by following the scientific principles.
- To Condition monitoring, preventive maintenance and breakdown maintenance issues are analyzed in order to improve the overall availability of the infrastructure by considering the reliability concepts.

Course Outcomes

- Maintenance concepts in the light of the overall utilization and availability of the machines in the industry are analyzed.
- Reliability and the breakdown phenomena of each equipment studied such that preventive maintenance can be scheduled.

UNIT – I
Introduction

Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance strategy for the 21^{st} Century Engineering Maintenance Objectives and Maintenance in Equipment Life cycle, Terms and Definitions.

Maintenance Management and Control

Maintenance Manual Maintenance, Facility Evaluation Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control indices.

UNIT – II
Types of Maintenance

Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program, PM Program Evaluation and improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

UNIT – III
Inventory Control in Maintenance

Inventory Control Objectives and Basic inventory Decisions, ABC inventory Control Models Two – Bin inventory Control and Safety Stock, spares Determination Factors spares calculation methods.

UNIT – IV

Quality and Safety in Maintenance

Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

Maintenance Costing

Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

UNIT – V

Reliability, Reliability Centered Maintenance, RCM

Goals and Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement indicators, RCM Benefits and Reasons for its Failures, Reliability Versus Maintenance and Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

Maintainability

Maintainability importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS

1. Reliability, Maintenance and Safety Engineering by Dr. A.K Guptha / Laxmi Publications-First edition -2015.
2. Industrial Safety Management by L.M.Deshmukh / TMH-2008

REFERENCES

1. Maintenance Engineering & Management by R.C.Mishra / PHI-Second edition-2012
2. Engineering Maintenance a modern approach, B.S.Dhallon, C.R.R Publishers 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD.

B. TECH. MECHANICAL ENGINEERING

I YEAR

Code	Subject	L	T/P/D	C
A10001	English	2	-	4
A10002	Mathematics – I	3	1	6
A10302	Engineering Mechanics	3	-	6
A10004	Engineering Physics	3	-	6
A10005	Engineering Chemistry	3	-	6
A10501	Computer Programming	3	-	6
A10301	Engineering Drawing	2	3	6
A10581	Computer Programming Lab.	-	3	4
A10081	Engineering Physics & Engineering Chemistry Lab.	-	3	4
A10083	English Language Communication Skills Lab.	-	3	4
A10082	IT Workshop / Engineering Workshop	-	3	4
	Total	**19**	**16**	**56**

II YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A30009	Environmental Studies	4	-	4
A30008	Probability and Statistics	4	-	4
A30203	Electrical and Electronics Engineering	4	-	4
A30104	Mechanics of Solids	4	-	4
A30306	Thermodynamics	4	-	4
A31803	Metallurgy and Materials Science	4	-	4
A30281	Electrical and Electronics Engineering Lab	-	3	2
A30085	Metallurgy & Mechanics of Solids Lab	-	3	2
	Total	**24**	**6**	**28**

II YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A40312	Production Technology	4	-	4
A40309	Kinematics of Machinery	4	-	4
A40313	Thermal Engineering -I	4	-	4
A40112	Mechanics of Fluids and Hydraulic Machines	4	-	4
A40310	Machine Drawing	-	6	4
A40006	Mathematics–II	4	-	4
A40382	Production Technology Lab	-	3	2
A40188	Mechanics of Fluids & Hydraulic Machines Lab	-	3	2
	Total	**20**	**12**	**28**

III YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A50010	Managerial Economics and Financial Analysis	4	-	4
A50318	Engineering Metrology	4	-	4
A50317	Dynamics of Machinery	4	-	4
A50321	Machine Tools	4	-	4
A50316	Design of Machine Members – I	4	-	4
A50326	Thermal Engineering -II	4	-	4
A50384	Machine Tools & Metrology Lab	-	3	2
A50383	Thermal Engineering Lab	-	3	2
	Total	**24**	**6**	**28**

III YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A62405	Automobile Engineering	4	-	4
A60330	Finite Element Methods	4	-	4
A60334	Refrigeration and Air Conditioning	4	-	4
A60329	Design of Machine Members – II	4	-	4
A60331	Heat Transfer	4	-	4
 A60117 A60017 A60018	**Open Elective** Disaster Management Intellectual Property Rights Human Values and Professional Ethics	4	-	4
A60387	Heat Transfer Lab	-	3	2
A60086	Advanced Communication Skills Lab	-	3	2
	Total	**24**	**6**	**28**

IV YEAR I SEMESTER

Code	Subject	L	T/P/D	C
A70352	Operations Research	4	-	4
A70353	Power Plant Engineering	4	-	4
A70328	CAD/CAM	4	-	4
A70343	Instrumentation and Control Systems	4	-	4
	ELECTIVE – I	4	-	4
A70355	Robotics			
A70346	Mechanical Vibrations			
A70348	Mechatronics			
A70347	Mechanics of Composite Materials			
A70332	Industrial Management			
	ELECTIVE – II	4	-	4
A70359	Unconventional Machining Processes			
A70337	CNC Technology			
A70336	Automation in Manufacturing			
A70339	Design for Manufacturing			
A72909	Nanotechnology			
A70390	Computer Aided Design & Manufacturing Lab	-	3	2
A70391	Production Drawing Practice and Instrumentation Lab	-	3	2
	Total	**24**	**6**	**28**

IV YEAR II SEMESTER

Code	Subject	L	T/P/D	C
A80366	Production Planning and Control	4	-	4
	ELECTIVE – III	4	-	4
A80527	Artificial Neural Networks			
A80367	Total Quality Management			
A80363	Maintenance and Safety Engineering			
A80365	Plant Layout & Material Handling			
	ELECTIVE – IV	4	-	4
A80324	Renewable Energy Sources			
A80362	Jet Propulsion & Rocket Engineering			
A80338	Computational Fluid Dynamics			
A80361	Gas Dynamics			
A80087	Industry Oriented Mini Project	-	-	2
A80089	Seminar	-	6	2
A80088	Project Work	-	15	10
A80090	Comprehensive Viva	-	-	2
	Total	**12**	**21**	**28**

Note: All End Examinations (Theory and Practical) are of three hours duration.

T-Tutorial L – Theory P – Practical D-Drawing C – Credits

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I Year B.Tech. ME	**L**	**T/P/D**	**C**
	2	**-/-/-**	**4**

(A10001) ENGLISH

Introduction:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read it on their own the topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.

Objectives:

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.
- To develop the study skills and communication skills in formal and informal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening so that they

can comprehend the speech of people of different backgrounds and regions.

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: **Skills Annexe -Functional English for Success)**
- Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Scanning
- Recognizing coherence/sequencing of sentences

NOTE : The students will be trained in reading skills using the prescribed text for detailed study.

They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/ newspaper articles.

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill.
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED:

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into Five Units, are prescribed:

For Detailed study: First Textbook: “Skills Annexe -Functional English for Success”, Published by Orient Black Swan, Hyderabad

For Non-detailed study

1. **Second text book “Epitome of Wisdom”,** Published by Maruthi Publications, Guntur
   - The course content and study material is divided into Five Units.

Unit –I:

1. Chapter entitled **'Wit and Humour**' from **'Skills Annexe'** -Functional English for Success, Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'Mokshagundam Visvesvaraya'** from **“Epitome of Wisdom**”, Published by Maruthi Publications, Hyderabad.

L- Listening For Sounds, Stress and Intonation

S- Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)

R- Reading for Subject/ Theme

W- Writing Paragraphs

G- Types of Nouns and Pronouns

V- Homonyms, homophones synonyms, antonyms

Unit –II

1. Chapter entitled **“Cyber Age”** from **“Skills Annexe -Functional English for Success”** Published by Orient Black Swan, Hyderabad.
2. Chapter entitled **'Three Days To See'** from **“Epitome of Wisdom”**, Published by Maruthi Publications, Hyderabad.

L – Listening for themes and facts

S – Apologizing, interrupting, requesting and making polite conversation

R- for theme and gist

W- Describing people, places, objects, events

G- Verb forms

V- noun, verb, adjective and adverb

Unit –III

1. Chapter entitled **'Risk Management'** from **“Skills Annexe -Functional English for Success”** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'Leela's Friend'** by R.K. Narayan from **“Epitome of Wisdom”**, Published by Maruthi Publications, Hyderabad

L – for main points and sub-points for note taking

S – giving instructions and directions; Speaking of hypothetical situations

R – reading for details

W – note-making, information transfer, punctuation

G – present tense

V – synonyms and antonyms

Unit –IV

1. Chapter entitled **'Human Values and Professional Ethics'** from **“Skills Annexe -Functional English for Success”** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'The Last Leaf'** from **“Epitome of Wisdom”**, Published by Maruthi Publications, Hyderabad

L - Listening for specific details and information

S- narrating, expressing opinions and telephone interactions

R - Reading for specific details and information

W- Writing formal letters and CVs

G- Past and future tenses

V- Vocabulary - idioms and Phrasal verbs

Unit –V

1. Chapter entitled **'Sports and Health'** from **"Skills Annexe - Functional English for Success"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'The Convocation Speech'** by N.R. Narayanmurthy' from **"Epitome of Wisdom"**, Published by Maruthi Publications, Hyderabad

L- Critical Listening and Listening for speaker's tone/ attitude

S- Group discussion and Making presentations

R- Critical reading, reading for reference

W- Project proposals; Technical reports, Project Reports and Research Papers

G- Adjectives, prepositions and concord

V- Collocations and Technical vocabulary

Using words appropriately

* Exercises from the texts not prescribed shall also be used for classroom tasks.

REFERENCES :

1. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi. 2010.
2. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
3. English Grammar Practice, Raj N Bakshi, Orient Longman.
4. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
5. Effective English, edited by E Suresh Kumar, A RamaKrishna Rao, P Sreehari, Published by Pearson
6. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
7. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
8. Technical Communication, Meenakshi Raman, Oxford University Press
9. Objective English Edgar Thorpe & Showick Thorpe, Pearson Education
10. Grammar Games, Renuvolcuri Mario, Cambridge University Press.

11. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw – Hill.
16. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO
17. A Communicative Grammar of English, Geoffrey Leech, Jan Svartvik, Pearson Education
18. Enrich your English, Thakur K B P Sinha, Vijay Nicole Imprints Pvt Ltd.,
19. A Grammar Book for You And I, C. Edward Good, MacMillan Publishers

Outcomes:

- Usage of English Language, written and spoken.
- Enrichment of comprehension and fluency.
- Gaining confidence in using language in verbal situations.

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	3	**1/-/-**	**6**

(A10002) MATHEMATICS -I

Objectives: To learn

- The types of Matrices and their properties.
- Concept of rank of a matrix and applying the concept of rank to know the consistency of linear equations and to find all possible solutions, if exist.
- The concept of eigenvalues and eigenvectors of a matrix is to reduce a quadratic form into a canonical form through a linear transformation.
- The mean value theorems and to understand the concepts geometrically.
- The functions of several variables and optimization of these functions.
- The evaluation of improper integrals, Beta and Gamma functions.
- Multiple integration and its applications.
- Methods of solving the differential equations of 1st and higher order
- The applications of the differential equations to Newton's law of cooling, Natural growth and decay, Bending of beams etc.
- The definition of integral transforms and Laplace Transform.
- Properties of Laplace transform.
- Inverse Laplace Transform.
- Convolution theorem.
- Solution of Differential equations using Laplace transform.

UNIT-I

Theory of Matrices: Real matrices – Symmetric, skew – symmetric, orthogonal. Complex matrices: Hermitian, Skew-Hermitian and Unitary Matrices. Idempotent matrix, Elementary row and column transformations- Elementary matrix, Finding rank of a matrix by reducing to Echelon and normal forms. Finding the inverse of a non-singular square matrix using row/ column transformations (Gauss- Jordan method). Consistency of system of linear equations (homogeneous and non- homogeneous) using the rank of a matrix. Solving m x n and n x n linear system of equations by Gauss elimination.

Cayley-Hamilton Theorem (without proof) – Verification. Finding inverse of a matrix and powers of a matrix by Cayley-Hamilton theorem, Linear dependence and Independence of Vectors. Linear Transformation – Orthogonal Transformation. Eigen values and eigen vectors of a matrix.

Properties of eigen values and eigen vectors of real and complex matrices. Finding linearly independent eigen vectors of a matrix when the eigen values of the matrix are repeated.

Diagonalization of matrix – Quadratic forms up to three variables. Rank – Positive definite, negative definite, semi definite, index, signature of quadratic forms. Reduction of a quadratic form to canonical form.

UNIT – II

Differential calculus methods: Rolle's Mean value Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – (all theorems without proof but with geometrical interpretations), verification of the Theorems and testing the applicability of these theorem to the given function.

Functions of several variables: Functional dependence- Jacobian- Maxima and Minima of functions of two variables without constraints and with constraints-Method of Lagrange multipliers.

UNIT – III

Improper integration, Multiple integration & applications: Gamma and Beta Functions –Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.

Multiple integrals – double and triple integrals – change of order of integration-change of variables (polar, cylindrical and spherical) Finding the area of a region using double integration and volume of a region using triple integration.

UNIT – IV

Differential equations and applications : Overview of differential equations-exact, linear and Bernoulli (NOT TO BE EXAMINED). Applications of first order differential equations – Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories.

Linear differential equations of second and higher order with constant coefficients, Non-homogeneous term of the type $f(X) = e^{ax}$, Sin ax, Cos ax, and x^n, $e^{ax}V(x)$, $x^n V(x)$, method of variation of parameters. Applications to bending of beams, Electrical circuits and simple harmonic motion.

UNIT – V

Laplace transform and its applications to Ordinary differential equations Definition of Integral transform, Domain of the function and Kernel for the Laplace transforms. Existence of Laplace transform. Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions when they are multiplied or divided by “t”. Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem – Dirac’s delta function, Periodic function – Inverse Laplace transform by Partial fractions(Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by ”s”, Inverse Laplace Transforms of derivatives and integrals of functions, Convolution theorem –- Solving ordinary differential equations by Laplace transforms.

TEXT BOOKS:

1. Advanced engineering Mathematics by Kreyszig, John Wiley & Sons Publishers.
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, 3rd edition, Narosa Publishing House, Delhi.
2. Engineering Mathematics – I by T.K. V. Iyengar, B. Krishna Gandhi & Others, S. Chand.
3. Engineering Mathematics – I by D. S. Chandrasekhar, Prison Books Pvt. Ltd.
4. Engineering Mathematics – I by G. Shanker Rao & Others I.K. International Publications.
5. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, CRC Press Taylor & Francis Group.
6. Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edi, 2013, Chapman & Hall/ CRC.
7. Advanced Engineering Mathematics, Michael Greenberg, Second Edition, Pearson Education.

Outcome:

- After learning the contents of this Unit the student is able to write the matrix representation of a set of linear equations and to analyze solutions of system of equations.
- The student will be able to understand the methods of differential calculus to optimize single and multivariable functions.
- The student is able to evaluate the multiple integrals and can apply the concepts to find the Areas, Volumes, Moment of Inertia etc., of regions on a plane or in space.
- The student is able to identify the type of differential equation and uses the right method to solve the differential equation. Also able to apply the theory of differential equations to the real world problems.
- The student is able to solve certain differential equations using Laplace Transform. Also able to transform functions on time domain to frequency domain using Laplace transforms.

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	3	**-/-/-**	**6**

(A10302) ENGINEERING MECHANICS

UNIT – I

Introduction to Engineering Mechanics – Basic Concepts. **Resultants of Force System:** Parallelogram law **–**Forces and components- Resultant of coplanar Concurrent Forces – Components of forces in Space – Moment of Force - principle of moments – Coplanar Applications – Couples - Resultant of any Force System.

Equilibrium of Force Systems : Free Body Diagrams, Equations of Equilibrium - Equilibrium of planar Systems - Equilibrium of Spatial Systems.

UNIT – II

Friction: Introduction **–** Theory of Friction – Angle of friction - Laws of Friction – Static and Dynamic Frictions – Motion of Bodies: Wedge, Screw, Screw-jack, and Differential Screw-jack.

Transmission of Power: Flat Belt Drives - Types of Flat Belt Drives – Length of Belt, tensions, Tight side, Slack Side, Initial and Centrifugal – Power Transmitted and Condition for Max. Power.

UNIT – III

Centroids and Centers of Gravity: Introduction – Centroids and Centre of gravity of simple figures (from basic principles) – Centroids of Composite Figures - Theorem of Pappus – Center of gravity of bodies and centroids of volumes.

Moments of Inertia : Definition – Polar Moment of Inertia –Radius of gyration - Transfer formula for moment of inertia - Moments of Inertia for Composite areas - Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia : Moment of Inertia of Masses- Transfer Formula for Mass Moments of Inertia - mass moment of inertia of composite bodies.

UNIT – IV

Kinematics of a Particle: Motion of a particle – Rectilinear motion – motion curves – Rectangular components of curvilinear motion– Kinematics of Rigid Body - Types of rigid body motion -Angular motion - Fixed Axis Rotation

Kinetics of particles: Translation -Analysis as a Particle and Analysis as a Rigid Body in Translation – Equations of plane motion - Angular motion - Fixed Axis Rotation – Rolling Bodies.

UNIT – V

Work - Energy Method: Work energy Equations for Translation - Work-

Energy Applications to Particle Motion – Work energy applied to Connected Systems - Work energy applied to Fixed Axis Rotation and Plane Motion. Impulse and momentum.

Mechanical Vibrations : Definitions and Concepts – Simple Harmonic Motion – Free vibrations, simple and Compound Pendulums – Torsion Pendulum – Free vibrations without damping: General cases.

TEXT BOOKS:

1. Engineering Mechanics - Statics and Dynamics by Ferdinand.L. Singer / Harper International Edition.
2. Engineering Mechanics/ S. Timoshenko and D.H. Young, Mc Graw Hill Book Compan.

REFERENCES:

1. Engineering Mechanics / Irving Shames / Prentice Hall
2. A text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain, Academic Publishing Company
3. Engg. Mechanics / M.V. Seshagiri Rao & D Rama Durgaiah/ Universities Press
4. Engineering Mechanics, Umesh Regl / Tayal.
5. Engg. Mechanics / KL Kumar / Tata McGraw Hill.
6. Engg. Mechanics / S.S. Bhavikati & K.G. Rajasekharappa.

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(A10004) ENGINEERING PHYSICS

Objectives:

It gives

- to the students basic understanding of bonding in solids, crystal structures and techniques to characterize crystals.
- to understand the behavior of electron in a solid and thereby one can determine the conductivity and specific heat values of the solids.
- to study applications in Engineering like memory devices, transformer core and Electromagnetic machinery.
- to help the student to design powerful light sources for various Engineering Applications and also enable them to develop communication systems using Fiber Technology.
- to understand the working of Electronic devices, how to design acoustic proof halls and understand the behavior of the materials at Nano scale.

UNIT-I

Crystallography: Ionic Bond, Covalent Bond, Metallic Bond, Hydrogen Bond, Vander-Waal's Bond, Calculation of Cohesive Energy of diatomic molecule- Space Lattice**,** Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Structure of Diamond and NaCl.

X-ray Diffraction & Defects in Crystals: Bragg's Law, X-Ray diffraction methods: Laue Method, Powder Method**:** Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects, line defects (Qualitative) & Burger's Vector.

UNIT-II

Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis , Matter Waves, Davisson and Germer' Experiment, Heisenberg's Uncertainty Principle, Schrödinger's Time Independent Wave Equation - Physical Significance of the Wave Function – Infinite square well potential, extension to three dimensions

Elements of Statistical Mechanics & Electron theory of Solids: Phase space, Ensembles, Micro Canonical , Canonical and Grand Canonical Ensembles **-** Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics (Qualitative Treatment), Concept of Electron Gas, , Density of States, Fermi

Energy- Electron in a periodic Potential, Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), E-K curve, Origin of Energy Band Formation in Solids, Concept of Effective Mass of an Electron, Classification of Materials into Conductors, Semi Conductors & Insulators.

UNIT-III

Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities: Ionic and Electronic - Internal Fields in Solids, Clausius - Mossotti Equation, Piezo - electricity and Ferro- electricity.

Magnetic Properties & Superconducting Properties: Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials and their Applications, Superconductivity, Meissner Effect, Effect of Magnetic field, Type-I & Type-II Superconductors, Applications of Superconductors.

UNIT-IV

Optics: Interference-Interference in thin films (Reflected light), Newton rings experiment- Fraunhofer diffraction due to single slit, N-slits, Diffraction grating experiment , Double refraction-construction and working, Nicol's Prism.

Lasers & Fiber Optics: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Einstein's Coefficients and Relation between them, Population Inversion, Lasing Action, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers- Principle of Optical Fiber, Construction of fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers: Step Index and Graded Index Fibers, Attenuation in Optical Fibers, Application of Optical Fiber in communication systems.

UNIT-V:

Semiconductor Physics: Fermi Level in Intrinsic and Extrinsic Semiconductors, Calculation of carrier concentration in Intrinsic &, Extrinsic Semiconductors, Direct and Indirect Band gap semiconductors, Hall Effect- Formation of PN Junction, Open Circuit PN Junction, Energy Diagram of PN Diode, Diode Equation, I-V Characteristics of PN Junction diode, Solar cell, LED & Photo Diodes. **Acoustics of Buildings & Acoustic Quieting:** Reverberation and Time of Reverberation, Sabine's Formula for Reverberation Time, Measurement of Absorption Coefficient of a Material, factors affecting the Architectural Acoustics and their Remedies

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume

Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Top-down Fabrication: Chemical Vapour Deposition, Characterization by TEM.

TEXT BOOKS:

1. Engineering Physics,K. Malik, A. K. Singh, Tata Mc Graw Hill Book Publishers.
2. Engineering Physics, V. Rajendran, Tata Mc Graw Hill Book Publishers.

REFERENCES:

1. Fundamentals of Physics, David Halliday, Robert Resnick, Jearl Walker by John Wiley & Sons.
2. Sears and Zemansky's University Physics (10th Edition) by Hugh D. Young Roger A. Freedman, T. R. Sandin, A. Lewis FordAddison-Wesley Publishers.
3. Applied Physics for Engineers – P. Madhusudana Rao (Academic Publishing company, 2013).
4. Solid State Physics – M. Armugam (Anuradha Publications).
5. Modern Physics – R. Murugeshan & K. Siva Prasath – S. Chand & Co. (for Statistical Mechanics).
6. A Text Book of Engg Physics – M. N. Avadhanulu & P. G. Khsirsagar– S. Chand & Co. (for acoustics).
7. Modern Physics by K. Vijaya Kumar, S. Chandralingam: S. Chand & Co.Ltd.
8. Nanotechnology – M.Ratner & D. Ratner (Pearson Ed.).
9. Introduction to Solid State Physics – C. Kittel (Wiley Eastern).
10. Solid State Physics – A.J. Dekker (Macmillan).
11. Applied Physics – Mani Naidu Pearson Education.

Outcomes:

- The student would be able to learn the fundamental concepts on behavior of crystalline solids.
- The knowledge on Fundamentals of Quantum Mechanics, Statistical Mechanics enables the student to apply to various systems like Communications Solar Cells, Photo Cells and so on.
- Design, Characterization and study of properties of materials help the student to prepare new materials for various Engineering applications.
- This course also helps the student exposed to non-destructive testing methods.
- Finally, Engineering Physics Course helps the student to develop problem solving skills and analytical skills.

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(A10005) ENGINEERING CHEMISTRY

Objective:

An engineer is as someone who uses scientific, natural and physical principles to design something of use for people or other living creatures. Much of what any engineer does involves chemistry because everything in our environment has a molecular make up. Engineering requires the concepts of applied chemistry and the more chemistry an engineer understands, the more beneficial it is. In the future, global problems and issues will require an in-depth understanding of chemistry to have a global solution. This syllabus aims at bridging the concepts and theory of chemistry with examples from fields of practical application, thus reinforcing the connection between science and engineering. It deals with the basic principles of various branches of chemistry which are fundamental tools necessary for an accomplished engineer.

UNIT I:

Electrochemistry & Corrosion: Electro Chemistry – Conductance - Specific, Equivalent and Molar conductance and their Units; Applications of Conductance (Conductometric titrations). **EMF:** Galvanic Cells, types of Electrodes – (Calomel, Quinhydrone and glass electrodes); Nernst equation and its applications ; concept of concentration cells, electro chemical series, Potentiometric titrations, determination of P^H using glass electrode-Numerical problems.

Batteries: Primary cells (dry cells) and secondary cells (lead-Acid cell, Ni-Cd cell, Lithium cells). Applications of batteries. **Fuel cells** – Hydrogen – Oxygen fuel cell; methanol – oxygen fuel cell ; Advantages and Applications.

Corrosion and its control: Causes and effects of corrosion; Theories of corrosion – Chemical & Electrochemical corrosion; Types of corrosion (Galvanic, Water line, Pitting and Intergranular); Factors affecting rate of corrosion – Nature of metal and Nature of Environment – Corrosion control methods – Cathodic protection (sacrificial anodic and impressed current). Surface coatings: Metallic coatings & methods of application of metallic coatings - hot dipping (galvanization & tinning), Cementation, cladding, electroplating (copper plating) Electroless plating (Ni plating) - Organic coatings – Paints - constituents and their functions.

UNIT II:

Engineering Materials: Polymers: Types of Polymerization (Chain & Step growth).**Plastics:** Thermoplastic & Thermo setting resins; Compounding &

fabrication of plastics (Compression and injection moulding).Preparation, properties, engineering applications of PVC, Teflon and Bakelite.

Fibers- Charcterstics of fibers – preparation, properties and uses of Nylon – 6,6 and Dacron – Fiber Reinforced Plastics (FRP) – applications. **Rubbers** – Natural rubber and its vulcanization. Elastomers – Buna-s, Butyl rubber and Thiokol rubber.

Conducting polymers: Polyacetylene, Polyaniline, Mechanism of Conduction, doping; applications of Conducting polymers. **Bio-degradable Polymers**- preparation and Applications of Poly vinyl acetate and Poly lactic acid - **Cement:** composition of Portland cement, setting & hardening of cement (reactions), **Lubricants:** Classification with examples- Characterstics of a good lubricant & mechanism of lubrication (thick film, thin film and extreme pressure) – properties of lubricants: viscosity, Cloud point, flash and fire points. **Refractories:** Classification, characteristics of a good refractory and applications.

Nanomaterials: Introduction, preparation by sol-gel & chemical vapour deposition methods. Applications of nanomaterials.

UNIT III:

Water and its Treatment: Hardness of Water: Causes of hardness, expression of hardness – units – types of hardness, estimation of temporary & permanent hardness of water by EDTA method - numerical problems. Boiler troubles – Scale & sludges, Priming and foaming, caustic enbrittlement and boiler corrosion; Treatment of boiler feed water – Internal treatment (Phosphate, Colloidal and calgon conditioning) – External treatment – Lime Soda process, Zeolite process and ion exchange process. Numerical Problems. **Potable Water**- Its Specifications – Steps involved in treatment of potable water – Disinfection of water by chlorination and ozonisation. Reverse osmosis & its significance.

Unit – IV :

Fuels & Combustion: Fuels – Classification – soild fuels : coal – analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining – cracking – types – fixed bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol, Bergius and Fischer-Tropsch's process: Gaseous fuels - constituents, characteristics and applications of natural gas, LPG and CNG. Analysis of flue gas by Orsat's apparatus – Numerical Problems.

Combustion – Definition, Calorific value of fuel – HCV , LCV; Determination of calorific value by Junker's gas calorimeter – theoretical calculation of Calorific value by Dulong's formula – Numerical problems on combustion.

UNIT V:

Phase Rule & Surface Chemistry : **Phase Rule:** Definition of terms: Phase, component, degree of freedom, phase rule equation. Phase diagrams – one component system- water system. Two component system Lead- Silver, cooling curves, heat treatment based on iron-carbon phase diagram - hardening, annealing and normalization.

Surface Chemistry: **Adsorption –** Types of Adsorption, Isotherms – Freundlich and Langmuir adsorption isotherm, applications of adsorption; **Colloids**: Classification of Colloids; Electrical & optical properties, micelles, applications of colloids in industry.

TEXT BOOKS:

1. Engineering Chemistry by R.P. Mani,K.N. Mishra, B. Rama Devi / CENGAGE learning.
2. Engineering Chemistry by P.C Jain & Monica Jain, Dhanpatrai Publishing Company (2008).

REFERENCE BOOKS

1. Engineering Chemistry by B. Siva Shankar Mc.Graw Hill Publishing Company Limited, New Delhi (2006).
2. Engineering Chemistry J.C. Kuriacase & J. Rajaram, Tata McGraw Hills Publishing Company Limited, New Delhi (2004).
3. Text Book of Engineering Chemistry by S.S. Dara & Mukkati S. Chand & Co Publishers, New Delhi (2006).
4. Chemistry of Engineering Materials by CV Agarwal,C.P Murthy, A.Naidu, BS Publications.

Outcome:

- Students will demonstrate a depth of knowledge and apply the methods of inquiry in a discipline of their choosing, and they will demonstrate a breadth of knowledge across their choice of varied disciplines.
- Students will demonstrate the ability to access and interpret information, respond and adapt to changing situations, make complex decisions, solve problems, and evaluate actions.
- Students will demonstrate awareness and understanding of the skills necessary to live and work in a diverse engineering world.

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(A10501) COMPUTER PROGRAMMING

Objectives:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs.
- To learn to write programs (using structured programming approach) in C to solve problems.
- To introduce the students to basic data structures such as lists, stacks and queues.
- To make the student understand simple sorting and searching methods.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Program Development.

Introduction to the C Language – Background, C Programs, Identifiers, Types, Variables, Constants, Input / Output, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements- Selection Statements (making decisions) – if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, goto, Simple C Program examples.

UNIT - II

Functions-Designing Structured Programs, Functions, user defined functions, inter function communication, Standard functions, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Limitations of recursion, example C programs, Preprocessor commands.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C program examples.

UNIT - III

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications-Arrays and Pointers, Pointer Arithmetic and arrays, Passing an array to a function, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions.

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

UNIT - IV

Enumerated, Structure, and Union Types– The Type Definition (typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, Complex structures, structures and functions, Passing structures through pointers, self referential structures, unions, bit fields, C programming examples, command –line arguments.

Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling),Positioning functions, C program examples.

UNIT – V

Searching and Sorting – Sorting- selection sort, bubble sort, Searching-linear and binary search methods.

Lists- Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Push and Pop Operations, Queues- Enqueue and Dequeue operations.

TEXT BOOKS:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.

REFERENCE BOOKS:

1. C& Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C for All, S. Thamarai Selvi, R.Murugesan, Anuradha Publications.
3. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, 7th Edition, Pearson education.
4. Programming in C, Ajay Mittal, Pearson.
5. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
6. Problem solving with C, M.T.Somasekhara, PHI
7. Programming with C, R.S.Bickar, Universities Press.
8. Computer Programming & Data Structures, E.Balagurusamy, 4th edition, TMH.
9. Programming in C – Stephen G. Kochan, III Edition, Pearson

Education.

10. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI.

11. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press.

Outcomes:

- Demonstrate the basic knowledge of computer hardware and software.
- Ability to apply solving and logical skills to programming in C language and also in other languages.

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(A10301) ENGINEERING DRAWING

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Drawing/ Graphics – Various Drawing Instruments – Conventions in Drawing – **Lettering practice** – BIS Conventions.

Curves: Constructions of Curves used in Engineering Practice:

a) Conic Sections including the Rectangular Hyperbola – General method only.

b) Cycloid, Epicycloid and Hypocycloid

c) Involute.

Scales: Construction of different types of Scales, Plain, Diagonal, Vernier scale.

UNIT – II

Orthographic Projections in First Angle

Projection: Principles of Orthographic Projections – Conventions – First and Third Angle projections.

Projections of Points : including Points in all four quadrants.

Projections of Lines : Parallel, perpendicular, inclined to one plane and inclined to both planes. True length and true angle of a line. Traces of a line.

Projections of Planes: Plane parallel, perpendicular and inclined to one reference plane. Plane inclined to both the reference planes.

UNIT – III

Projections of Solids: Projections of regular solids, cube, prisms, pyramids, tetrahedran, cylinder and cone, axis inclined to both planes.

Sections and Sectional Views: Right Regular Solids – Prism, Cylinder, Pyramid, Cone – use of Auxiliary views.

UNIT – IV

Development of Surfaces: Development of Surfaces of Right, Regular Solids – Prisms, Cylinder, Pyramids, Cone and their parts. frustum of solids.

Intersection of Solids:- Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT – V

Isometric Projections : Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Plane Figures, Simple and Compound

Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of parts with Spherical surface.

Transformation of Projections : Conversion of Isometric Views to Orthographic Views. Conversion of orthographic views to isometric views – simple objects.

Perspective Projections : Perspective View : Points, Lines and Plane Figures, Vanishing Point Methods (General Method only).

TEXT BOOKS

1. Engineering Drawing – Basant, Agrawal, TMH
2. Engineering Drawing, N.D. Bhatt

REFERENCES :

1. Engineering Graphics. P I Varghese Tata McGraw Hill Education Pvt. Ltd.
2. Engineering drawing – P.J. Shah .S.Chand Publishers.
3. Engineering Drawing- Johle/Tata Macgraw Hill Book Publishers.
4. Engineering Drawing – M.B. Shah and B.C. Rana, Pearson.
5 . Engineering Drawing by K.Venu Gopal & V.Prabu Raja New Age Publications.
6. Engineering Drawing by John. PHI Learning Publisher.

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(A10581) COMPUTER PROGRAMMING LAB

Objectives:

- To write programs in C to solve the problems.
- To implement linear data structures such as lists, stacks, queues.
- To implement simple searching and sorting methods.

Recommended Systems/Software Requirements:

- Intel based desktop PC
- ANSI C Compiler with Supporting Editors

Week I

a) Write a C program to find the sum of individual digits of a positive integer.

b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2

a) Write a C program to calculate the following Sum:

$Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$

b) Write a C program to find the roots of a quadratic equation.

Week 3

a) The total distance travelled by vehicle in 't' seconds is given by distance s = $ut+1/2at^2$ where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 4

a) Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

Week 5

a) Write a C program to find the largest integer in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices

ii) Multiplication of Two Matrices

Week 6

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not

Week 7

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 8

a) Write a C program to generate Pascal's triangle.

b) Write a C program to construct a pyramid of numbers.

Week 9

Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:

$1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$

For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Print x, n, the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal? If so, test for them too.

Week 10

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

b) Write a C program to convert a Roman numeral to its decimal equivalent.

Week 11

Write a C program that uses functions to perform the following operations:

i) Reading a complex number

ii) Writing a complex number

iii) Addition of two complex numbers

iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 12

a) Write a C program which copies one file to another.

b) Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

Week 13

a) Write a C program to display the contents of a file.

b) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Week 14

a) Write a C program that uses non recursive function to search for a Key value in a given list of integers using Linear search.

b) Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using Binary search.

Week 15

a) Write a C program that implements the Selection sort method to sort a given array of integers in ascending order.

b) Write a C program that implements the Bubble sort method to sort a given list of names in ascending order.

Week 16

Write a C program that uses functions to perform the following operations:

i) Create a singly linked list of integer elements.

ii) Traverse the above list and display the elements.

Week 17

Write a C program that implements stack (its operations) using a singly linked list to display a given list of integers in reverse order. Ex. input: 10 23 4 6 output: 6 4 23 10

Week 18

Write a C program that implements Queue (its operations) using a singly linked list to display a given list of integers in the same order. Ex. input: 10

23 4 6 output: 10 23 4 6

Week 19

Write a C program to implement the linear regression algorithm.

Week 20

Write a C program to implement the polynomial regression algorithm.

Week 21

Write a C program to implement the Lagrange interpolation.

Week 22

Write C program to implement the Newton- Gregory forward interpolation.

Week 23

Write a C program to implement Trapezoidal method.

Week 24

Write a C program to implement Simpson method.

TEXT BOOKS:

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications.
2. Computer Programming in C, V. Rajaraman, PHI Publishers.
3. C Programming, E.Balagurusamy, 3rd edition, TMH Publishers.
4. C Programming, M.V.S.S.N.Prasad, ACME Learning Pvt. Ltd.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand Publishers.
6. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.

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(A10081) ENGINEERING PHYSICS / ENGINEERING CHEMISTRY LAB

ENGINEERING PHYSICS LAB

(Any TEN experiments compulsory)

Objectives

This course on Physics lab is designed with 13 experiments in an academic year. It is common to all branches of Engineering in B.Tech Ist year.

The objective of the course is that the student will have exposure to various experimental skills which is very essential for an Engineering student.

The experiments are selected from various areas of Physics like Physical Optics, Lasers, Fiber Optics, Sound, Mechanics, Electricity & Magnetism and Basic Electronics.

Also the student is exposed to various tools like Screw gauge, Vernier Callipers, Physics Balance , Spectrometer and Microscope.

1. Dispersive power of the material of a prism – Spectrometer
2. Determination of wavelength of a source – Diffraction Grating.
3. Newton's Rings - Radius of curvature of plano convex lens.
4. Melde's experiment – Transverse and longitudinal modes.
5. Time constant of an R-C circuit.
6. L-C-R circuit.
7. Magnetic field along the axis of current carrying coil – Stewart and Gees method.
8. Study the characteristics of LED and LASER sources.
9. Bending losses of fibres & Evaluation of numerical aperture of a given fibre.
10. Energy gap of a material of p-n junction.
11. Torsional pendulum.
12. Wavelength of light –diffraction grating - using laser.
13. Characteristics of a solar cell

LABORATORY MANUAL:

1. Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers)

Outcomes

The student is expected to learn from this laboratory course the concept of error and its analysis. It also allows the student to develop experimental skills to design new experiments in Engineering.

With the exposure to these experiments the student can compare the theory and correlate with experiment.

ENGINEERING CHEMISTRY LAB

List of Experiments (Any 12 of the following)

Titrimetry:

1. Estimation of ferrous iron by dichrometry.
2. Estimation of hardness of water by EDTA method.

Mineral analysis:

3. Determination of percentage of copper in brass.
4. Estimation of manganese dioxide in pyrolusite.

Instrumental Methods:

Colorimetry:

5. Determination of ferrous iron in cement by colorimetric method
6. Estimation of copper by colorimetric method.

Conductometry:

7. Conductometric titration of strong acid vs strong base.
8. Conductometric titration of mixture of acids vs strong base.

Potentiometry:

9. Titration of strong acid vs strong base by potentiometry.
10. Titration of weak acid vs strong base by potentiometry.

Physical properties:

11. Determination of viscosity of sample oil by redwood / oswald's viscometer.
12. Determination of Surface tension of lubricants.

Preparations:

13. Preparation of Aspirin
14. Preparation of Thiokol rubber

Adsorption:

15. Adsorption of acetic acid on charcoal.

TEXT BOOKS:

1. Practical Engineering Chemistry by K. Mukkanti, etal, B.S. Publications, Hyderabad.
2. Inorganic quantitative analysis, Vogel.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R. N. Goyal and Harrmendra Goel, Ane Books Private Ltd.,
2. A text book on experiments and calculation Engg. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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(A10083) ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
- To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

The following course content is prescribed for the **English Language Communication Skills Lab**

Exercise – I

CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants

ICS Lab: Ice-Breaking activity and JAM session

Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise – II

CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.

ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing Others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette.

Concord (Subject in agreement with verb) and Words often misspelt-confused/misused

Exercise - III

CALL Lab: Minimal Pairs- Word accent and Stress Shifts- Listening Comprehension.

ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.

Sequence of Tenses, Question Tags and One word substitutes.

Exercise – IV

CALL Lab: Intonation and Common errors in Pronunciation.

ICS Lab: Extempore- Public Speaking

Active and Passive Voice, –Common Errors in English, Idioms and Phrases

Exercise – V

CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice

ICS Lab: Information Transfer- Oral Presentation Skills

Reading Comprehension and Job Application with Resume preparation.

Minimum Requirement of infra structural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

   The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor

   a) Speed – 2.8 GHZ

   b) RAM – 512 MB Minimum

   c) Hard Disk – 80 GB

ii) Headphones of High quality

2. Interactive Communication Skills (ICS) Lab :

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Suresh Kumar, E. & Sreehari, P. 2009. *A Handbook for English Language Laboratories.* New Delhi: Foundation
2. *Speaking English Effectively* 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
3. Sasi Kumar, V & Dhamija, P.V. *How to Prepare for Group Discussion and Interviews.* Tata McGraw Hill
4. Hancock, M. 2009. *English Pronunciation in Use. Intermediate.* Cambridge: CUP
5. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.
6. Hewings, M. 2009. *English Pronunciation in Use. Advanced.* Cambridge: CUP
7. Marks, J. 2009. *English Pronunciation in Use. Elementary.* Cambridge: CUP
8. Nambiar, K.C. 2011. *Speaking Accurately. A Course in International Communication.* New Delhi : Foundation
9. Soundararaj, Francis. 2012. *Basics of Communication in English. New Delhi: Macmillan*
10. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
11. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
12. **A textbook of English Phonetics for Indian Students** by T. Balasubramanian (Macmillan)
13. **Prescribed Lab Manual:** A Manual entitled "***English Language Communication Skills (ELCS) Lab Manual- cum- Work Book***", published by Cengage Learning India Pvt. Ltd, New Delhi. 2013

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Examination:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

Outcomes:

- Better Understanding of nuances of language through audio- visual experience and group activities.
- Neutralization of accent for intelligibility.
- Speaking with clarity and confidence thereby enhancing employability skills of the students.

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(A10082) IT WORKSHOP / ENGINEERING WORKSHOP

Objectives:

The IT Workshop for engineers is a training lab course spread over 54 hours. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel and Power Point.

PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. **The students should work on working PC to disassemble and assemble to working condition and install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.**

Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks would be introduced.

Productivity tools module would enable the students in crafting professional word documents, excel spread sheets and power point presentations using the Microsoft suite of office tools and LaTeX. (**Recommended to use Microsoft office 2007 in place of MS Office 2003)**

PC Hardware

Week 1 – Task 1 : Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Week 2 – Task 2 : Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Week 3 – Task 3 : Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Week 4 – Task 4 : Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Week 5 – Task 5: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

Week 6 – Task 6 : Software Troubleshooting : Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Internet & World Wide Web

Week 7 - Task 1 : **Orientation & Connectivity Boot Camp :** Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Week 8 - Task 2 : Web Browsers, Surfing the Web : Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Week 9 - Task 3 : **Search Engines & Netiquette :** Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Week 10 - Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install antivirus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

Week 11- Task 5: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list.

Productivity tools

LaTeX and Word

Week 12 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of LaTeX and MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the three tasks and features that would be covered in each, using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

Task 1 : Using LaTeX and Word to create project certificate. Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Week 13 - Task 2: Creating project abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Week 14 - Task 3 : Creating a Newsletter : Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel

Week 15 - Excel Orientation: The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the two tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

Week 16 - Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP, Sorting, Conditional formatting

LaTeX and MS/equivalent (FOSS) tool Power Point

Week 17 - Task1: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and Power point. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

Week 18- Task 2: Second week helps students in making their presentations interactive. Topic covered during this week includes: Hyperlinks, Inserting – Images, Clip Art, Audio, Video, Objects, Tables and Charts

Week 19 - Task 3: Concentrating on the in and out of Microsoft power point and presentations in LaTeX. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides.

REFERENCE BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. LaTeX Companion – Leslie Lamport, PHI/Pearson.
3. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill Publishers.
4. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
5. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
7. PC Hardware and A+Handbook – Kate J. Chase PHI (Microsoft)

Outcomes:

- Apply knowledge for computer assembling and software installation.
- Ability how to solve the trouble shooting problems.
- Apply the tools for preparation of PPT, Documentation and budget sheet etc.

ENGINEERING WORKSHOP

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. Welding
8. Power tools in construction, wood working, electrical engineering and mechanical Engineering.

2. TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Machine Shop
3. Metal Cutting (Water Plasma)

TEXT BOOK:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition.

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(A30009) ENVIRONMENTAL STUDIES

Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations

UNIT-I :

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II:

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III:

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV:

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT-V:

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

SUGGESTED TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B.Botkin & Edward A.Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn helps in sustainable development.

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(A30008) PROBABILITY AND STATISTICS

Objectives: To learn

- Understand a random variable that describes randomness or an uncertainty in certain realistic situation. It can be of either discrete or continuous type.
- In the discrete case, study of the binomial and the Poisson random variables and the Normal random variable for the continuous case predominantly describe important probability distributions. Important statistical properties for these random variables provide very good insight and are essential for industrial applications.
- Most of the random situations are described as functions of many single random variables. In this unit, the objective is to learn functions of many random variables through joint distributions.
- The types of sampling, Sampling distribution of means ,Sampling distribution of variance,Estimations of statistical parameters, Testing of hypothesis of few unknown statistical parameters.
- The mechanism of queuing system ,The characteristics of queue,The mean arrival and service rates
- The expected queue length, The waiting line
- The random processes, The classification of random processes, Markov chain, Classification of states
- Stochastic matrix (transition probability matrix),Limiting probabilities, Applications of Markov chains

UNIT-I

Single Random variables and probability distributions: Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution . Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.

Binomial, Poisson & normal distributions and their properties. Moment generating functions of the above three distributions, and hence finding the mean and variance.

UNIT-II

Multiple Random variables, Correlation & Regression: Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions, Covariance of two random variables, Correlation - Coefficient of correlation, The rank correlation.

Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

UNIT-III

Sampling Distributions and Testing of Hypothesis

Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and varience, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of varience.

Parameter estimations – likelihood estimate, interval estimations.

Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, two sided test,

Large sample tests:

(i) Test of Equality of means of two samples equality of sample mean and population mean (cases of known varience & unknown varience, equal and unequal variances)

(ii) Tests of significance of difference between sample S.D and population S.D.

(iii) Tests of significance difference between sample proportion and population proportion&difference between two sample proportions.

Small sample tests:

Student t-distribution,its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples

Snedecor's F- distribution and it's properties. Test of equality of two population variences

Chi-square distribution , it's properties, Chi-square test of goodness of fit

UNIT-IV

Queuing Theory: Structure of a queuing system, Operating Characteristics of queuing system, Transient and steady states, Terminology of Queuing systems, Arrival and service processes- Pure Birth-Death process Deterministic queuing models- M/M/1 Model of infinite queue, M/M/1 model of finite queue .

UNIT-V

Stochastic processes: Introduction to Stochastic Processes –Classification of Random processes, Methods of description of random processes, Stationary and non-stationary random process, Average values of single random process and two or more random processes. Markov process, Markov chain, classification of states – Examples of Markov Chains, Stochastic Matrix.

TEXT BOOKS:

1) Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

2) Probability and Statistics for Engineers and Scientists by Sheldon M.Ross, Academic Press.

3) Operations Research by S.D. Sarma.

REFERENCE BOOKS:

1. Mathematics for Engineers by K.B.Datta and M.A S.Srinivas,Cengage Publications.
2. Probability and Statistics by T.K.V.Iyengar & B.Krishna Gandhi Et.
3. Fundamentals of Mathematical Statistics by S C Gupta and V.K.Kapoor.
4. Probability and Statistics for Engineers and Scientists by Jay l.Devore.

Outcomes:

- Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variable involved in the probability models. It is quite useful for all branches of engineering.
- The student would be able to calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations .It is Mainly useful for non-circuit branches of engineering.
- The students would be able to find the expected queue length, the ideal time, the traffic intensity and the waiting time. These are very useful tools in many engineering and data management problems in the industry. It is useful for all branches of engineering.
- The student would able to understand about the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems. The student would be able to find the limiting probabilities and the probabilities in n^{th} state. It is quite useful for all branches of engineering.

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(A30203) ELECTRICAL AND ELECTRONICS ENGINEERING

Objective:

This course introduces the concepts of electrical DC and AC circuits, basic law's of electricity, instruments to measure the electrical quantities, different methods to solve the electrical networks, construction operational features of energy conversion devices i.e. DC and AC machines, transformers. It also emphasis on basics of electronics, semiconductor devices and their characteristics and operational features.

UNIT-I:

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations.

Instruments: Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT-II:

DC Machines: Principle of operation of DC Generator – EMF equation - types – DC motor types –torque equation – applications – three point starter.

UNIT-III:

Transformers: Principle of operation of single phase transformers –EMF equation – losses – efficiency and regulation.

AC Machines: Principle of operation of alternators – regulation by synchronous impedance method –Principle of operation of induction motor – slip – torque characteristics – applications.

UNIT–IV:

Diodes: P-n junction diode, symbol, V-I Characteristics, Diode Applications, and Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems).

Transistors: PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

UNIT-V:

Cathode Ray Oscillos Scope: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

Outcome:

After going through this course the student gets a thorough knowledge on basic electrical circuits, parameters, and operation of the transformers in the energy conversion process, electromechanical energy conversion, construction operation characteristics of DC and AC machines and the constructional features and operation of measuring instruments like voltmeter, ammeter, wattmeter etc...and different semiconductor devices, their voltage-current characteristics, operation of diodes, transistors, realization of various electronic circuits with the various semiconductor devices, and cathode ray oscilloscope, With which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

EEE: TEXT BOOKS:

1. Basic concepts of Electrical Engineering, PS Subramanyam, BS Publications.
2. Basic Electrical Engineering, S.N. Singh, PHI.

EEE: REFERENCE BOOKS:

1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudipta nath, Chandrakumar Chanda, Tata-McGraw-Hill.
2. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications.
3. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.
4. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
5. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

ECE: TEXT BOOKS:

1. Electronic Devices and Circuits, S.Salivahanan, N.Suresh Kumar, A.Vallavaraj,Tata McGraw-Hill companies..
2. Electronic Devices and Circuits, K. Lal Kishore,BS Publications.

ECE: REFERENCE BOOKS:

1. Millman's Electronic Devices and Circuits,J. Millman, C.C.Halkias, and Satyabrata Jit, Tata McGraw-Hill companies.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky,PEI/PHI.
3. Introduction to Electronic Devices and Circuits, Rober T. Paynter,PE.
4. Integrated Electronics, J. Millman and Christos C. Halkias, Tata McGraw-Hill companies.
5. Electronic Devices and Circuits, Anil K. Maini, Varsha Agarwal,Wiley India Pvt. Ltd.

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(A30104) MECHANICS OF SOLIDS

UNIT – I

Simple Stresses & Strains : Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – compositebars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force and Bending Moment : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

Flexural Stresses : Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V

Torsion of Circular Shafts : Theory of pure torsion – Derivation of Torsion equations : $T/J = q/r = N\theta/L$– Assumptions made in the theory of pure torsion

– Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Thin Cylinders : Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

TEXT BOOKS :

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov.
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH.

REFERENCES :

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S.S.Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechancis by M.L.Gambhir, PHI Learning Pvt. Ltd
7. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

	L	T/P/D	C
II Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A30306) THERMODYNAMICS

UNIT – I

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale- Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

UNIT II

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics

UNIT – III

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes. Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables- Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT IV

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - V

Thermodynamic Cycles : Power cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Refrigeration Cycles: Bell-Coleman cycle- Vapour compression cycle-performance Evaluation.

TEXT BOOKS :

1. Engineering Thermodynamics / PK Nag /TMH, 5th Edition.
2. Engineering Thermodynamics/E Rathakrishnan/PHI/Second Edition/ 2013.

REFERENCE BOOKS:

1. Engineering Thermodynamics/DP Mishra/ Cengage Learning/Second impression 2012.
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH.
3. Thermodynamics – J.P.Holman / McGrawHill.
4. Engineering Thermodynamics – Jones & Dugan.
5. Engineering Thermodynamics/P.Chattopadhyay/Oxford Higher Education/Revised First Edition.
6. Thermodynamics & Heat Engines – Yadav – Central Book Depot, Allahabad.

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II Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A31803)METALLURGY AND MATERIALS SCIENCE

UNIT – I

Structure of Metals: Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods.

Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

UNIT –II

Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT –III

Engineering Materials –I STEELS: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe_3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels, Hardenability. Alloy steels.

UNIT –IV

Engineering Materials –II: CAST IRONS: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.

Engineering Materials-III: Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – V

Engineering Materials –IV: Ceramics, Polymers and Composites: Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties and applications of composites. Classification, Properties and applications of Polymers.

TEXT BOOKS:

1. Material Science and Metallurgy/ Kodgire
2. Essentials of Materials Science and engineering / Donald R.Askeland / Thomson.

REFERENCES:

1. Introduction to Physical Metallurgy / Sidney H. Avner.
2. Materials Science and engineering / William and callister.
3. Elements of Material science / V. Rahghavan
4. Engineering Material and Metallurgy – Er Amandeep Singh Wadhva
5. Materials Science for Engineering Students- Traugott Fischer 2009 Edition.

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	L	T/P/D	C
II Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A30281) ELECTRICAL AND ELECTRONICS ENGINEERING LAB

SECTION A: ELECTRICAL ENGINEERING:

1. Verification of KCL and KVL.
2. Magnetization characteristics of D.C. Shunt generator.
3. Speed control of DC motor.
4. Swinburne's Test on DC shunt machine.
5. Brake test on DC shunt motor.
6. OC and SC tests on Single-phase transformer.
7. Brake test on 3-phase Induction motor.
8. Regulation by an alternator by synchronous impedance method.

SECTION B: ELECTRONICS ENGINEERING:

1. PN Junction Diode Characteristics (Forward bias, Reverse bias)
2. Transistor CE Characteristics (Input and Output)
3. Study of CRO.
4. Class A Power Amplifier
5. Zener Diode Characteristics
6. Transistor CE Characteristics
7. Rectifier without Filters (Full wave & Half wave)
8. Rectifier with Filters (Full wave & half wave).

Note: Total 12 experiments are to be conducted.

(Six experiments from PART-A, Six experiments from PART-B)

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II Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A30085) METALLURGY AND MECHANICS OF SOLIDS LAB

(A) METALLURGY LAB :

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

(B) MECHANICS OF SOLIDS LAB :

1. Direct tension test
2. Torsion test
3. Hardness test
   a) Brinells hardness test
   b) Rockwell hardness test
4. Test on springs
5. Compression test on cube
6. Impact test
7. Punch shear test

NOTE : Any 10 experiments from the above are to be conducted taking atleast 4 from each section.

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II Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A40312) PRODUCTION TECHNOLOGY

UNIT – I

Casting: Steps involved in making a casting - Its applications - Patterns and Types of patterns – Pattern allowances and their construction. Types of casting processes –Solidification of casting.

UNIT – II

Welding: welding Types - Oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding – Resistance welding, Thermit welding.

UNIT – III

Inert Gas Welding, TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding, Laser Welding Soldering and Brazing, Heat affected zone in welding. Welding defects – causes and remedies – destructive and non- destructive testing of welds.

UNIT – IV

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements

Stamping, forming and other cold working processes : Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools. Forces and power requirement for the above operations.

UNIT – V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging. **Forging hammers**: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS :

1. Manufacturing Technology (Vol.1) / P.N. Rao/TMH/2nd Edition
2. Workshop Technology (Vol.1) /Hajra Chowdary/Asia Publishing

House/2nd Edition.

REFERENCE BOOKS:

1. Production Technology /Sarma P C /S.Chand.
2. Production Technology / R.K. Jain/Khanna Publishers.
3. Metal Casting / T.V Ramana Rao / New Age.
4. Principles of Metal Castings / Rosenthal/TMH.
5. A Course in Workshop Technology/B.S. Raghuwamshi /Dhanpat rai & Sons.
6. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.

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	L	T/P/D	C
II Year B.Tech. ME-II Sem	**4**	**-/-/-**	**4**

(A40309) KINEMATICS OF MACHINERY

UNIT – I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs –Types of constrained motion-kinetic chain-. Mechanism-machine-Structure - inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage-Grubler's Criterion.

UNIT – II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane Motion of Body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration

Analysis of Mechanisms: Analysis of slider crank chain for displacement-velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III

Straight-Line Motion Mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt - Tchebicheff's and Robert Mechanism - Pantographs

Steering Gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint –velocity ratio – application – problems.

UNIT – IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of Motion Of Followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.

Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing.

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford/ 3rd Edition/International Edition.
2. Theory of Machines / Thomas Bevan/Pearson/3rd Edition.

REFERENCE BOOKS:

1. Theory of Mechanism and Machines /Jagdish Lal/Metropolitan Book Company.
2. Theory of Machines /S.S.Rattan / Tata McGraw Hill Publishers.
3. Kinematics & Dynamics Of machinery/Norton/TMH.
4. Theory of Machines / Sadhu Singh / Pearson.
5. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age.
6. Theory of Machines by / R.K. Bansal (Lakshmi Publications).

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II Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A40313) THERMAL ENGINEERING - I

UNIT – I

I.C. Engines:

Four & Two stroke engine - SI & CI engines - Valve and Port Timing Diagrams - Fuel Injection Systems for SI engines - Fuel injection systems for CI engines-Ignition - Cooling and Lubrication system - Fuel properties and Combustion Stoichiometry.

UNIT – II

Combustion in SI and CI Engines: Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion - pre-ignition and knocking in SI Engines -Fuel requirements and fuel rating - anti knock additives – combustion chamber – requirements - types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating.

UNIT III

Testing and Performance of Engines and Compressors: Measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Performance test – Heat balance sheet and chart - Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

UNIT – IV

Rotary, Dynamic and Axial Flow (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations. **Centrifugal compressors**: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power. Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

UNIT – V

Refrigeration : Mechanical Refrigeration and types – units of refrigeration

– Air Refrigeration system, details and principle of operation – applications of air refrigeration, Vapour compression refrigeration systems – calculation of COP – effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants- Vapour absorption system – mechanical details – working principle, Use of p-h charts for calculations.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan/ TMH.
2. Thermal Engineering / R.K. Rajput / Lakshmi Publications/Reprints 2011.

REFERENCE BOOKS:

1. Thermal Engineering / P.K.Nag/3rd Edition.
2. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
3. Engineering fundamentals of IC Engines – Pulkrabek / Pearson /PHI
4. Thermal Engineering / Rudramoorthy / TMH.
5. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot., Allahabad.
6. I.C. Engines / Heywood /McGrawHIll.

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II Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A40112) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

UNIT I

Fluid statics : Dimensions and units: physical properties of fluids- specific gravity, viscosity, surface tension- vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT II

Fluid kinematics : Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT III

Boundary Layer Concepts : Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation-Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter, and orifice meter, Flow nozzle

UNIT IV

Basics of turbo machinery : Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines : Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines : Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT V

Centrifugal pumps : Classification, working, work done – barometric head-losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps : Working, Discharge, slip, indicator diagrams.

TEXT BOOKS :

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCES :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

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II Year B.Tech. ME-II Sem	L	T/P/D	C
	-	-/-/6	4

(A40310) MACHINE DRAWING

PART-A

MACHINE DRAWING CONVENTIONS:

Need for drawing conventions – introduction to ISI conventions - Conventional representation of materials, common machine elements such as screws, nuts, bolts, keys, gears, webs, ribs. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features. Title boxes, their size, location and details - common abbreviations and their liberal usage. Types of Drawings – working drawings for machine parts.

DRAWING OF MACHINE ELEMENT:

Simple parts - Selection of Views, additional views for the following machine elements and parts with every drawing proportions. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws. Keys, cottered joints and knuckle joint. Rivetted joints for plates. Shaft coupling, spigot and socket pipe joint. Journal, pivot and collar and foot step bearings.

PART- B

ASSEMBLY DRAWINGS:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions. Engine parts – stuffing boxes, cross heads, Eccentrics - Connecting Rod – Piston Assembly. Machine tool parts: Tail stock, Tool Post, Machine Vices - Screws jacks- Plummer block. **VALVES**: Spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOK :

1. Machine Drawing /K.L.Narayana/ New Age International Publishers.
2. Textbook of Machine Drawing/K.C. John/PHI/Eastern Economy Edition.

REFERENCE BOOKS:

1. Machine Drawing / P.S.Gill.
2. Machine Drawing / Junnarkar N.D./ Pearson Edu.
3. Machine Drawing/Bhattacharya/Oxford University Press
4. Machine Drawing/N.D. Bhat/ Charotar.
5. A Textbook of Machine Drawing/R. K. Dhawan/ S. Chand.

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II Year B.Tech. ME-II Sem	L	T/P/D	C
	4	-/-/-	4

(A40006) MATHEMATICS - II

Objectives:

- The objective is to find the relation between the variables x and y out of the given data (x,y).
- This unit also aims to find such relationships which exactly pass through data or approximately satisfy the data under the condition of least sum of squares of errors.
- The aim of numerical methods is to provide systematic methods for solving problems in a numerical form using the given initial data.
- This topic deals with methods to find roots of an equation and solving a differential equation.
- The numerical methods are important because finding an analytical procedure to solve an equation may not be always available.
- In the diverse fields like electrical circuits, electronic communication, mechanical vibration and structural engineering, periodic functions naturally occur and hence their properties are very much required.
- Indeed, any periodic and non-periodic function can be best analyzed in one way by Fourier series and transforms methods.
- The unit aims at forming a partial differential equation (PDE) for a function with many variables and their solution methods. Two important methods for first order PDE's are learnt. While separation of variables technique is learnt for typical second order PDE's such as Wave, Heat and Laplace equations.
- In many Engineering fields the physical quantities involved are vector-valued functions.
- Hence the unit aims at the basic properties of vector-valued functions and their applications to line integrals, surface integrals and volume integrals.

UNIT – I

Vector Calculus: Vector Calculus: Scalar point function and vector point function, Gradient- Divergence- Curl and their related properties. Solenoidal and irrotational vectors – finding the Potential function. Laplacian operator. Line integral – work done – Surface integrals -Volume integral. Green's

Theorem, Stoke's theorem and Gauss's Divergence Theorems (Statement & their Verification).

UNIT – II:

Fourier series and Fourier Transforms: Definition of periodic function. Fourier expansion of periodic functions in a given interval of length 2π . Determination of Fourier coefficients – Fourier series of even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – III:

Interpolation and Curve fitting

Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations of symbols. Difference expressions – Differences of a polynomial-Newton's formulae for interpolation - Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

UNIT – IV : Numerical techniques

Solution of Algebraic and Transcendental Equations and Linear system of equations: Introduction – Graphical interpretation of solution of equations .The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method .

Solving system of non-homogeneous equations by L-U Decomposition method (Crout's Method). Jacobi's and Gauss-Seidel iteration methods.

UNIT – V

Numerical Integration and Numerical solutions of differential equations:

Numerical integration - Trapezoidal rule, Simpson's $1/3^{rd}$ and 3/8 Rule , Gauss-Legendre one point, two point and three point formulas.

Numerical solution of Ordinary Differential equations: Picard's Method of successive approximations. Solution by Taylor's series method – Single step methods-Euler's Method-Euler's modified method, Runge-Kutta (second and classical fourth order) Methods.

Boundary values & Eigen value problems: Shooting method, Finite difference method and solving eigen values problems, power method

TEXT BOOKS:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi & Others, S. Chand.
2. Introductory Methods by Numerical Analysis by S.S. Sastry, PHI Learning Pvt. Ltd.
3. Mathematical Methods by G.Shankar Rao, I.K. International Publications, N.Delhi.
4. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, 2013, CRC Press Taylor & Francis Group.
5. Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edi, 2013, Chapman & Hall/ CRC.
6. Advanced Engineering Mathematics, Michael Greenberg, Second Edition, Person Education.
7 Mathematics For Engineers By K.B.Datta And M.A S.Srinivas, Cengage Publications.

Outcomes: From a given discrete data, one will be able to predict the value of the data at an intermediate point and by curve fitting, can find the most appropriate formula for a guessed relation of the data variables. This method of analysis data helps engineers to understand the system for better interpretation and decision making

- After studying this unit one will be able to find a root of a given equation and will be able to find a numerical solution for a given differential equation.
- Helps in describing the system by an ODE, if possible. Also, suggests to find the solution as a first approximation.
- One will be able to find the expansion of a given function by Fourier series and Fourier Transform of the function.
- Helps in phase transformation, Phase change and attenuation of coefficients in acoustics.
- After studying this unit, one will be able to find a corresponding Partial

Differential Equation for an unknown function with many independent variables and to find their solution.

- Most of the problems in physical and engineering applications, problems are highly non-linear and hence expressing them as PDEs'. Hence understanding the nature of the equation and finding a suitable solution is very much essential.
- After studying this unit, one will be able to evaluate multiple integrals (line, surface, volume integrals) and convert line integrals to area integrals and surface integrals to volume integrals.
- It is an essential requirement for an engineer to understand the behavior of the physical system.

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II Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A40382) PRODUCTION TECHNOLOGY LAB

Minimum of 12 Exercises need to be performed

I. METAL CASTING LAB:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. WELDING LAB:

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises
   (Water Plasma Device)

III. MECHANICAL PRESS WORKING:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press : Deep drawing and extrusion operation.
3. Bending and other operations

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

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	L	T/P/D	C
II Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A40188) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems

Note : Any 10 of the above 12 experiments are to be conducted.

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	L	T/P/D	C
III Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A50010) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Objectives:

To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations namely: demand and supply, production function, cost analysis, markets, forms of business organisations, capital budgeting and financial accounting and financial analysis.

Unit I

Introduction & Demand Analysis*:* Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. *Elasticity of Demand*: Definition, Types, Measurement and Significance of Elasticity of Demand. *Demand Forecasting,* Factors governing demand forecasting, methods of demand forecasting.

Unit II

Production & Cost Analysis: *Production Function* – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. *Cost Analysis***:** Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit III

Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. *Pricing*: Objectives and Policies of Pricing. Methods of Pricing. *Business:* Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, *New Economic Environment*: Changing Business Environment in Post-liberalization scenario.

Unit IV

Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

Unit V

Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions - Introduction IFRS - Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis***:** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012
4. Domnick Salvatore: Managerial Economics in a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting—A Managerial Perspective, Pearson, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha : MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J. V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

Outcomes:

At the end of the course, the student will

- understand the market dynamics namely, demand and supply, demand forecasting , elasticity of demand and supply, pricing methods and pricing in different market structures.

- Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis
- Develop an understanding of
- Analyse how capital budgeting decisions are carried out
- Understand the framework for both manual and computerised accounting process
- Know how to analyse and interpret the financial statements through ratio analysis.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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	4	**-/-/-**	**4**

(A50318) ENGINEERING METROLOGY

UNIT – I

Systems of Limits and Fits : Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – International Standard system for plane and screwed work.

UNIT – II

Linear Measurement : Length standard: line and end standard, slip gauges – calibration of slip gauges, Dial indicator, micrometers.

Measurement Of Angles and Tapers : Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar – Sine plate used to determine the tapers.

Limit Gauges : Taylor's principle – Design of GO and NO GO gauges, plug, ring, snap, taper, profile and position gauges.

UNIT – III

Optical Measuring Instruments : Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.

Flat Surface Measurement : Measurement of flat surfaces – instruments used: straight edges, surface plates, optical flat and auto collimator.

UNIT – IV

Surface Roughness Measurement: Differences between surface roughness and surface waviness – Numerical assessment of surface finish: CLA, R.M.S Values, R_z values,R_{10} value- Methods of measurement of surface finish: profilograph, Talysurf- ISI symbols for indication of surface finish.

UNIT -V

Measurement Through Comparators: Comparators: Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

Screw Thread Measurement : Element of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools. Preparation of acceptance charts.

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement, Measurement of diameter, pitch pressure angle and tooth thickness.

Coordinate Measuring Machines: Types of CMM, Role of CMM, and Applications of CMM.

TEXT BOOKS :

1. Engineering Metrology / R.K. Jain / Khanna Publishers.
2. Engineering Metrology / I C Gupta./ Dhanpath Rai.

REFERENCE BOOKS :

1. Dimensional Metrology/Connie Dotson/Cengage Learning.
2. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
3. Fundamentals of Dimensional Metrology/ / Connie Dotson / Thomson/ 4th Edition.
4. Engineering Metrology/Kenneth John Hume/McDonald.
5. Engineering Metrology/D.M. Anthony/Pergamon Press.
6. Principles of Engineering Metrology/Rega Rajendra/Jaico Publications.

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III Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
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(A50317) DYNAMICS OF MACHINERY

UNIT – I

Angular Motion: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aero planes and ships. Static and Dynamic Force Analysis of planar mechanisms.

UNIT – II

Friction: Inclined plane – Friction of screw and nuts - Pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches. Single plate, multi plate, cone clutch, centrifugal clutches.

Brakes And Dynamometers: Simple block brake - Internal expanding brake-band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – III

Turning Moment Diagram and Flywheels: Turning moment- Inertia torque-connecting rod angular velocity and acceleration-crank effort and torque diagrams-fluctuation of energy – flywheels and their

Governors: Watt, Porter and Proell governors- Spring loaded governors – Hartnell and Hartung with auxiliary springs- Sensitiveness, isochronisms and hunting– effort and power of the governors.

UNIT – IV

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of "V" and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring –oscillation of pendulums- Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines/ S.S.Rattan/McGraw Hill.

2. Theory of Mechanism and Machines /Jagdish Lal/Metropolitan Book Company.

REFERENCE BOOKS:

1. Theory of Machines/ Shigley/ Mc Graw Hill Publishers.
2. Theory of Machines/ Thomas Bevan/Pearson.
3. Theory of Machines/ R.K.Bansal/Lakshmi publications/5th Edition.
4. Mechanism and Machine Theory/ JS Rao and RV Duggipati/ New Age.
5. Theory of Machines/Sadhu Singh/Pearson/3rd Edition.
6. Mechanism and Machine Theory/Ashok G. Ambekar/PHI/Eastern Economy Edition.

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(A50321) MACHINE TOOLS

UNIT – I

Elementary treatment of metal cutting theory – Element of cutting process – Geometry of single point tool and angles chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants, machinability – Tool materials.

UNIT – II :

Engine lathe – Principle of working, specification of lathe – types of lathe – work and tool holding devices, Taper turning, Thread turning – Lathe attachments. Turret and capstan lathe – Principal features of automatic lathes – classification : Single spindle and multi-spindle automatic lathes – tool layouts.

UNIT – III :

Shaping ,slotting and planning machines – Principles of working – Principal parts – specification, classification, operations performed. Kinematic scheme of the shaping, slotting and planning machines, machining time calculations.

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig boring machine. Deep hole drilling machine. Kinematics scheme of the drilling and boring machines

UNIT – IV

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – machining operations Geometry of milling cutters – methods of indexing – Accessories to milling machines, kinematic scheme of milling machines.

Lapping, honing and broaching machines – comparison of grinding, lapping and honing. Kinematics scheme of Lapping, Honing and Broaching machines. Constructional features of speed and feed Units, machining time calculations

UNIT –V

Finishing Processes: Grinding – fundamentals – theory of grinding – classification of grinding machines – cylindrical and surface grinding machine- Tool and cutter grinding machine – special types of grinding machines, Different types of abrasives – bonds specification of a grinding wheel and selection of a grinding wheel, Kinematic. Scheme of grinding machines.

TEXT BOOKS:

1. Production Technology/HMT/Tata McGraw Hill.
2. Production Technology / R.K. Jain and S.C. Gupta/Khanna Publishers.

REFERENCE BOOKS:

1. Principles of Machine Tools/ Bhattacharya A and Sen.G.C/ New Central Book Agency.
2. Workshop Technology – Vol.-II/ B.S. Raghuvamsi.
3. Elements of Work Shop Technology – Vol. II/Hajra Choudry/ Media Promoters.
4. Fundamentals of Metal Machining and Machine Tools/ Geofrey Boothroyd/ McGraw Hill.
5. Manufacturing Processes/JP Kaushish/Prentice Hall/2nd Edition.
6. Machine Tools/C Elanchezhian & M. Vijayan/Anuradha Publications.

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(A50316) DESIGN OF MACHINE MEMBERS - I

NOTE : Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. Tolerances and fits –BIS codes of steels. Theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers.

Fatigue loading: Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line.

UNIT – II

Design of Fasteners: Riveted joints-methods of failure of riveted joints-strength equations-efficiency of riveted joints- eccentrically loaded riveted joints.

Welded joints: Design of fillet welds- axial loads-circular fillet welds-bending and torsion.

Design of bolts with pre-stresses- design of joints under eccentric loading-bolts of uniform strength.

UNIT – III

Keys, Cotters and Knuckle Joints: Design of Keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints-Knuckle joints.

UNIT – IV

Design of Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for complex loads– Shaft sizes – BIS code- Design of shafts for gear and belt drives.

Shaft couplings : Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – PIN-Bush coupling.

UNIT – V

Mechanical Springs: Stresses and deflections of helical springs-extension-compression springs- springs for static and fatigue loading-natural frequency of helical springs-energy storage capacity-helical torsion springs-co-axial springs.

TEXT BOOKS:

1. Machine design/Pandya & Shah/ Charotar Publishing House Pvt. Ltd.
2. Machine Design/ PV Soundararajan Murthy and N. Shanmugam/ Anuradha Publishers.

REFERENCE BOOKS:

1. Design of Machine Elements/V.M. Faires.
2. Machine design/ Schaum Series.
3. Mechanical Engineering Design/JE Shigley.
4. Machine Design/S Md. Jalaluddine/Anuradha Publishers.
5. Machine Design/UC Jindal/Pearson.
6. Design of Machine Elements (Vol.1)/T. Krishna Rao/IK International Publishing House/2nd Edition.

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(A50326) THERMAL ENGINEERING – II

UNIT – I

Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

Combustion: Fuels and combustion- concept of heat of reaction-adiabatic flame temperature-stoichiometry-flue gas analysis.

UNIT – II

Boilers: Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principle.

Steam Nozzles : Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis.

UNIT – III

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction –Velocity diagram – Parson’s reaction turbine – Condition for maximum efficiency.

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Working principle of different types.

UNIT IV

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Actual cycle – Regeneration, Inter cooling and Reheating –Closed and Semi-closed cycles – Merits and Demerits- Brief Concepts about compressors- Combustion chambers and turbines of Gas Turbine Plant.

UNIT – V

Jet Propulsion : Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Rockets: Application – Working Principle – Classification – Propellant Type

– Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering / Rajput / Lakshmi Publications.
2. Gas Turbines/V.Ganesan /TMH.

REFERENCE BOOKS:

1. Gas Turbines and Propulsive Systems/ P.Khajuria & S.P.Dubey / Dhanpatrai Pub.
2. Thermal Engineering/ Ballaney / Khanna Pub.
3. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman.
4. Thermal Engineering/R.S. Khurmi & J.S.Gupta / S.Chand Pub.
5. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot.
6. Thermal Engineering / Ajoy Kumar/ Narosa.

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III Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	-	**-/3/-**	**2**

(A50384) MACHINE TOOLS & METROLOGY LAB

Section-A:

1. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.
2. Machine tool alignment of test on the lathe.
3. Tool makers microscope and its application
4. Angle and taper measurements by bevel protractor and sine bars.
5. Use of spirit level and optical flats in finding the flatness of surface plate.
6. Thread measurement by 2-wire and 3-wire methods.

Section-B:

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper,
2. Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
3. Step turning and taper turning on lathe machine
4. Thread cutting and knurling on -lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding
10. Grinding of Tool angles.

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	-	**-/3/-**	**2**

(A50383) THERMAL ENGINEERING LAB

PERFORM ANY 10 OUT OF THE 12 EXERCISES.

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

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III Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
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(A62405) AUTOMOBILE ENGINEERING

UNIT – I

Introduction : Layout of automobile – introduction chassis and body components . types of Automobile engines. – power unit – Introduction to engine lubrication – engine servicing.

Fuel System :S.I. Engine : Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. Introductionto MPFI and GDI Systems.

C.I. Engines : Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction CRDI and TDI Systems.

UNIT – II

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System : Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – III

Transmission System : Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constantt mesh, synchro mesh gear boxes, epicyclic gear box , over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

Suspension System : Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT – IV

Braking System : Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System : Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT – V

Emissions from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG,CNG, liquid Fuels and gaseous fuels, Hydrogen as a fuel for IC Engines. - their merits and demerits.

Standard Vehicle maintenance practice.

TEXT BOOKS :

1. Automobile Engineering / William H Crouse/McGraw Hill-2012.
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

REFERENCES :

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner.
2. Automotive Engineering / Newton Steeds & Garrett.
3. Automotive Engines / Srinivasan.
4. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International.

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	4	**-/-/-**	**4**

(A60330) FINITE ELEMENT METHODS

UNIT – I:

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Boundary conditions. Strain – Displacement relations. Stress – strain relations for 2-D and 3-D Elastic problems.

One Dimensional Problems: Finite element modeling coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT – II:

Analysis of Trusses: Stiffness Matrix for Plane Truss Elements, Stress Calculations and problems.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element and simple problems.

UNIT – III:

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of Load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.

Two dimensional four noded Isoparametric elements and problems.

UNIT – IV:

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

UNIT – V:

Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss.

Finite element – formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation, techniques such as semi automatic and fully Automatic use of softwares such as ANSYS, NISA, NASTRAN, etc.

TEXT BOOKS:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.

2. Finite Element Methods: Basic Concepts and applications/ Alavala/ PHI.

REFERENCE BOOKS :

1. Introduction to Finite Elements in Engineering/Chandrupatla, Ashok and Belegundu/ Prentice – Hall.
2. Finite Element Method /Zincowitz / Mc Graw Hill.
3. Introduction to Finite element analysis/ S.Md.Jalaludeen/Anuradha Publications, print-2012.
4. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th Edition.
5. Finite Element Method/Krishna Murthy / TMH.
6. Finite Element Analysis /Bathe / PHI.

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III Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A60334) REFRIGERATION AND AIR CONDITIONING

UNIT – I

Introduction to Refrigeration: -Basic concepts - Unit of refrigeration and C.O.P-refrigerators-heat pump- carnot refrigerator-applications of refrigerator – Vapour compression refrigeration- Ideal cycle –effect of sub cooling of liquid- super heating of vapour-deviations of practical (actual cycle) from ideal cycle- construction and use of P-H chart- problems.

UNIT – II

Components :

Compressors –classification – Working – Advantages and Disadvantages.

Condensers – classification – Working Principles

Evaporators – classification – Working Principles

Expansion devices – Types – Working Principles

UNIT III:

Vapor Absorption refrigeration – Description and working of ammonia – water, Li Br – water system – Calculation of HCOP, Principle and operation of three fluid vapour absorption refrigeration system.

Air refrigeration- Bell Coleman cycle – open and dente air system - ideal and actual refrigeration – applications – steam jet refrigeration system – working principle – basic operation

UNIT – IV:

Introduction to Air Conditioning:

Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP.

Concept of human comfort and effective temperature –Comfort Air conditioning – Industrial air conditioning and Requirements – Air conditioning Load Calculations.

UNIT – V:

Air Conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers.

Heat Pump – Heat sources – different heat pump circuits – Applications.

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH.
2. A Course in Refrigeration and Air Conditioning / SC Arora & Domkundwar / Dhanpatrai.

REFERENCE BOOKS:

1. Principles of Refrigeration /Dossat / Pearson Education.
2. Basic Refrigeration and Air-Conditioning/ Ananthanarayanan / TMH.
3. Refrigeration and Air Conditioning/ Manohar Prasad/ New Age.
4. Refrigeration and Air Conditioning/Ahmadul Ameen/PHI.

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III Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A60329) DESIGN OF MACHINE MEMBERS - II

NOTE : Design Data Book Permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

UNIT – I

Bearings : Types of Journal bearings –basic modes of Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design. Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

UNIT – II

Design of IC Engine Parts :

Connecting Rod : Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung and center cranks – Crank pins, Crank shafts. Pistons, Forces acting on piston – Construction, Design and proportions of piston.

UNIT – III

Power Transmission Systems and Pulleys: Transmission of power by Belt and Rope ways, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives-materials-chain drives.

UNIT – IV

Gears : Spur gears– Load concentration factor – Dynamic load factor. – analysis of spur gears –check for plastic deformation-check for dynamic and wear consideration.

Helical and bevel gear drives: Helical and bevel gears**-** Load concentration factor- Dynamic load factor-analysis of helical and bevel gears- check for plastic deformation-check for dynamic and wear consideration

Design of worm gears: Properties of worm gears- selection of materials-strength and wear rating of worm gears- force analysis-friction in worm gears.

UNIT – V

Design of Power Screws: Design of Screw – design of nut – compound screw – differential screw – ball screw-possible failures.

TEXT BOOKS:

1. Machine Design/Pandya & Shah/ Charotar Publishing House Pvt. Ltd.

2. Machine Design/ PV Soundararajan Murthy and N. Shanmugam/ Anuradha Publishers.

REFERENCE BOOKS:

1. Design of Machine Elements/V.M. Faires.
2. Machine design/ Schaum Series.
3. Mechanical Engineering Design/JE Shigley.
4. Machine Design/S Md. Jalaluddine/Anuradha Publishers.
5. Machine Design/UC Jindal/Pearson.
6. Design of Machine Elements (Vol.1)/T. Krishna Rao/IK International Publishing House/2nd Edition.

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III Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
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(A60331) HEAT TRANSFER

UNIT – I

Introduction**,** Basic Modes of heat transfer – Fundamental laws of heat transfer – Simple General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier Heat transfer equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

UNIT – II

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation-Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface and fins.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance –Chart solutions of transient conduction systems.

UNIT – III

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Π Theorem and method, application for developing semi – empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – use of empirical correlation for convective heat transfer.

Forced convection: External Flows: Flat plates and Horizontal pipes.

Free Convection: Vertical plates and pipes-concepts about Hydrodynamic and thermal boundary layer along a vertical plate.

UNIT – IV

Heat Transfer With Phase Change:

Boiling: – Pool boiling– Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation –Film Condensation on a vertical and horizontal cylinders using empirical correlations.

Radiation Heat Transfer : Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

UNIT V

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

TEXT BOOKS :

1. Heat& Man Transfer-D.S.Kumar/S.K.Kataria& sons.
2. Heat Transfer-P.K.Nag /Mc Graw Hill/Third Edition.

REFERENCE BOOKS:

1. Heat Transfer: A Practical Approach /Yunus Cengel, Boles / TMH.
2. Heat Transfer: A Conceptual Approach/PK Sharma, K. Rana Krishna/ New age International Publishers.
3. Heat Transfer / HOLMAN/TMH.
4. Heat and Mass Transfer/ R. Yadav /CPH.
5. Essential Heat Transfer/ Christopher A Long / Pearson Education.
6. Fundamentals of Engineering, Heat & Man Transfer/R.C.Sachdeva/ NewAge.

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III Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
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(A60117) DISASTER MANAGEMENT
(Open Elective)

Unit-I

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Unit –II

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards –

Unit –III

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake.

Unit –IV

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters.

Infrequent events: Cyclones – Lightning – Hailstorms.

Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation) Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation) Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards / Disasters- Physical hazards/ Disasters-Soil Erosion.

Soil Erosion:— Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion.

Chemical hazards/ disasters:— Release of toxic chemicals, nuclear explosion- Sedimentation processes Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation

Biological hazards/ disasters:- Population Explosion.

Unit –V

Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage (preparedness)
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

TEXT BOOKS:

1. Disaster Mitigation: Experiences And Reflections by Pardeep Sahni.
2. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning.

REFERENCES

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990.
2. Savinder Singh Environmental Geography, Prayag Pustak Bhawan, 1997.
3. Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978.
4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000.
5. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003.
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994.
7. Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi, 2003.
8. A.S. Arya Action Plan For Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994.
9. R.K. Bhandani An overview on Natural & Man made Disaster & their Reduction,CSIR, New Delhi.
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001.

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(A60017) INTELLECTUAL PROPERTY RIGHTS

(Open Elective)

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks : Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights : Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents : Foundation of patent law, patent searching process, ownership rights and transfer.

UNIT – IV

Trade Secrets : Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition : Misappropriation right of publicity, False advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law ; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, cengage learing.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tate Mc Graw Hill Publishing company ltd.,

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III Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
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(A60018) HUMAN VALUES AND PROFESSIONAL ETHICS

(Open Elective)

Objectives : This introductory course input is intended

a. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

b. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.

c. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Unit I:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II:

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III:

Understanding Harmony in the Family and Society- Harmony in Human -

Human Relationship : Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Unit IV:

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence : Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Unit V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics : Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order,

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers.

b) At the level of society: as mutually enriching institutions and organizations .

TEXT BOOK

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

2. Prof. KV Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications,3rd Edition.

REFERENCE BOOKS

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
5. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
6. A.N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethichs (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story

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(A60387) HEAT TRANSFER LAB

(Consider Performance in Any 12)

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

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	-	**-/3/-**	**2**

(A60086) ADVANCED COMMUNICATION SKILLS (ACS) LAB

Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate acoustics.**
- **Round Tables with movable chairs**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ**
- **T. V, a digital stereo & Camcorder**
- **Headphones of High quality**

Prescribed Lab Manual: A book titled ***A Course Book of Advanced***

Communication Skills (ACS) Lab published by Universities Press, Hyderabad.

Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

Books Recommended:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
4. Business and Professional Communication: Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
5. The Basics of Communication: A Relational Perspective. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
6. English Vocabulary in Use series, Cambridge University Press 2008.
7. Management Shapers Series by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
8. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
9. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.

10. Handbook for Technical Writing by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
11. Job Hunting by Colm Downes, Cambridge University Press 2008.
12. Master Public Speaking by Anne Nicholls, JAICO Publishing House, 2006.
13. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.
14. Books on TOEFL/GRE/GMAT/CAT/ IELTS by Barron's/DELTA/ Cambridge University Press.
15. International English for Call Centres by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

***Advanced Communication Skills Lab Practicals**:*

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

Mini Project: As a part of Internal Evaluation

1. Seminar/ Professional Presentation

2. A Report on the same has to be prepared and presented.

- ***Teachers may use their discretion to choose topics relevant and suitable to the needs of students.***
- ***Not more than two students to work on each mini project.***
- ***Students may be assessed by their performance both in oral presentation and written report.***

Outcomes

- Accomplishment of sound vocabulary and its proper use contextually.
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

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(A70352) OPERATIONS RESEARCH

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method.

UNIT – II

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

UNIT – III

Sequencing – Introduction – Flow **–**Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

Inventory: Introduction – Single item, Deterministic models – Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand may be discrete variable or continuous variable – Single Period model and no setup cost.

UNIT – V

Waiting Lines: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

Dynamic Programming:

Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

Simulation: Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages- applications of simulation to queuing and inventory.

TEXT BOOKS :

1. Operations Research /J.K.Sharma 4e. /MacMilan.
2. Introduction to O.R/Hillier & Libermann/TMH.

REFERENCE BOOKS :

1. Introduction to O.R /Taha/PHI.
2. Operations Research/ NVS Raju/ SMS Education/3rd Revised Edition.
3. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research / Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K, Vijaya Kumar Reddy, J. Suresh Kumar/ Cengage Learning.

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(A70353) POWER PLANT ENGINEERING

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India. **Steam Power Plant :** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II

Internal Combustion Engine Plant:

DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging. **Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison. **Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways. **Hydro Projects And Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants. **Power From Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation. **Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V

Power Plant Economics And Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS :

1. Power Plant Engineering/ P.C.Sharma / S.K.Kataria Pub.
2. A Course in Power Plant Engineering: / Arora and S. Domkundwar.

REFERENCES :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications.
2. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers.
4. Power plant Engg / Elanchezhian/ I.K. International Pub.
5. Power plant Engineering/ Ramalingam/ Scietech Publishers.

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(A70328) CAD / CAM

UNIT – I

Fundamentals of CAD/CAM, Automation , design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD ,Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT-II

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions,parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems : Numerical control, Elements of NC system, NC part programming : Methods of NC part programming, Manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning.

UNIT – V

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM /Groover M.P./ Pearson education.
2. CAD/CAM Concepts and Applications/ Alavala/ PHI.

REFERENCE BOOKS :

1. CAD/CAM Principles and Applications/P.N.Rao/ TMH.
2. CAD / CAM Theory and Practice/ Ibrahim Zeid/TMH.
3. CAD / CAM / CIM/Radhakrishnan and Subramanian/ New Age.
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson.
5. Computer Numerical Control Concepts and programming/Warren S Seames/ Thomson.

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(A70343) INSTRUMENTATION AND CONTROL SYSTEMS

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

UNIT – II

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators..

Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA) .

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Non- contact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

UNIT – IV

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

Measurement Of Force, Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & Design / D.S Kumar/Anuradha Agencies.
2. Instrumentation, measurement & analysis /B.C.Nakra & K.K.Choudhary/ TMH.

REFERENCE BOOKS:

1. Principles of Industrial Instrumentation and Control Systems/ Chennakesava R Alavala/ Cengage Learning.
2. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
3. Experimental Methods for Engineers / Holman/McGraw Hill.
4. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age.
6. Instrumentation & Mech. Measurements /A.K. Tayal /Galgotia Publications.

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IV Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A70355) ROBOTICS

(Elective – I)

UNIT – I

Introduction**,** Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems - **Components of the Industrial Robotics:** Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design, Robot actuator and sensors.

UNIT – II

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H notations - Joint coordinates and world coordinates - Forward and inverse kinematics – problems.

UNIT – III

Differential Kinematics: Differential Kinematics of planar and spherical manipulators - Jacobians – problems.

Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

UNIT IV

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – **Types of motion:** Slew motion - joint interpolated motion – straight line motion – problems.

Robot actuators and Feed back components: Actuators: Pneumatic.

UNIT V

Robot Application in Manufacturing: Material handling - Assembly and Inspection – Work cell design, work volume, Robot screan.

TEXT BOOKS :

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control / JJ Craig/ Pearson/ 3rd edition.

REFERENCES :

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klaftez/ Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4. Robot Dynamics & Control/Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J / TMH.

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IV Year B.Tech. ME-I Sem	L	T/P/D	C
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(A70346) MECHANICAL VIBRATIONS

(Elective-I)

UNIT- I:

Single Degree of Freedom Systems : Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility- Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT- II:

Two Degree Freedom Systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers;

UNIT-III:

Multi Degree Freedom Systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

UNIT- IV:

Frequency Domain Vibration Analysis: Over view, machine-train monitoring parameters-Data base development-vibration data acquisition-trending analysis-failure- node analysis-signature analysis-root cause analysis.

UNIT V:

Numerical Methods: Raleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

TEXT BOOKS:

1. Mechanical Vibrations/Groover/Nem Chand and Bros.
2. Elements of Vibration Analysis / Meirovitch/ TMH, 2001.

REFERENCE BOOKS:

1. Mechanical Vibrations/VP Singh/Danapathi Rai & Sons.
2. Mechanical Vibrations/ SS Rao/ Pearson, 2009/4th Edition.
3. Mechanical Vibrations/Debabrata Nag/Wiley.
4. Vibration problems in Engineering / S.P. Timoshenko.
5. Mechanical Vibrations and sound engineering/ A.G.Ambekar/ PHI.
6. Theory and Practice of Mechanical Vibrations/JS Rao & K. Gupta/ New Age Intl. Publishers/Revised 2nd Edition.

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IV Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A70348) MECHATRONICS
(Elective-I)

UNIT-I

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT-III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition, DAQS , SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson Education Press/3rd edition, 2005.

REFERENCES:

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.

2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.
4. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
5. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton
6. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print.

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(A70347) MECHANICS OF COMPOSITE MATERIALS

(Elective-I)

UNIT-I

Introduction to Composite Materials: Introduction ,Classification Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber-Reinforced Composites and nature-made composites, and applications .

UNIT-II

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT-III

Macro Mechanical Analysis of a Lamina: Introduction, Definitions Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT-IV

Macro Mechanical Analysis of Laminates: Introduction , Laminate Code , Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus.

UNIT-V

Failure Analysis of Laminates: Introduction, Special Cases of Laminates, Applications, Failure Criterion for a Laminate.

TEXT BOOKS:

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials/Isaac and M Daniel/ Oxford University Press, 1994.

REFERENCES:

1. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley- Inter science, New York, 1980.
2. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K. Kaw/Publisher: CRC.
3. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Rainfold, New York, 1969.
4. Advanced Mechanics of Composite Materials/ Vasiliev &Morozov/ Elsevier/Second Edition.

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	4	-/-/-	4

(A70332) INDUSTRIAL MANAGEMENT
(Elective-I)

UNIT I:

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT II:

Designing Organizational Structures: Departmentation and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT III:

Operations Management: Objectives- product design process- Process selection-Types of production system(Job, batch and Mass Production),- Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing(RPW method)

Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT IV:

Work Study: Introduction – definition – objectives – steps in work study – Method study – definition – objectives – steps of method study. Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.

Statistical Quality Control: variables-attributes, Shewart control charts for variables- $\overline{X}$ chart, R chart, - Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT V:

Job Evaluation : methods of job evaluation – simple routing objective systems – classification method – factor comparison method – point method

– benefits of job evaluation and limitations.

Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

TEXT BOOKS:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers.

REFERENCE BOOKS:

1. Motion and Time Study by Ralph M Barnes/ John Willey & SonsWork Study by ILO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.
3. Production & Operation Management /Paneer Selvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book /Maynard.
6. Industrial Engineering Management / RaviShankar/ Galgotia.

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(A70359) UNCONVENTIONAL MACHINING PROCESSES

(Elective – II)

Objectives:

1. To understand the need and importance of non traditional machining methods.
2. To know the basic principle, equipment, process variables and mechanics of metal removal in abrasive jet machining and water jet machining.
3. To study the fundamentals of tool design, surface finishing and metal removal rate of electro chemical grinding , electro chemical machining and electro chemical honing.
4. To understand principles of operation, types of electrodes and process parameters and machine tool selection in EDM and Electric discharge grinding and wire cut process.
5. To know the basics of Electron Beam Machining and comparison of thermal and non thermal processes.
6. To study the various process parameters and applications of Plasma in manufacturing industries.

UNIT – I

Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT – II

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes : Fundamentals of electro-chemical machining, electro-chemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate.

UNIT - III

Thermal Metal Removal Processes : General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM-principle and applications.

UNIT – IV

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes – General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT-V

Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining-principle- maskants – etchants- applications.

TEXT BOOK:

Advanced machining processes - VK Jain, Allied publishers.

REFERENCES :

1. Modern Machining Process - Pandey P.C. and Shah H.S., TMH.
2. New Technology - Bhattacharya A, The Institution of Engineers, India 1984.
3. Unconventional Machining Processes - C. Elanchezhian,, B. Vijaya Ramnath and M Vijayan, Anuradha Publications, 2005.
4. Unconventional Manufacturing Processes – M.K. Singh, New Age International Publishers.

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	L	T/P/D	C
IV Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A70337) CNC TECHNOLOGIES

(Elective – II)

Objectives:

1. Understand basic features of NC and CNC Machines and their Design Considerations.
2. To study various system devices hardware and software interpolations.
3. To know various tooling systems used in CNC Machines.
4. Understand both Manual and Computer Aided Programming for Generating Various Contours.
5. To study about the DNC systems and Adaptive Control used for various machining process.

UNIT I:

Features of NC Machines, Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of NC Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT II:

CNC Machines Elements: Machine Structure- Guideways - feed drives-spindles - spindle bearings.

System Devices: Drives, feedback devices, counting devices.

Interpolators for manufacturing systems: DDA integrator, DDA hardware interpolators, CNC software interpolators.

UNIT III:

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

UNIT IV:

NC Part Programming: Manual programming-Basic concepts, Point-to-Point contour programming, canned cycles, parametric programming.

Computer-Aided Programming: General information, APT programming, Examples APT programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT V:

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems - Yoram Koren ,Tata Mc Graw Hill, 2009.
2. Computer Aided Manufacturing - Elanchezhian, Sunder Selvan and Shanmuga Sunder, University Science Press, Second edition.

REFERENCE BOOKS:

1. Machining Tools Hand Book Vol 3, (Automation & Control)/ Manfred Weck / John Wiley and Sons, 1984.
2. Mechatronics – HMT, TMH.
3. Computer Numerical Control-Operations and Programming – Jon Stenerson and Kelly Curron Pul, 3rd Edition.

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	L	T/P/D	C
IV Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A70336) AUTOMATION IN MANUFACTURING

(Elective – II)

UNIT – I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

UNIT – II

Automated flow lines : Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III

Assembly system and line balancing : Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT –I V

Automated material handling : Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – V

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover 3e./PE/PHI, 2009.

REFERENCES:

1. Computer Aided Manufacturing, Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009.
2. Automation by W. Buekinsham.

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IV Year B.Tech. ME-I Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A70339) DESIGN FOR MANUFACTURING AND ASSEMBLY

(Elective - II)

Objectives:

- To understand various general design rules for manufacturability and criteria for material selection.
- To study various machining process and tolerance aspects in machining.
- To know the design considerations for casting and welding process.
- To understand the conceptual design factors to be considered in forging, extrusion and sheet metal work.
- To study the general design guidelines for manual assembly and development of DFA Methodology.

UNIT I:

Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design.

Materials: Selection of Materials for design – Developments in Material Technology – Criteria for material selection – Material selection interrelationship with process selection – process selection charts.

UNIT II:

Machining Process: Overview of various machining processes – general design rules for machining - Dimensional tolerance and surface roughness – Design for Machining ease – Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts

UNIT III:

Metal Casting: Appraisal of various casting processes, Selection of casting process, General design considerations for casting – casting tolerances – Use of Solidification Simulation in casting design – Product design rules for sand casting.

Metal Joining: Appraisal of various welding processes, Factors in design of weldments – General design guidelines – pre and post treatment of welds – Effects of thermal stresses in weld joints – Design of brazed joints.

UNIT IV:

Forging: Design factors for forging – Closed die forging design – parting lines of dies – Drop forging die design – General design recommendations

Extrusion, Sheet Metal Work: Design guidelines for Extruded sections - Design principles for Punching, Blanking, Bending, Deep Drawing – Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

UNIT V:

Design for Assembly: General design guidelines for Manual Assembly-Development of Systematic DFA Methodology- Assembly Efficiency-Classification System for Manual handling- Classification System for Manual Insertion and Fastening- Effect of part symmetry on handling time-.

TEXT BOOK:

1. Product design for Manufacture and Assembly - Geoffrey Boothroyd, Peter Dewhurst and W.A. Knight, CRC Press.

REFERENCE BOOKS:

1. Product design and Manufacturing - A.K Chitale and R.C Gupta, Prentice – Hall of India, New Delhi, 2003.
2. Design and Manufacturing - Surender Kumar & Goutham Sutradhar, Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.
3. Product Design- Kevin Otto and Kristin Wood, Pearson Education.

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	4	**-/-/-**	**4**

(A72909) NANO TECHNOLOGY

(Elective-II)

Objective:

Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness and efficiency. The objective here is impart the basic knowledge in Nano Science and Technology.

Unit-I:

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

Unit-II:

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials:Dislocations, Twins,stacking faults and voids, Grain

Boundaries, triple and disclinations, **Effect of Nano-dimensions on Materials Behavior:** Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, Enhanced solid solubility, **Magnetic Properties**: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit-III:

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self assembly, **Top down approaches:** Mechanical alloying, Nano-lithography, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

Unit-IV:

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional

Atom Probe (3DAP), Nanoindentation.

Unit-V:

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS:

1. Nano: The Essentials by T.Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S.,S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

Outcome of the study:

The present syllabus of "Introduction to Nano Technology" will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

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	-	**-/3/-**	**2**

(A70390) COMPUTER AIDED DESIGN AND MANUFACTURING LAB

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.
13. Quality Control and inspection.

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(A70391) PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

(A) PRODUCTION DRAWING PRACTICE

UNIT – I

CONVENTIONAL REPRESENTATION OF MATERIALS: conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

Limits, Fits and Tolerances: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

UNIT – II

FORM AND POSITIONAL TOLERANCES: Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication.

UNIT – III

SURFACE ROUGHNESS AND ITS INDICATION: Definition, types of surface roughness indication – Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

UNIT – IV

DETAILED AND PART DRAWINGS: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

UNIT – V

PRODUCTION DRAWING PRACTICE: Part drawings using computer aided drafting by CAD software

TEXT BOOKS:

1. Production and Drawing /K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing with Auto CAD/ Pohit and Ghosh, PE

REFERENCES:

1. Geometric dimensioning and tolerancing/James D. Meadows/ B.S Publications
2. Engineering Metrology/ R.K. Jain/Khanna Publications

(B) INSTRUMENTATION LAB

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

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	4	**-/-/-**	**4**

(A80366) PRODUCTION PLANNING AND CONTROL

UNIT-I

Introduction: Definitions – objectives of production planning and control-functions of production planning and control-elements of production control-types of production- organization of production planning and control – internal organizations department

UNIT-II

Forecasting – Importance of forecasting – types of forecasting, their uses-general principles of forecasting techniques- Qualitative methods and quantitative methods.

UNIT-III

Inventory management – Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model – Inventory control systems – P- Systems and Q – Systems

Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

UNIT- IV

Routing – Definition – routing procedure- Route sheets – Bill of material-factors affecting routing procedure. Schedule – definition – difference with loading.

Scheduling polices – techniques, standard scheduling methods- job shop, flow shop,.

Line balancing, aggregate planning- methods for aggregate planning- Chase planning, expediting, control aspects.

UNIT-V

Dispatching – Activities of dispatcher- Dispatching procedure - follow up – definition – reasons for existence of functions – types of follow up, applications of computer in production planning and control

TEXT BOOKS:

1. Production Planning and Control/ M.Mahajan/ Dhanpati rai & Co.
2. Production Planning and Control/ Jain & Jain/ Khanna publications

REFRENCE BOOKS :

1. Production Planning and Control- Text & cases/ SK Mukhopadhyaya /PHI.

2. Production and operations Management/ R.Panneer Selvam/PHI.
3. Operations Management/Chase/PHI.
4. Operations management/ Heizer/Pearson.
5. Production and Operations Management(Theory and Practice)/Dipak Kumar Bhattacharyya/University Press.
6. Operations Management/S.N. Chary/TMH.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A80527) ARTIFICIAL NEURAL NETWORKS
(Elective-III)

UNIT- I

Introduction - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process – Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT- II

Back Propagation: back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT- III

Single Layer Perceptrons: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron – convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment

Multilayer Perceptron – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection.

UNIT- IV

Self Organization Maps: Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification.

UNIT- V

Neuro Dynamics: Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm

Hopfield Models – Hopfield models, computer experiment

TEXT BOOK:

1. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.

REFERENCES:

1. Artificial neural networks/ B.Vegnanarayana/PHI.
2. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003.
3. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004.
4. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

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IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A80367) TOTAL QUALITY MANAGEMENT

(Elective-III)

UNIT - I

Introduction, The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems.

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Startification, check sheet, Scatter diagram, Ishikawa diagram, paneto diagram, Kepner &Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOK:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited.
2. Total Quality Management/P.N.Mukherjee/PHI.

REFERENCE BOOKS:

1. Beyond TQM / Robert L.Flood.
2. Statistical Quality Control / E.L. Grant.
3. Total Quality Management:A Practical Approach/H. Lal.
4. Quality Management/Kanishka Bedi/Oxford University Press/2011.
5. Total Engineering Quality Management/Sunil Sharma/Macmillan.

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IV Year B.Tech. ME-II Sem	L	T/P/D	C
	4	-/-/-	4

(A80363) MAINTENANCE AND SAFETY ENGINEERING

(Elective-III)

UNIT-I

Introduction, Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st Century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.

Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control Indices.

UNIT-II

Types of Maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program PM Program Evaluation and Improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

Inventory Control In Maintenance: Inventory Control Objectives and Basic Inventory Decisions, ABC Inventory Control Method, Inventory Control Models Two-Bin Inventory Control and Safety Stock, Spares Determination Factors Spares Calculation Methods

UNIT- III

Quality and Safety In Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to Improve Safety in Maintenance Work, Safety Officer’s Role in Maintenance Work, Protection of Maintenance Workers.

Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and Steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

UNIT-IV

Reliability, Reliability Centered Maintenance, RCM: Goals and Principles, RCM Process and Associated Questions, RCM Program Components

Effectiveness Measurement Indicators, RCM Benefits and Reasons for Its Failures, Reliability Versus Maintenance and Reliability in Support Phase, Bathtub Hazard Rate Concept, Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

UNIT-V

Maintainability: Maintainability Importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

TEXT BOOKS

1. Reliability, Maintenance and Safety Engineering/ Dr. A.K.Guptha/ Laxmi Publications.
2. Industrial Safety Management/ L.M. Deshmukh/TMH.

REFERENCES:

1. Maintenance Engineering & Management / R.C.Mishra/ PHI.
2. Reliability Engineering / Elsayed/ Pearson.
3. Engineering Maintenance a modern approach/ B.S Dhallon/ C.R.R Publishers.
4. A Text Book of Reliability and Maintenance Engineering/Alakesh Manna/IK International Publishing House.
5. Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning.

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IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A80365) PLANT LAYOUT AND MATERIAL HANDLING
(Elective-III)

UNIT – I

Introduction- Classification of Layout, Advantages and Limitations of different layouts, Layout design procedures, Overview of the plant layout.

Process layout & Product layout: Selection, specification, Implementation and follow up, comparison of product and process layout.

UNIT – II

Heuristics for Plant layout – ALDEP, CORELAP, CRAFT, Group Layout, Fixed position layout- Quadratic assignment model. Branch and bound method

UNIT – III

Introduction, Material Handling systems, Material Handling principles, Classification of Material Handling Equipment, Relationship of material handling to plant layout.

UNIT – IV

Basic Material Handling systems: Selection, Material Handling method- path, Equipment, function oriented systems.

UNIT – V

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments, Safety in handling Ergonomics of Material Handling equipment. Design, Miscellaneous equipments.

TEXT BOOKS:

1. Operations Management/ PB Mahapatra/PHI.
2. Aspects of Material handling/ Dr. KC Arora & Shinde/ Lakshmi Publications.

REFERENCES:

1. Facility Layout & Location an analytical approach/ RL Francis/ LF Mc Linnis Jr, White/ PHI.
2. Production and Operations Management/ R Panneerselvam/ PHI.
3. Introduction to Material handling/ Ray, Siddhartha/ New Age.
4. Plant Layout and Material Handling/RB Chowdary/Khanna Publishers.
5. Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning.

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IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A80324) RENEWABLE ENERGY SOURCES

(Elective-IV)

UNIT – I

Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT – II

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/ cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

UNIT – III

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics.

Bio-Mass: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation, and economic aspects.

UNIT – IV

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

OTEC : Principles, utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

UNIT –V

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Renewable Energy Sources / Twidell & Weir / Taylor and Francis / 2nd Special Indian Edition.
2. Non- conventional Energy Sources / G.D. Rai / Dhanpat Rai and Sons.

REFERENCE BOOKS:

1. Energy Resources Utilization and Technologies / Anjaneyulu & Francis / BS Publications/2012.
2. Principles of Solar Energy / Frank Krieth & John F Kreider / Hemisphere Publications.
3. Non-Conventional Energy / Ashok V Desai / Wiley Eastern.
4. Non-Conventional Energy Systems / K Mittal / Wheeler.
5. Renewable Energy Technologies / Ramesh & Kumar / Narosa.
6. Renewable Energy Resources / Tiwari and Ghosal / Narosa.

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IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A80362) JET PROPULSION AND ROCKET ENGINEERING
(Elective-IV)

UNIT-I

Fundamentals of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed – parameters of performances –cycle modifications for improvement of performance.

JET PROPULSION: Historical sketch-reaction principle – essential features of propulsion devices-Thermal Engines, Classification of – Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications.

UNIT-III

TURBOPROP AND TURBOJET: Thermo dynamic cycles, plant layout, essential components, principles of operation – performance evaluation. Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

UNIT-IV

RAMJET: Thermo dynamic Cycle, plant lay-out, essential components – principle of operation - performance evaluation – comparison among atmospheric thermal jet engines – scram jet and pulse jet, elementary treatment.

ROCKET ENGINES: Need for, applications **–** Basic principles of operation and parameter s of performance – classification ,solid and liquid propellant rocket engines ,advantages, domains of application –propellants – comparison of propulsion systems.

UNIT-V

ROCKET TECHNOLOGY: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets, need for – Feed systems, injectors and expansion nozzles – Rocket heat transfer and ablative cooling.

TEXT BOOKS:

1. Gas Turbines and propulsive systems/P.Khajuria & S.P.Dubey/ Dhanpat rai pub.
2. Gas Dynamics & Space Propulsion/ M.C.Ramaswamy / Jaico Publishing House.

REFERENCE BOOKS:

1. Rocket propulsion Elements / Sutton / John Wiley & sons / 7th Edition.
2. Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.
3. Gas Turbines/V. Ganesan /TMH.
4. Elements of Gas Turbine Propulsion / Jock D Mattingly /Mc Grill.

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IV Year B.Tech. ME-II Sem	**L**	**T/P/D**	**C**
	4	**-/-/-**	**4**

(A80338) COMPUTATIONAL FLUID DYNAMICS

(Elective-IV)

UNIT-I

Elementary details in numerical techniques: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition for instability, computational methods for error estimation, convergence of sequences.

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

UNIT - II

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT - III

Introduction to first order wave equation; Stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

UNIT - IV

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

UNIT-V

Finite volume method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
2. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa

Publications.

REFERENCES:

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
3. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis/Oxford University Press/2nd Edition.

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IV Year B.Tech. ME-II Sem	L	T/P/D	C
	4	-/-/-	4

(A80361) GAS DYNAMICS
(Elective-IV)

UNIT-I

Introduction, Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation. Basic concepts of compressible flow.

Properties of atmosphere, standard atmosphere, relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

UNIT-II

Isentropic Flow: Stagnation enthalpy, density, pressure and temperature, local acoustic speed. maximum speed, variation of Compressibility with mach number.

UNIT-III

Variable Area Flow: Criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying backpressures.

Flow in constant area duct: Adiabatic and isothermal- flow calculation of pressure, temperature, density, Mach number relationships. Limiting length of duct for adiabatic and isothermal flow. Fanno line.

Diabatic flow: Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships. Limiting conditions. Rayleigh line.

UNIT-IV

Wave Phenomenon: Pressure disturbances in compressible fluid, type of shock waves – normal, shock. Pressure –density-velocity-temperature and Mach number relations for a plane normal shock- Shock tube-mach reflection – thin area prandtl theory.

UNIT-V

Shock intensity- Rayleigh- Pilot and Prandtl- Pitot equation for normal shock. Introduction to oblique shockwaves and hypersonic flow – Fenno flow.

TEXT BOOKS:

1. Gas dynamics through problems/ Zoeb Hussain/ WILEY EASTERN LTD.

2. Fundamentals of Compressible Flow/ S.M. Yahya / New Age International Publishers, 2004.

REFERENCES:

1. Gas dynamics/ E. Radha Krishnan/ P.H.I Publication/4th Edition/2012.
2. Gas Dynamics for engineers / P Balachandran / PHI / Eastern Economy Edition /2012.
3. Gas Dynamics/ H.W. Lipman and A. Rashkho/ John Wiley/ 1963.
4. Gas Dynamics/ Cambel and Jennings/ McGraw Hill/ 1958.
5. Fundamentals of Gas Dynamics / Robert D. Zucker & Oscar Biblarz/ Wiley India / 2nd Edition.
6. Gas Dynamics and Jet Propulsion / S L Somasundaram / New age International Publishers.

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IV Year B.Tech. ME-II Sem	L	T/P/D	C
	-	-/-/-	2

(A80087) INDUSTRY ORIENTED MINI PROJECT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	L	T/P/D	C
	-	-/6/-	2

(A80089) SEMINAR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	L	T/P/D	C
	-	-/15/-	10

(A80088) PROJECT WORK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-II Sem	L	T/P/D	C
	-	-/-/-	2

(A80090) COMPREHENSIVE VIVA