Vidya Jyothi Institute of Technology

(An Autonomous Institution)

Accredited by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTUH, Hyderabad

Aziz Nagar, C.B.Post, Hyderabad -500075

Board of Studies Meeting

of

Department of Electrical and Electronics Engineering

held on 13.07.2021

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Aziz Nagar Gate, C.B. Post, Hyderabad-500 0

Department of Electrical and Electronics Engineering

Minutes of the Board of studies of Department of Electrical and Electronics Engineering meeting held on 13-07-2021 at 11:00 AM.

The following members were present in the meeting.

S. No	Name of the Member	Designation	Signature
1	Dr. A. Srujana, Professor and HOD/EEE,VJIT	Chairperson	
2	Dr. K. H. Phani Sree, Associate Professor/ EEE, JNTUH,	JNTUH Nominee	
3	Mr. P. Chow Reddy, Managing Director, Interleaved Multidisciplinary Research Centre	External Member	
4	Dr. T. Anil Kumar, Professor &HOD/EEE, Anurag University	External Member	
5	Dr. G. Suresh Babu, Professor& HOD /EEE, CBIT	External Member	
6	Dr. P. Ram Kishore Kumar Reddy, Professor & HOD/EEE, MGIT	External Member	
7	Dr. D. B. G. Reddy, Professor/EEE,VJIT	Internal Member	
8	Dr. C. N. Ravi, Professor/EEE, VJIT	Internal Member	
9	Dr. M. Hari Krishna, Associate Professor/EEE, VJIT	Internal Member	
10	Dr. M. Dileep Krishna, Associate Professor/EEE, VJIT	Internal Member	
11	Mr. B. Rajesh, Assistant Professor/EEE,VJIT	Internal Member	

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Aziz Nagar Gate, C.B. Post, Hyderabad 500 0

Department of Electrical and Electronics Engineering

BOS MEETING ON 13- 07-2021 at 11:00 AM

<u>AGENDA</u>

1. To discuss and decide the course structure and syllabi of II, III Year and IV Year B.Tech Electrical and Electronics Engineering for the students admitted under R20 Regulations (including FASTTRACK batch). **Annexure - I**
2. To discuss and decide the syllabi of the subjects offered by EEE Department for other departments admitted under R20 Regulations: **Annexure - II**
    1. Electrical Technology (for II B. Tech ECE II semester)
    2. Control Systems Engineering (for III B. Tech ECE I Semester)
    3. Basic Electrical Engineering (for II B. Tech Mechanical II Semester)
    4. Basic Electrical Engineering Laboratory (for II B.Tech Mechanical II Semester)
    5. Principles of Electrical Engineering (for II B. Tech Civil Engineering II Semester)
3. To discuss and decide substitute subjects for rejoined students of R19 regulation (VJIT Autonomous). **Annexure - III**
4. To Approve Panel of Examiners.
5. Any other matter with the permission of the Chair.

Resolutions

Item No.1: To discuss and decide the course structure and syllabi of II Year, III Year and IV Year B. Tech. Electrical and Electronics engineering for the students admitted under R20 Regulation

The Chairperson presented the course structure and syllabi of II Year, III Year and IV Year B. Tech. EEE subjects as per Annexure-I.

After discussing various aspects of the Course Structure and syllabi the committee passed the following resolution.

Resolution(1): The members after thorough discussion approved the course structure and syllabi of III Year and IV Year B. Tech. in Electrical and Electronics Engineering for R20 Regulation as per Annexure-I

Noted and Approved.

Item No.2: To discuss and decide the course structure and syllabi of Fast track Curriculum scheme offered to III Year and IV Year B. Tech. Electrical and Electronics engineering for the students admitted under R20 Regulation

The Chairperson presented the course structure and syllabi of III Year and IV Year B. Tech. EEE Fast Track Curriculum Scheme (FTCS) subjects as per Annexure-I.

After discussing various aspects of the Course Structure and syllabi the committee passed the following resolution.

Resolution(2): The members after thorough discussion approved the course structure and syllabi of Fast Track Curriculum Scheme(FTCS) offered to III Year and IV Year B. Tech. in Electrical and Electronics Engineering for R20 Regulation as per Annexure-I

Noted and Approved.

Item No. 3: To discuss and decide the syllabi of the subjects offered by EEE Department to other departments admitted under R20 Regulation:

(i) The Chairperson presented the syllabi of subjects offered to B. Tech. ECE, Mechanical and Civil Engineering Branches viz:

1. Electrical Technology (for II B.Tech. ECE II semester)
2. Control Systems (for III B. Tech. ECE I Semester)

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3. Basic Electrical Engineering (for II B. Tech. Mechanical II Semester)
4. Basic Electrical Engineering Laboratory(for II B. Tech. Mechanical II Semester)
5. Principles of Electrical Engineering (for II B. Tech. Civil Engineering II Semester)

(ii) Further, the Chairperson presented subjects along with syllabi offered as Open Electives for other Branches of Engineering under R20 regulation in the college viz:

1. Non Conventional Energy Sources (OE-1)
2. Fundamentals of Electrical Power Generation and Protection(OE-1)
3. Energy Audit and Conservation (OE-2)
4. Principles of Electric Power Utilization(OE-2)
5. Electric Vehicles and Hybrid Vehicles(OE-3)
6. Energy Storage Systems(OE-3)

After discussion and deliberation the committee approved the subjects along with the syllabi and passed the following resolution.

Resolution (3): The members after thorough discussion approved the syllabi of subjects offered to B. Tech. ECE, Mechanical and Civil Engineering Branches and Open Elective subjects offered to other Branches mentioned in Item 3 as per Annexure -II.

Noted and Approved.

Item No. 4: To discuss and decide substitute subjects for rejoined students of R20 regulation (VJIT Autonomous).

The Chairperson presented the substitute subjects for rejoining students of R20 ((VJIT Autonomous) as per Annexure - V

After discussing various aspects of the subjects the committee passed the following resolution

Resolution (4): The members after thorough discussion approved the substitute subjects for rejoined students of R20 (VJIT Autonomous) as per Annexure -III. The BoS Chairperson is authorized to choose and approve the substitute subjects for rejoined students.

Noted and Approved.

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Item No. 5: To approve the Panel of examiners

The Chairperson explained on the requirement and emphasized on the panel of examiners, whose services will be utilized, as and when required for preparation of the question paper for End Semester examination and also for evaluation of the Answer scripts of the End Semester Examinations. The panel of the examiners will be prepared in consultation with the senior faculty of the department. They will be paid remuneration as per the recommendations of College Finance Committee.

Resolution (5): The committee of BoS, after discussion, authorized the Chairperson of BoS to prepare the Panel of examiners, as and when required in consultation with the senior faculty members for both B. Tech. (EEE) courses under R20 regulations. The same may be submitted to the Examination branch (Autonomous) for further processing.

Noted and Approved.

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Annexure – I

Vidya Jyothi Institute of Technology

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Aziz Nagar Gate, C.B. Post, Hyderabad-500 075

R20 B.TECH EEE SECOND YEAR COURSE STRUCTURE

B. Tech. II Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 5	Complex Analysis & Fourier Transforms	3	0	0	3
2	H&S - 2	Professional Communication	3	0	0	3
3	ES – 5	Electronic Devices and Circuits	3	0	0	3
4	PC – 1	Network Analysis	3	0	0	3
5	PC – 2	Electro Magnetic Fields	3	0	0	3
6	PC – 3	Electrical Machines-I	3	0	0	3
7	PC Lab-1	Basic Simulation Tools Lab	0	0	2	1
8	PC Lab-2	Electrical Circuits Lab	0	0	2	1
9	MC – 1	Environmental Science/Gender Sensitization	2	0	0	0
Total			**20**	**0**	**4**	**20**

B. Tech. II Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 6	Numerical Methods and Partial Differential Equations	3	0	0	3
2	ES – 6	Switching Theory and Logic Design	3	0	0	3
3	PC – 4	Python for Electrical Engineers	2	0	0	2
4.	PC – 5	Electrical Machines-II	4	0	0	4
5	PC – 6	Power Systems – I	3	0	0	3
6	PC – 7	Control Systems	3	0	0	3
7	PC Lab-3	Electrical Machines-I Lab	0	0	2	1
8	PC Lab-4	Electronic Devices and Circuits Lab	0	0	2	1
9	MC – 2	Gender Sensitization/ Environmental Science	2	0	0	0
Total			**20**	**0**	**4**	**20**

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R20 B.TECH EEE THIRD YEAR COURSE STRUCTURE

B. Tech. III Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	H&S – 3	Managerial Economics and Financial Analysis	3	0	0	3
2	PC – 8	Power Systems- II	3	0	0	3
3	PC – 9	Power Electronics	3	0	0	3
4	PC – 10	Microprocessors and Interfacing Devices	3	0	0	3
5	PE – 1	AI Techniques in Electrical Engineering /Integrated Circuits and Applications/Electrical Energy Conservation and Auditing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines-II Lab	0	0	2	1
8	PC Lab – 6	Advanced Communication Skills Lab	0	0	2	1
9	VAC - 1	Personality Development & Behavioral Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	ES – 7	Essentials of Computer Networks	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Modern Power Electronics/ Advanced Control Systems / System Design using Verilog HDL	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	VAC - 2	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**20**	**0**	**4**	**21**

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R20 B.TECH EEE FOURTH YEAR COURSE STRUCTURE

B. Tech. IV Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -14	Electrical Measurements & Instrumentation	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE – 3	Electric Vehicles/Power Quality & FACTS/ Embedded Systems & IOT	3	0	0	3
4	PE – 4	Advanced Control of Electric Drives/ Programmable Logic Controllers & SCADA/ Smart Grids	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab - 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	PW-1	Mini Project	0	0	0	3
Total			**15**	**0**	**4**	**20**

B. Tech. EEE IV Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -16	Utilization of Electrical Energy	3	0	0	3
2	PC -17	Renewable Energy and Energy Storage Technologies	3	0	0	3
3	TS	Technical Seminar	2	0	0	2
4	CVV	Comprehensive Viva-Voce	0	0	0	2
5	PW-2	Major Project	0	0	0	10
Total			**8**	**0**	**0**	**20**

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R20 COURSE STRUCTURE (for FAST TRACK)

B. Tech. III Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	H&S – 3	Managerial Economics and Financial Analysis	3	0	0	3
2	PC – 8	Power Systems- II	3	0	0	3
3	PC – 9	Power Electronics	3	0	0	3
4	PC – 10	Microprocessors and Interfacing Devices	3	0	0	3
5	PE – 1	AI Techniques in Electrical Engineering /Integrated Circuits and Applications/Electrical Energy Conservation and Auditing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines-II Lab	0	0	2	1
8	PC Lab – 6	Advanced Communication Skills Lab	0	0	2	1
9	VAC – 1	Personality Development & Behavioral Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	ES – 7	Essentials of Computer Networks	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Modern Power Electronics/ Advanced Control Systems/ System Design using Verilog HDL	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	VAC – 2	Quantitative Methods & Logical Reasoning	2	0	0	1
10	PC -16	Utilization of Electrical Energy	3	0	0	3
Total			**23**	**0**	**4**	**24**

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R20 COURSE STRUCTURE (for FAST TRACK)

B. Tech. IV Year I Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	PC -14	Electrical Measurements & Instrumentation	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE – 3	Electric Vehicles/ Power Quality & FACTS/ Embedded Systems & IOT	3	0	0	3
4	PE – 4	Advanced Control of Electric Drives/ Programmable Logic Controllers & SCADA/ Smart Grids	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab - 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	PW-1	Mini Project	0	0	0	3
9	PC – 17	Renewable Energy and Energy Storage Technologies	3	0	0	3
Total			**18**	**0**	**4**	**23**

B. Tech. IV Year II Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	TS	Technical Seminar	2	0	0	2
2	CVV	Comprehensive Viva-Voce	0	0	0	2
3	PW-2	Major Project	0	0	0	10
Total			**2**	**0**	**0**	**14**

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B.TECH SECOND YEAR COURSE STRUCTURE & SYLLABUS

B. Tech. II Year I Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 5	Complex Analysis & Fourier Transforms	3	0	0	3
2	H&S - 2	Professional Communication	3	0	0	3
3	ES – 5	Electronic Devices and Circuits	3	0	0	3
4	PC – 1	Network Analysis	3	0	0	3
5	PC – 2	Electro Magnetic Fields	3	0	0	3
6	PC – 3	Electrical Machines-I	3	0	0	3
7	PC Lab-1	Basic Simulation Tools Lab	0	0	2	1
8	PC Lab-2	Electrical Circuits Lab	0	0	2	1
9	MC – 1	Environmental Science/Gender Sensitization	2	0	0	0
Total			**20**	**0**	**4**	**20**

B. Tech. II Year II Semester

S. No.	Course Category	Course Title	L	T	P	Credits
1	BS – 6	Numerical Methods and Partial Differential Equations	3	0	0	3
2	ES – 6	Switching Theory and Logic Design	3	0	0	3
3	PC – 4	Python for Electrical Engineers	2	0	0	2
4.	PC – 5	Electrical Machines-II	4	0	0	4
5	PC – 6	Power Systems – I	3	0	0	3
6	PC – 7	Control Systems	3	0	0	3
7	PC Lab-3	Electrical Machines-I Lab	0	0	2	1
8	PC Lab-4	Electronic Devices and Circuits Lab	0	0	2	1
9	MC – 2	Gender Sensitization/ Environmental Science	2	0	0	0
Total			**20**	**0**	**4**	**20**

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NETWORK ANALYSIS

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Apply network theorems for the analysis of electrical networks.
2. Obtain the transient and steady-state response of electrical circuits.
3. Examine graph theory to formulate network equations.
4. Analyze two port networks.
5. Evaluate circuits in the sinusoidal steady-state (Three-phase).

UNIT I

NETWORK THEOREMS (DC & AC), MESH AND NODAL ANALYSIS:

Analysis of Circuits using Mesh and Nodal methods, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and Compensation theorem.

UNIT II

D.C AND A.C TRANSIENTANALYSIS:

Transient response of R-L, R-C, R-L-C circuits (series and parallel) for D.C excitation- Initial conditions- Solution method using differential equation and Laplace transforms .
Transient response of R-L, R-C, R-L-C circuits (series and parallel) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms.

UNIT III

NETWORK TOPOLOGY:

Network Topology - Definitions, Graph, Tree, Incidence Matrix, Basic Cut Set and Basic Tie Set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Voltage and Current Sources, Duality & Dual Networks.

UNIT IV

TWO PORT NETWORKS:

Two port network parameters - Z, Y, ABCD and Hybrid parameters and their inter relations. Series, parallel and cascaded connection of two port networks, Concept of transformed network - Two port network parameters using transformed variables.

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NETWORK ANALYSIS

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Apply network theorems for the analysis of electrical networks.
2. Obtain the transient and steady-state response of electrical circuits.
3. Examine graph theory to formulate network equations.
4. Analyze two port networks.
5. Evaluate circuits in the sinusoidal steady-state (Three-phase).

UNIT I

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Analysis of Circuits using Mesh and Nodal methods, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and Compensation theorem.

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Transient response of R-L, R-C, R-L-C circuits (series and parallel) for D.C excitation- Initial conditions- Solution method using differential equation and Laplace transforms .

Transient response of R-L, R-C, R-L-C circuits (series and parallel) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms.

UNIT III

NETWORK TOPOLOGY:

Network Topology - Definitions, Graph, Tree, Incidence Matrix, Basic Cut Set and Basic Tie Set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Voltage and Current Sources, Duality & Dual Networks.

UNIT IV

TWO PORT NETWORKS:

Two port network parameters - Z, Y, ABCD and Hybrid parameters and their inter relations. Series, parallel and cascaded connection of two port networks, Concept of transformed network - Two port network parameters using transformed variables.

UNIT V

ANALYSIS OF THREE PHASE CIRCUITS:

Three phase Circuits – Generation of Three Phase Voltage - Review of Voltage and Current relations in Star and Delta systems. Analysis of balanced and unbalanced three phase circuits - Measurement of active and reactive power.

TEXT BOOKS

1. Circuit theory-analysis & synthesis, A. Chakrabarthy, Dhanpat Rai & Sons - 7th revised Edition.
2. Circuits & networks-analysis and synthesis, A. Sudhakar and Shyammohan S. Palli, Tata McGraw Hill-5thEdition.

REFERENCE BOOKS

1. Network analysis, Van Valkenburg, Prentice Hall-3rdEdition.
2. Network analysis, Mahmood Nahvi, Joseph Edminister, Schaum's Outline series, McGraw Hill Companies 4thEdition.
3. Electric circuit analysis, C.L.Wadhwa, New Age International-2ndEdition.

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ELECTRO MAGNETIC FIELDS

B. Tech. II Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the basic laws of electromagnetism.
2. Compare the electric and magnetic fields concepts for simple configurations under static conditions.
3. Illustrate time varying magnetic fields.
4. Examine Maxwell's equations in different forms and different media.
5. Apply electromagnetic concepts to electrical machines.

UNIT I

ELECTROSTATICS:

Vector Algebra - Coordinate Systems - Divergence theorem. Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) - EFI due to a line and a surface charge, work done in moving a point charge in an electrostatic field, Electric Potential, Properties of potential function, Potential gradient. Gauss's law - Application of Gauss's Law, Maxwell's first law, Laplace's equations and Poison's equations.

UNIT II

DIPOLE& CAPACITANCE:

Electric Dipole, Dipole moment, Polarization, Potential due to an Electric Dipole and Torque. Capacitance - Capacitance of parallel plate, spherical and co-axial capacitors with composite dielectrics. Energy stored and energy density in static electric field. Current density, conduction and Convection current densities, Ohm's law in point form, Equation of continuity.

UNIT III

MAGNETO STATICS, AMPERE'S CIRCUITAL LAW:

Biot-Savart's law - Magnetic field intensity (MFI) - MFI due to a straight current carrying filament- MFI due to circular and solenoid current Carrying wire, Relation between magnetic flux, magnetic flux density, Maxwell's second Equation.

Ampere's circuital Law & Applications:

Ampere's circuital law and its applications viz. - MFI due to an infinite sheet of current and a long current carrying filament, Point form of Ampere's circuital law - Curl-Stroke's Theorem, Maxwell's third equation.

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UNIT IV

FORCE IN MAGNETIC FIELDS, MAGNETIC POTENTIAL:

Magnetic force - Lorentz force equation – force on a current element in a magnetic field - Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying conductors – Magnetic dipole and dipole moment – Torque in a magnetic field. Scalar Magnetic potential and its limitations, vector magnetic potential and its properties.

UNIT V

INDUCTANCE, TIME VARYING FIELDS:

Self and Mutual inductances, Determination of self-inductance of a solenoid, toroid and mutual inductance between a straight long wire, Energy stored and Density in a Magnetic field. Time varying fields - Faraday's laws of electromagnetic induction, Maxwell's fourth equation - Simple problems, Modification of Maxwell's equations for time varying fields, Displacement current.

TEXT BOOKS

1. Engineering electromagnetics by William H. Hayt & John. A. Buck, McGraw Hill Companies-7th Edition, 2012.
2. Electromagnetic fields, Sadiku, Oxford Publications-7thEdition.

REFERENCE BOOKS

1. Engineering electromagnetics, J P Tewari, Khanna Publishers-2nd Edition, 2005.
2. Elements of electromagnetic fields, S. P. Seth, Dhanpat Rai & Co. (Pvt.) Ltd-2ndEdition.
3. Electromagnetic field theory, K. A. Gangadhar, P. M. Ramanathan, Khanna Publishers-16th Edition.

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ELECTRICAL MACHINES-I

L	T	P	C
3	0	0	3

B. Tech. II Year I Semester

Course Outcomes: At the end of this course, students will be able to

1. Understand different parts of DC Generators & understand its operation.
2. Explain the operation of DC motors.
3. Illustrate the different testing methods of DC machines.
4. Examine the constructional and operation of single phase transformers.
5. Analyze three phase transformers connections.

UNIT - I

D.C. Generators: Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E.M.F Equation. Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation. Methods of Excitation – separately excited and self-excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure of self-excitation and remedial measures. Load characteristics of shunt, series and compound generators.

UNIT – II

D.C Motors: Principle of operation – Back E.M.F. - Torque equation – characteristics and applications of shunt, series and compound motors – Necessity of starter, principle of operation of 3-point and 4-point starters with protective devices ,Speed control of D.C. Motors - Armature voltage and field flux control methods.

UNIT - III

Testing of DC Machines: Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency. Methods of Testing – direct, indirect, and regenerative testing – Brake test – Swinburne's test – Hopkinson's test – Field's test - separation of stray losses in a d.c. motor.

UNIT - IV

Single Phase Transformers: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

UNIT - V

Testing of Transformers and Poly-Phase Transformers: OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of core losses-parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/ Δ and open Δ

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TEXT BOOKS:

1. Theory and Performance of Electrical Machines, J.B. Gupta , S.K.Kataria & Sons , 2013.
2. Electrical Machines, R.K.Rajput Laxmi Publications (P) Ltd, 2004.

REFERENCE BOOKS:

1. Electrical Machinery, P. S. Bimbhra, Khanna Publishers, 2011.
2. Electric Machines, I. J. Nagrath and D. P. Kothari McGraw Hill Education, 2010.
3. Electrical Machines III, **M.V.Bakshi & U.A.Bakshi, Technical Publications.**

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BASIC SIMULATION TOOLS LAB

B. Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of laboratory course, the student will be able to

1. Correlate the data using plots.
2. Verify network theorems.
3. Observe transient response of series circuits.
4. Simulate rectifier circuits.
5. Analyze networks using network theorems.

Any Ten of the following experiments should be conducted

1. Basic operation on matrices.
2. Basic 2D plots of simple equations.
3. Find loop currents using mesh analysis.
4. Find node voltage using nodal analysis.
5. Transient analysis of RL series circuit.
6. Transient analysis of RC series circuit.
7. Transient analysis of RLC series circuit.
8. Analysis of half wave rectifier with and without filter.
9. Analysis of full wave rectifier with and without filter.
10. Verification of Thevenin's theorem.
11. Verification of Maximum power transfer theorem.
12. Verification of super position theorem.

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ELECTRICAL CIRCUITS LAB

B. Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Evaluate response in a given network by using network theorems.
2. Analyze complex DC and AC linear circuits.
3. Apply concepts of electrical circuits.
4. Evaluate active power and reactive power of electric circuits.
5. Determine two port network parameters.

Any Ten of the following experiments should be conducted

1. Measurement of voltage, current and equivalent resistance of various circuits.
2. Verification of Norton's theorem.
3. Verification of maximum power transfer theorem on DC excitation.
4. Verification of compensation theorem.
5. Verification of reciprocity theorem & Millman's theorem.
6. Resonance in series and parallel R, L, C circuits.
7. Determination of self-inductance, mutual inductance and coefficient of coupling.
8. Locus diagrams of series RL and RC circuits.
9. Calculation of RMS, average values, form factor and peak factor of complex waveform.
10. Determination of Z & Y parameters.
11. Determination of transmission & hybrid parameters.
12. Measurement of active power for three phase balanced loads.
13. Measurement of reactive power for three phase balanced loads.

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PYTHON FOR ELECTRICAL ENGINEERS

B. Tech. II Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand the applications of Python programming in the area of electrical and electronics engineering.
2. Write programs on functions, modules and packages.
3. Apply Lists, Tuples, Dictionaries and matrix operations in Python
4. Enhance logical thinking and implementation of the electrical and electronic principles into a working code.

UNIT – I

Introduction to Python:

History of python, Features of Python Language, understanding wide range of Python applications, Literal Constants, Comments, Reserved Words, Variables and Identifiers, Data Types, functions (Arguments, Return & In-built functions), Operations (Integers and floats, Strings, Type Conversions & Booleans), Expressions, Type Conversion.

Control Statements: Selection / Conditional Branching Statements, Loops (IF, IF - else &elif, for and while). Break and continue.

UNIT – II

Functions and Modules:

Function Definition, Function Calling, return statement, Types of Arguments: Required, Keyword, Default Variable-length, Pandas and NumPy Packages in Python, Doc Strings.

Lists: Basic operations, list methods, looping in lists, Dictionaries, Tuples, Sets, Arrays, Exceptions,

Tuples: Creating Tuple, Accessing Values in a Tuple, Basic Tuple Operations, Nested Tuples, index() and count() methods of tuple, Variable-length Argument Tuples, zip() Function, Advantages of Tuple over List.

UNIT – III

Dictionaries: Creating a Dictionary, Accessing Values, Modifying an Entry, Deleting Items, Sorting Items in a Dictionary, Nested Dictionaries, Built-in Dictionary Functions and Methods.Difference between a List and a Dictionary

NumPy package: Array, Matrix and associated operations, Linear algebra and related operations, Data visualization on dataset using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

UNIT – IV

Boolean Algebra& Logic Gates: Boolean operations, Boolean functions, Algebraic manipulations, Min-terms and Max terms, Sum-of-products and Product-of-sum representations, Two-input logic gates, NAND /NOR implementations using Python programming.

Implementation of Network Theorems: D.C Circuits & Network Theorems: Superposition theorem, Reciprocity theorem, Thevenin's and Norton's theorem, and Maximum Power Transfer Theorem.

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UNIT – V

An Engineering perspective: Simulating a basic resistive circuit, The working of a diode using simulations, Basics of magnetic and electric fields. Study of inductors and capacitors, Phasor diagrams, writing control functions using Python, Simulating a transformer and magnetic circuits.

Text Books

1. Python Programming using Problem Solving Approach, Reema Thareja, First Edition, Oxford Higher Education.
2. Circuit theory-analysis & synthesis, A. Chakrabarthy, Dhanpat Rai & Sons - 7th revised Edition.

Reference Books

1. Fundamentals of Python, Kenneth A.Lambert
2. The Joy Of Computing UsingPython[NPTEL], Prof. Sudarshanlyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad (05-01 2021), Available:https: // nptel.ac.in /courses/ 106/106/106106 182/#
3. Python OOP Tutorials - Working with Classes, (05-01-2021) Prof. Kannan Moudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM], (05-01-2021), Available: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview[4].Corey Schafer

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ELECTRICAL MACHINES – II

B. Tech. II Year II Semester

L	T	P	C
4	0	0	4

Course Outcomes: At the end of this course, students will be able to

1. Understand the concepts of poly phase induction machines.
2. Examine the operation of induction motors.
3. Analyze performance characteristics of synchronous machines.
4. Evaluate the performance characteristics of Synchronous Generators
5. Assess the construction and operation of synchronous motors and special machines

UNIT - I

Poly-Phase Induction Machines: Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation. Induction generator-principle of operation(elementary treatment only).

UNIT - II

Characteristics of Induction Motor: Rotor power input, rotor copper loss and mechanical power developed. Torque equation- expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram-crawling and cogging - No-load Test and Blocked rotor test –Predetermination of performance-Methods of starting and starting current and Torque calculations.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, and injection of an EMF into rotor circuit (qualitative treatment only)

UNIT - III

Synchronous Machines: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings –distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT-IV

Regulation and Parallel operation of Synchronous Machine:

Regulation: Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction concept – experimental determination of X_d and X_q (Slip test).

Parallel Operation of Synchronous Machines: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input.

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UNIT-V

Synchronous Motors and Special Machines:

Synchronous Motors: Theory of operation –Methods of starting- phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed - hunting and its suppression –synchronous induction motor.

Special Machines:

Principles of operation of Reluctance Motors, Permanent magnet Brushless DC Motors.

TEXT BOOKS:

1. J.B. Gupta , "Theory and Performance of Electrical Machines", S.K.Kataria & Sons , 2013.
2. R.K.Rajput, "Electrical Machines", Laxmi Publications (P) Ltd, 2004.

REFERENCE BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

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POWER SYSTEMS – I

B. Tech. II Year I Semester

L	T	P	C
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Course Outcomes: At the end of the course, the student will be able to

1. Understand the principle of generation of electric power in thermal, hydro, nuclear and gas power stations.
2. Apply concepts in distribution systems to solve problems.
3. Interpret the arrangement and operation of AIS and GIS substations.
4. Analyze methods to improve the power factor and voltage control.
5. Evaluate various power tariff methods.

UNIT I

POWER STATIONS:

Thermal Power Stations: Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses. Brief description of TPS components-Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and cooling towers.

Hydel Power Stations: Schematic Arrangement, Brief description of Hydraulic Structures, Water turbines.

Nuclear Power Stations: Nuclear Fission and Chain reaction, Nuclear fuels, Principle of operation of Nuclear reactor, Reactor Components- Moderators, Control rods, Reflectors and Coolants, Radiation hazards- Shielding and Safety precautions, Types of Nuclear reactors and brief description of PWR,BWR and FBR.

Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only).

UNIT II

D.C & A.C DISTRIBUTION SYSTEMS:

D.C Distribution Systems: Classification of Distribution Systems - Comparison of DC vs. AC and Under-Ground vs. Over -Head Distribution Systems- Requirements and Design features of Distribution Systems Voltage, Drop Calculations (Numerical Problems in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal voltages) and Ring Main Distributor.

Distribution Systems: Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to related load voltages.

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UNIT III

AIR INSULATED & GAS INSULATED (GIS) SUBSTATIONS:

Classification of substations: - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single busbar, sectionalized single busbar, main and transfer busbar system with relevant diagrams.

Gas Insulated Substations (GIS): Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, busbar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT IV

POWER FACTOR & VOLTAGE CONTROL:

Causes of low power factor – Methods of Improving power factor – Phase advancing and generation of reactive KVAR using static Capacitors – Most economical power factor for constant KW load and constant KVA type loads, Numerical Problems. Dependency of Voltage on Reactive Power flow- Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers.

UNIT V

ECONOMIC ASPECTS OF POWER GENERATION & TARIFF:

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.

Tariff methods: Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method-Tariff Methods: Flat Rate, Block- Rate, two-part, three-part, and power factor tariff methods and Numerical Problems.

TEXT BOOKS:

1. A text book on power system engineering, A.Chakrabarthi, M.L.Soni, P.V.Gupta and M.L Soni, DhanpathRai and Sons-2016 Edition
2. Principles of power systems, V.K.Mehtha and Rohit Mehtha, S.Chand Company Pvt. Ltd, 2005, RevisedEdition

REFERENCE BOOKS:

1. Generation, distribution and utilization of electrical energy, C.L.Wadhwa, New Age International-3rd Edition.
2. A course in power systems, J.B.Gupta, S.K. Kataria&Sons-11thEdition.
3. A text book of power system engineering, R.K. Rajput, Laxmi Publications (P) Limited-1st Edition.

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CONTROL SYSTEMS

B. Tech. II Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand the fundamentals of classical control systems.
2. Apply transfer function reduction techniques and Time response analysis for standard test signals.
3. Examine stability and frequency responses of first and second-order systems.
4. Classify different types of Controller design.
5. Represent linear time systems in State space

UNIT I

INTRODUCTION TO CONTROL PROBLEM:

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Transfer function of DC & AC Servomotors, Synchros, Magnetic Amplifiers, Stepper Motor and its use in Control Systems.

UNIT II

TRANSFER FUNCTION REDUCTION TECHNIQUES

Block diagram algebra and Signal Flow Graph

TIME RESPONSE ANALYSIS OF STANDARD TEST SIGNALS:

Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response.

UNIT III

CONCEPT OF STABILITY

Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

FREQUENCY-RESPONSE ANALYSIS:

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion - gain and phase margin. Closed-loop frequency response.

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UNIT IV

INTRODUCTION TO CONTROLLER DESIGN:

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

UNIT V

STATE VARIABLE ANALYSIS AND CONCEPTS OF STATE VARIABLES:

State space model. Diagonalization of State Matrix. Solution of state equations. Properties of State Transition Matrix, Eigen values and Stability Analysis. Transfer Function from state model, Concept of controllability and observability. Pole-placement by state feedback.

TEXT BOOKS:

1. Control Systems Engineering, I.J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers-2nd Edition.
2. Control Systems, Nagoorkani – RBA Publications - 2nd Edition.

REFERENCE BOOKS:

1. Automatic Control Systems, B. C. Kuo, John wiley and sons-8th Edition.
2. Control Systems, N.C.Jagan, BS Publications-2nd Edition.
3. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd.-3rd Edition.

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ELECTRICAL MACHINES - I LAB

B. Tech. II Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Start and control the Different types of DC motors.
2. Assess the performance of different types of DC machines using different testing methods.
3. Identify different conditions required to be satisfied for self - excitation of DC Generators.
4. Separation losses of DC motor into different components.
5. Analyze the performance of coupled machines.

Any 10 out of the following 12 experiments should be conducted:

1. Magnetization characteristics of a DC shunt generator.
2. Load test on DC shunt generator.
3. Load test on DC compound generator.
4. Load test on DC series generator.
5. Brake test on DC compound motor.
6. Hopkinson's test on DC Shunt machines.
7. Field's test on DC Series machines.
8. Separation of losses in DC shunts motor.

In addition to the above eight experiments at least any two of the following experiments are required to be conducted from the following list.

1. Retardation test on DC shunt motor.
2. Speed control of DC shunt motor.
3. Swinburne's test on DC shunt machine.
4. Brake Test on DC shunt Motor.

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R20 B.TECH THIRD YEAR COURSE STRUCTURE

B. Tech. III Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	H&S – 3	Managerial Economics and Financial Analysis	3	0	0	3
2	PC – 8	Power Systems- II	3	0	0	3
3	PC – 9	Power Electronics	3	0	0	3
4	PC – 10	Microprocessors and Interfacing Devices	3	0	0	3
5	PE – 1	Artificial Intelligence Techniques in Electrical Engineering /Integrated Circuits and Applications/Electrical Energy Conservation and Auditing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines-II Lab	0	0	2	1
8	PC Lab – 6	Advanced Communication Skills Lab	0	0	2	1
9	VAC - 1	Personality Development & Behavioral Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	ES – 7	Essentials of Computer Networks	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Modern Power Electronics/ Advanced Control Systems/ System Design using Verilog HDL	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	VAC - 2	Quantitative Methods & Logical Reasoning	2	0	0	1
Total			**20**	**0**	**4**	**21**

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R20 COURSE STRUCTURE (for FAST TRACK)

B. Tech. III Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	H&S – 3	Managerial Economics and Financial Analysis	3	0	0	3
2	PC – 8	Power Systems- II	3	0	0	3
3	PC – 9	Power Electronics	3	0	0	3
4	PC – 10	Microprocessors and Interfacing Devices	3	0	0	3
5	PE – 1	Artificial Intelligence Techniques in Electrical Engineering /Integrated Circuits and Applications/Electrical Energy Conservation and Auditing	3	0	0	3
6	OE – 1	Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection	3	0	0	3
7	PC Lab – 5	Electrical Machines-II Lab	0	0	2	1
8	PC Lab – 6	Advanced Communication Skills Lab	0	0	2	1
9	VAC – 1	Personality Development & Behavioral Skills	2	0	0	1
Total			**20**	**0**	**4**	**21**

B. Tech. III Year II Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	ES – 7	Essentials of Computer Networks	3	0	0	3
2	PC – 11	Computer Methods in Power Systems	3	0	0	3
3	PC – 12	Power Semiconductor Drives	3	0	0	3
4	PC – 13	Switch Gear and Protection	3	0	0	3
5	PE – 2	Modern Power Electronics/ Advanced Control Systems/ System Design using Verilog HDL	3	0	0	3
6	OE – 2	Energy Auditing and Conservation/Principles of Electric Power Utilization	3	0	0	3
7	PC Lab – 7	Control Systems and Simulation Lab	0	0	2	1
8	PC Lab – 8	Power Electronics and Simulation Lab	0	0	2	1
9	VAC – 2	Quantitative Methods & Logical Reasoning	2	0	0	1
10	PC -16	Utilization of Electrical Energy	3	0	0	3
Total			**23**	**0**	**4**	**24**

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POWER SYSTEMS – II

B. Tech. II Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand transmission line parameters.
2. Observe the performance of transmission lines.
3. Analyze transient behavior of transmission lines.
4. Evaluate mechanical design of transmission lines.
5. Understand the construction, grading and capacitance of underground cables.

UNIT I

TRANSMISSION LINE PARAMETERS:

Types of conductors, calculation of resistance for solid conductors, Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT II

PERFORMANCE OF SHORT, MEDIUM AND LONG LENGTH TRANSMISSION LINES:

Classification of Transmission Lines Short, medium and long line and their model representations Nominal-T, Nominal-Pie A, B, C, D Constants for symmetrical & Asymmetrical Networks, Numerical Problems. Mathematical Solutions to estimate regulation and efficiency of all types of lines, Numerical Problems. **Long Transmission Line:** Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves - Representation of Long Lines - Equivalent-T and Equivalent Pie network models (numerical problems).

UNIT III

POWER SYSTEM TRANSIENTS:

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Incident, Reflected and Refracted Waves - Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

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UNIT IV

FACTORS GOVERNING THE PERFORMANCE OF TRANSMISSION LINES, TRANSMISSION LINE INSULATORS, SAG AND TENSION CALCULATIONS:

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect- Charging Current - Effect on Regulation of the Transmission Line. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Types of Insulators, String efficiency and Methods for improvement, Numerical Problems voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT V

UNDERGROUND CABLES:

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

TEXT BOOKS:

1. Electrical power systems, C. L. Wadhwa, New Age International (P) Limited, Publishers.
2. Principles of Power Systems, V. K. Mehta and Rohit Mehta, S. Chand Company Pvt. Ltd, 2005.

REFERENCE BOOKS:

1. A Text Book on Power System Engineering, M.L.Soni, P.V. Gupta, U.S. Bhatnagar, A. Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Power System Engineering, I.J. Nagarath and D.P. Kothari, TMG.
3. Power System Analysis and Design, Dr. B. R. Gupta, S. Chand & Company Limited.

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POWER ELECTRONICS

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3	0	0	3

B. Tech. III Year I Semester

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

1. Understand about various power electronic devices and their commutation procedure.
2. Discuss the operation of various single phase-controlled converters.
3. Examine operation of various three phase-controlled converters and AC voltage controllers.
4. Identify the operation of DC-DC converters.
5. Analyze the operation of DC-AC converters.

UNIT I
POWER SEMI CONDUCTOR DEVICES & COMMUNICATION CIRCUITS:

THYRISTORS: Silicon Controlled Rectifiers (SCR's), BJT, Power MOSFET, Power IGBT, their characteristics and other thyristors. Basic theory of operation of SCR, Static characteristics, Turn on and turn off methods. Dynamic characteristics of SCR - Turn on and Turn off times - Salient points. Two transistor analogy. UJT firing circuit, Series and parallel connections of SCR's, Snubber circuit details – Specifications .Ratings of SCR's, BJT and IGBT - Line Commutation and Forced Commutation circuits. Numerical problems

UNIT II
AC-DC CONVERTERS (1-PHASE CONTROLLED RECTIFIERS):

Phase control techniques, Single phase Line commutated converters, Midpoint and Bridge connections, Half controlled converters with R, RL and RLE loads. Derivation of average load voltage and current-Active and Reactive power inputs to the converters without and with Freewheeling Diode Numerical problems. Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load Derivation of average load voltage and current Line commutated inverters -Active and Reactive power inputs to the converters without and with Freewheeling Diode, Effect of source inductance- Derivation of load voltage and current. Numerical problems.

UNIT III
AC-DC CONVERTERS (3-PHASE CONTROLLED RECTIFIERS):

THREE PHASE CONVERTERS: Three pulse and six pulse converters, Midpoint and bridge connections- average load voltage With R and RL loads, effect of Source inductance. Dual converters (both single phase and three phase) Waveforms. Numerical Problems.

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AC-AC CONVERTERS (AC VOLTAGE CONTROLLERS) & FREQUENCYCHANGERS (CYCLO-CONVERTERS):

AC VOLTAGE CONTROLLERS: Single phase two SCR's in anti-parallel with R and RL loads. Modes of operation of Triac, Triac with R and RL loads - Derivation of RMS load voltage, current and power factor wave forms. Firing circuits -Numerical problems – **CYCLOCONVERTERS:** Single phase mid-point cyclo-converters with Resistive and inductive loads. (Principle of operation only) Bridge configuration of single phase cyclo- converter (Principle of operation only) Waveforms.

UNIT IV

DC-DC CONVERTERS (CHOPPERS):

CHOPPERS: Time ratio control and Current limit control strategies. Step down choppers- Derivation of load voltage and currents with R, RL and RLE loads. Step up Chopper – load voltage expression. Jones chopper, AC Chopper, Problems. Switched Mode Regulator - SMPS (Basic Principle of Operation).

UNIT V

DC-AC CONVERTERS (INVERTERS):

INVERTERS: Single phase inverter, basic series inverter, parallel inverter - operation and waveforms .Three phase inverters (180, 120 degrees conduction modes of operation). Voltage control techniques for inverters, Pulse width modulation techniques. Numerical problems.

TEXT BOOKS:

1. Power electronics, Dr. P. S. Bimbhra, Khanna Publishers, 3rd edition.
2. Power electronics, circuits, devices and applications, M. H. Rashid, Prentice Hall of India, 4th edition.

REFERENCE BOOKS:

1. Power electronics devices, circuits and industrial applications, V. R. Moorthi, Oxford University Press.
2. Power electronics, M. D. Singh &K. B. Kanchandhani, Tata McGraw - Hill Publishing Company, 1998,
3. Power electronics, Vedam Subramanyam, New Age International (P) Limited Publishers, 2nd edition.

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ARTIFICIAL INTELLIGENCE TECHNIQUES IN ELECTRICAL ENGINEERING

(Professional Elective-1)

B. Tech. III Year II Semester

L	T	P	C
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Course Outcomes: At the end of the course, the student will be able to

1. Understand artificial neural networks.
2. Generalize feed forward neural networks, feedback neural networks and learning techniques.
3. Identify fuzziness involved in various systems and fuzzy set theory.
4. Discover fuzzy logic control for applications in electrical engineering.
5. Interpret genetic algorithm for applications in electrical engineering.

UNIT I

ARTIFICIAL NEURAL NETWORKS:

Introduction, Models of Neuron Network-Architectures Knowledge representation, Artificial Intelligence and Neural networks–Learning process-Error correction learning, Hebbian learning Competitive learning-Boltzman learning, supervised learning-Unsupervised learning. Reinforcement learning - Learning tasks.

UNIT II

ANN PARADIGMS:

Multi-layer perceptron using Back propagation Algorithm (BPA), Self –Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT III

FUZZYLOGIC:

Introduction: Fuzzy versus crisp, Fuzzy sets-Membership function –Basic Fuzzy set operations, Properties of Fuzzy sets. Fuzzy Cartesian Product, Operations on Fuzzy relations Fuzzy logic, Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT IV

GENETIC ALGORITHMS:

Introduction-Encoding Fitness Function-Reproduction operators, Genetic Modeling Genetic operators-Cross over-Single site cross over, Two point cross over Multi point cross over Uniform cross over, Matrix cross over-Crossover Rate-Inversion & Deletion, Mutation operator Mutation Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.

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UNIT V

APPLICATIONS OF AI TECHNIQUES:

Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

TEXT BOOKS:

1. Neural networks, fuzzy logic and genetic algorithms, S.Rajasekaran and G.A.V.Pai PHI, New Delhi.
2. Neural networks: A comprehensive foundation, Simon O Haykin, International Edition- 2nd Edition.

REFERENCE BOOKS:

1. Neural computing theory & practice, P.D.Wasserman & Van Nostrand Reinhold, New York.
2. Neural network & fuzzy system, Bart Kosko, PrenticeHall.
3. Genetic algorithms, D.E.Goldberg, Pearson Education.

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ELECTRICAL ENERGY CONSERVATION AND AUDITING

(Professional Elective-1)

B. Tech. III Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the current energy scenario and importance of energy conservation.
2. Apply the concepts of energy management.
3. Evaluate energy efficiency in different electrical systems.
4. Describe the energy audit of different energy systems.
5. Analyze the energy audit of different energy systems.

UNIT I

ENERGY SCENARIO:

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution and climate change. Energy Conservation Act- 2001 and its features.

UNIT II

BASICS OF ENERGY AND ITS VARIOUS FORMS:

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT III

ENERGY MANAGEMENT & AUDIT:

Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

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Energy Efficiency in Electrical Systems

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT IV

ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS:

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and saving opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies energy saving opportunities and assessment of cooling towers.

UNIT V

ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS:

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls and energy saving potential of each technology.

TEXT BOOKS:

1. Guide books for national certification examination for energy manager/energy auditors' book-1, general aspects.
2. Guide books for national certification examination for energy manager/energy auditors' book-3, electricalutilities.

REFERENCE BOOKS:

1. Utilization of electrical energy and conservation, S. C. Tripathy, McGraw Hill.
2. Success stories of energy conservation by BEE, New Delhi.

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NON CONVENTIONAL ENERGY SOURCES
(Open Elective-1)

B. Tech. III Year I Semester

L	T	P	C
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Course Outcomes: At the end of the course, the student will be able to

1. Realize the importance of renewable energy sources for energy planning.
2. Understand the value of solar energy potential and exploit the solar energy for real world applications.
3. Describe the potential of wind energy, types of wind mills, performance characteristics and Betz criteria.
4. Analyze the potential of both tidal and ocean thermal energies and learn the extraction methods.
5. Know the potential of geothermal, bio-mass energies and learn relevant extraction methods.

UNIT I
PRINCIPLE OF RENEWABLE ENERGY:

Comparison of renewable and conventional energy sources, ultimate energy sources, natural energy currents on earth, primary supply to end use, spaghetti & pie diagrams,energy planning-energy efficiency and management.

UNIT II
SOLAR RADIATION:

Extra-terrestrial and terrestrial solar radiation, solar thermal conversion, solar thermal central receiver, photovoltaic energy conversion, solar cell configurations.

UNIT III
WIND ENERGY:

Planetary and local winds, vertical and horizontal axis wind mills, principles of wind power-maximum power and actual power, wind turbine operation - Sources and potentials, horizontal and vertical axis windmills, performance characteristics and Betz criteria.

UNIT IV
ENERGY FROM OCEANS:

Ocean thermal energy- principles of OTEC plant operations. Wave energy-devices for energy extraction. Tides: types of tidal stations.

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UNIT V

GEOTHERMAL AND BIO FUEL ENERGY:

Origin and types Bio fuels. Direct combustion for heat and electricity generation- anaerobic digestion for biogas-biogas digester and power generation.

TEXT BOOKS:

1. Renewable energy sources, John Twidell &Timey &Weir.Rouledge Talylor &Francis group London & New York.
2. Non-conventional energy sources, G.D. Rai, Khanna publications.

REFERENCE BOOKS:

1. Power plant technology, EL-Wakil, McGraw-Hill.
2. Renewable energy resources: basic principles and applications, G.N.Tiwari, M K. Ghosal, Narosa publishers.
3. Energy conversion systems, Rakosh das Begamudre, New age International publishers.

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FUNDAMENTALS OF ELECTRICAL POWER GENERATION AND PROTECTION

(Open Elective-1)

B. Tech. III Year I Semester

L	T	P	C
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Course Outcomes: At the end of the course, the student will be able to

1. Interpret the operation of thermal power station through its schematic diagram.
2. Observe the arrangement of hydroelectric power station through its components.
3. Examine various components of nuclear power station.
4. Describe the operation of gas and diesel power station through its schematic diagram.
5. Differentiate various power system protection components.

UNIT I

THERMAL POWER STATIONS:

Introduction to Generating stations -Steam Power Stations, advantages and disadvantages, Schematic arrangement of Steam power system, choice of site of steam power station, efficiency of steam power station and equipment of steam power station.

UNIT II

HYDRO ELECTRIC POWER STATION:

Introduction, advantages and disadvantages, Schematic arrangement of hydro electric power station, Choice of site for Hydro electric power station, constituents of hydro electric power station and pumped storage plants.

UNIT III

NUCLEAR POWER STATIONS:

Introduction, advantages and disadvantages, selection of site for nuclear power station, nuclear fission and chain reaction. Nuclear fuels, principle of operation of nuclear reactor, schematic arrangement of nuclear power stations, components of Nuclear Power plant, radiation hazards: Shielding and Safety precautions.

UNIT IV

GAS AND DIESEL POWER STATION:

Gas Turbine Power Station: Introduction, advantages, disadvantages, Schematic arrangement of gas turbine power station. Diesel Power station: Introduction, advantages, disadvantages, schematic arrangement of diesel power station.

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UNIT V

INTRODUCTION TO POWER SYSTEM PROTECTION COMPONENTS (ELEMENTARY TREATMENT ONLY):

Fuses-Definition, advantages, disadvantages of fuses, desirable characteristics of fuses, fuse element materials and important terms. Circuit Breakers: definition, important terms and Comparison of fuse and Circuit breaker Isolators: Protective relay, Requirement of Protective relay, electrical Hazards and need of earthing.

TEXT BOOKS:

1. Principles of power systems, V.K Mehta and Rohit Mehta, S. Chand Company Pvt. Ltd, New Delhi-4thEdition.
2. A course in power systems, J.B. Gupta, S.K. Kataria & Sons.

REFERENCE BOOKS:

1. A text book of power system engineering, R. K. Rajput, Laxmi Publications (P)Limited.
2. Electrical Power Generation: Transmission and distribution, S.N. Singh, PHI.
3. Generation of electrical energy, B.R. Gupta, S. Chand.

ELECTRICAL MACHINES – II LAB

B. Tech. III Year I Semester

L	T	P	C
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Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Understand the basic working principle of a transformer; obtain the equivalent circuit parameters, estimate efficiency & regulation at various loads of 1-Φ transformers.
2. Examine load sharing of transformers & conversion of 3- Φ to 2- Φ supply.
3. Determine the equivalent circuit parameters of a single phase induction motor; determine the performance characteristics and efficiency by direct and indirect methods of three phase induction motor.
4. Analyze the regulation of an alternator by various methods at different power factors.
5. Assess synchronous motor performance curves at various power factors and field currents.

Any Ten of the following experiments are required to be conducted.

1. Sumpner's test on a pair of single phase transformer.
2. Separation of core losses of a single phase transformer.
3. Scott connection of transformer and Parallel operation of single phase transformer.
4. No-load & Blocked rotor tests on three phase induction motor.
5. Regulation of a three – phase alternate by synchronous impedance M.M.F methods.
6. V and inverted V curves of a three – phase synchronous motor.
7. Equivalent circuit of a single phase induction motor.
8. Determination of Xd and Xq of a salient pole synchronous machine.

In addition to the above eight experiments at least any two of the following experiments are required to be conducted from the following list.

9. Regulation of three phase alternator by Z.P.F. and A.S.A methods.
10. Determination of sequence impedances of a three-phase alternator.
11. Determination of sequence impedances of a three-phase transformer.
12. Speed control of three phase slip ring Induction Motor.

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COMPUTER METHODS IN POWER SYSTEMS

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Demonstrate the knowledge and ability to develop Y-bus and Z-bus matrices.
2. Apply the concepts of load flow studies.
3. Analyze different types of faults
4. Identify power system steady state stability of power system.
5. Investigate methods to improve transient state stability of power system.

UNIT I

POWER SYSTEM NETWORK MATRICES:

Graph Theory: Definitions, Bus Incidence Matrix, Y-bus formation by Singular Transformation Methods and Direct Inspection methods, Numerical Problems.

FORMATION OF Z-BUS: Partial network, Algorithm for the Modification of Z-bus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses (Numerical Problems). Modification of Z-bus for the changes in network (Problems).

UNIT II

POWER FLOW STUDIES:

Necessity of Power Flow Studies Data for Power Flow Studies Derivation of Static load flow equations, classification of Buses and their relevance to Power Flow.

LOAD FLOW SOLUTION USING GAUSS SEIDEL METHOD: Acceleration Factor, Load flow solution without and with P-V buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3- Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

NEWTON RAPHSON METHOD IN RECTANGULAR AND POLAR CO-ORDINATES FORM: Load Flow Solution without and with PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart (Max. 3-Buses).

DECOUPLED AND FAST DECOUPLED METHODS: Comparison of Different Methods DC load Flow.

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UNIT III

SHORT CIRCUIT ANALYSIS:

PER-UNIT SYSTEM OF REPRESENTATION: Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Needs and assumptions for short circuit analysis.

SYMMETRICAL FAULT ANALYSIS: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.

SYMMETRICAL COMPONENT THEORY: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances. Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.

UNSYMMETRICAL FAULT ANALYSIS: LG, LL, LLG faults without and with fault impedance, Numerical Problems.

UNIT IV

STEADY STATE STABILITY ANALYSIS:

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Description of Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State stability and methods to improve steady state stability.

UNIT V

TRANSIENT STABILITY ANALYSIS:

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Case study sudden loss of parallel lines, Critical Clearing Angle Calculation Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability Application of Auto Reclosing and Fast Operating Circuit Breakers.

TEXT BOOKS:

1. Power system analysis, Dr. N. V. Ramana, Pearson Education India.
2. Computer methods in power system analysis, Stagg and EL-Abiad, McGrawHill

REFERENCE BOOKS:

1. Modern power system analysis, I. J. Nagrath & D.P. Kothari, Tata McGraw Hill Publishing Company-4thEdition
2. Power system analysis, A. Nagoorkani, RBA Publications-3rdEdition
3. Power system analysis and stability, S. S. Vadhera, Khanna Publications

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POWER SEMICONDUCTOR DRIVES

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B. Tech. III Year II Semester

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

1. Understand the concepts of the dynamics of electric drives and speed control of different types of DC drives.
2. Examine four quadrant operation to control speed of DC drives using dual converters.
3. Classify four quadrant operation to control speed of DC drives using choppers.
4. Compare speed control methods of induction motor drives.
5. Investigate speed control methods of synchronous motor drives.

UNIT I

CONTROL OF DC MOTORS THROUGH PHASE CONTROLLED RECTIFIERS:

Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to DC separately excited and DC series motors -continuous current operation output voltage and current waveforms- Speed and Torque expressions Speed Torque Characteristics- Problems on Converter fed DC motors. Three phase semi and fully controlled converters Connected to DC separately excited and DC series motors output voltage and current waveforms Speed and Torque expressions Speed Torque characteristics - Problems.

UNIT II

FOUR QUADRANT OPERATIONS OF DC DRIVES THROUGH DUAL CONVERTERS:

Introduction to Four quadrant operation Motoring operations, Electric Braking Plugging, Dynamic and Regenerative Braking operations, Four quadrant operation of D C motors by dual converters Closed loop operation of DC motor (Block Diagram Only).

UNIT III

CONTROL OF DC MOTORS BY CHOPPERS (1, 2, 4 QUADRANT OPERATIONS):

Single quadrant, Two quadrant and four quadrant chopper fed separately excited and series exacted motors Continuous current operation Output voltage and current wave forms Speed torque expressions speed torque characteristics Problems on Chopper fed DC Motors Closed Loop operation (Block Diagram Only).

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UNIT IV
CONTROL OF INDUCTION MOTORS:

Variable voltage& Frequency Characteristics: Control of Induction Motor by AC Voltage Controllers Waveforms speed torque characteristics. Variable frequency control of induction motor by Voltage source and current source Inverter and cyclo-converters- PWM control - Comparison of VSI and CSI operations Speed torque Characteristics numerical problems on induction motor drives Closed loop operation of induction motor delves (Block Diagram Only).

Static rotor resistance control: Slip power recovery Static Scherbius drive Static Kramer Drive their performance and speed torque characteristics advantages applications - problems.

UNIT V
CONTROL OF SYNCHRONOUS MOTORS:
Separate control & self-control of synchronous motors Operation of self-controlled synchronous motors by VSI and CSI Cycloconverters. Load commutated CSI fed Synchronous Motor - Operation Waveforms speed torque characteristics Applications -Advantages and Numerical Problems Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control, Cycloconverter, PWM, VFI, CSI. Principle of operation of BLDC motor drive.

TEXT BOOKS:

1. Fundamentals of electrical drives, G. K. Dubey, Alpha Science International Limited-2nd Edition.
2. Power Semiconductor Drives, J. Gnanavadivel, Anuradha Publications.

REFERENCE BOOKS:

1. Power semiconductor drives, PV Rao, BS Publications.
2. Thyristor control of electric drives, Vedam Subramanyam, Tata McGraw Hill Publications.
3. A first course on electrical drives, S K Pillai, New Age International (P) Ltd-2nd Edition

SWITCH GEAR AND PROTECTION

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand basic working of circuit breaker and classification of circuit breakers.
2. Examine different types of circuit breakers in power systems.
3. Analyze Principle of operation of over current, directional, differential and distance relays.
4. Design protection schemes for alternators, transformers, bus-bars.
5. Assess over voltage protection and insulation level

UNIT I

CIRCUIT BREAKERS:

Circuit Breaker (CB): Elementary principles of arc interruption, Recovery and Recovery voltages - Restriking phenomenon, average, maximum RRRV and numerical Problems. Current chopping and Resistance switching. CB ratings and specifications: Types and Numerical problems. Auto reclosing. Description and operation of following types Circuit Breakers: Minimum Oil Circuit Breaker, Air Blast Circuit Breaker, Vacuum and SF6 circuit breaker.

UNIT II

ELECTROMAGNETIC, STATIC RELAYS & NUMERICAL RELAYS:

Principle of operation and construction of attracted armature, balanced beam, induction disc and induction cup relays-classification. Instantaneous DMT and IDMT types, Applications of relays: Over current/under voltage relays, Directional relays, percentage differential relays. Distance relays: Impedance, Reactance, Mho and offset Mho relays and Characteristics of distance relays. Comparison of numerical relays & static relays with electromagnetic relays.

UNIT III

GENERATOR & TRANSFORMER PROTECTION:

Protection of generators against stator faults, Rotor faults and abnormal conditions. Restricted earth fault and inter turn fault protection. Numerical examples on percentage of winding unprotected. Protection of transformers: Percentage and differential protection, Numerical problems on Design of CT's ratios and Buchholz relay protection.

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UNIT IV

FEEDER AND BUS BAR PROTECTION& GROUNDING PROTECTION OF LINES:

Over current earth fault, Carrier current and three zone distance protection using impedance relays– Translay relay Protection of bus bars and Differential protection.

NEUTRAL GROUNDING

Grounded & ungrounded neutral systems. Effects of ungrounded neutral system performance. Methods of neutral grounding: Solid resistance, reactance, Arcing grounds& grounding practices.

UNIT V

PROTECTION AGAINST OVER VOLTAGE AND GROUNDING:

Generation of over voltages in power systems, Protection against lightning over voltages, Valve type and zinc–Oxide lighting arresters, Insulation coordination, BIL– impulse ratio. Earthing Practices in Substations.

TEXT BOOKS:

1. Power system protection and switch gear, Badriram, D. N. Viswakarma Tata McGraw Hill Education-2nd Edition.
2. Switchgear and protection, Sunil. S. Rao, Khanna publishers.

REFERENCE BOOKS:

1. Electrical power systems, C. L. Wadhwa, New age international (P) limited-4th Edition.
2. A Textbook on power system engineering, M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakrabarthy, Dhanapat Rai & Co. pvt.ltd.
3. Principles of power system, V.K. Mehtha & Rohit Mehtha, S. Chand company Pvt. Ltd - 4th Edition.

MODERN POWER ELECTRONICS

(Professional Elective-2)

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Define the advances in power electronic devices.
2. Articulate power electronic resonant converters in power control applications.
3. Evaluate the design and control of multi-level inverters.
4. Articulate DC power supplies in Power electronic applications
5. Evaluate the design and control of AC power supplies and uninterruptable power supplies.

UNIT I

Modern power semiconductor devices:

Modern power semiconductor devices- MOS turn Off Thyristor (MTO) - Emitter Turn Off Thyristor (ETO) Integrated Gate- Commutated Thyristor (IGCTs)-MOS-controlled Thyristors (MCTs)-Static Induction circuit comparison of their features.

UNIT II

Resonant Pulse Inverters:

Resonant pulse inverters-series resonant inverters-series resonant inverters with unidirectional switches series resonant inverters with bidirectional Switches analysis of half bridge resonant inverter - evaluation of currents and Voltages of a simple resonant inverter-analysis of half bridge and full bridge resonant inverter with bidirectional switches.

UNIT III

Multilevel Inverters:

Multi level concept-Classification of multilevel inverters- Diode clamped multilevel inverter-principle of operation-main features improved diode - Clamped inverter-principle of operation-Flying capacitors multilevel inverter principle of operation-main features.

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UNIT IV

DC Power Supplies:

DC power supplies-classification-switched mode dc power supplies-fly back Converter -forward converter- push pull converter-half bridge converter-Full bridge converter-Resonant dc power supplies-bidirectional dc power supplies-Applications.

UNIT V

AC Power Supplies:

AC power supplies classification-switched mode ac power supplies. Resonant AC power supplies-bi directional ac power supplies-multi stage conversions-control circuits - applications. Introduction-power line disturbances-power conditioners - uninterruptible Power supplies applications.

TEXT BOOKS

1. Power Electronics -Mohammed H. Rashid, Pearson Education - Third Edition
2. Power Electronics - Ned Mohan, Tore M. Undeland and William P. Robbins - John Wiley and Sons Second Edition.

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ADVANCED CONTROL SYSTEMS

B. Tech. III Year II Semester

L	T	P	C
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Course Outcomes: At the end of the course, the student will be able to

6. Understand mathematical preliminaries for advanced control systems.
7. Realize state variable models for linear time invariant systems.
8. Analyze Non linearities in control Systems.
9. Evaluate stability using Lyapunov theorems.
10. Assess optimal control for control problems.

UNIT–I

Mathematical Preliminaries:

Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-II

State Variable Analysis:

Linear Continuous time models for Physical systems–Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-III

Non Linear Systems:

Introduction – Non Linear Systems – Types of Non-Linearities – Saturation – Dead-Zone – Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

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UNIT-IV
Stability Analysis:

Stability in the sense of Lyapunov, Lyapunov's stability, and Lypanov's instability theorems – Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method Generation of Lyapunov functions – Variable gradient method – Krasooviski's method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT-V
Optimal Control:

Introduction to optimal control – Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization.

TEXT BOOKS:

1. Modern Control System Theory by M.Gopal – New Age International -1984
2. Control System Engineering, Nagrath and Gopal – New Age International – Fourth Edition

REFERENCES:

1. Optimal control by Kirck , Dover Publications
2. Advanced Control Theory A. Nagoor Kani, RBA Publications, 1999
3. Modern Control Engineering by Ogata. K – Prentice Hall – 1997

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ENERGY AUDITING & CONSERVATION

(Open Elective-2)

B. Tech. III Year II Semester

L	T	P	C
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Course Outcomes: At the end of the course, the student will be able to

1. Realize the need for energy auditing and conservation. Get awareness on types of energy audit; represent energy flows and energy consumption in tabular and graphical methods.
2. Understand and exploit energy saving opportunities in energy efficient motors and power factor improvement methods.
3. Learn energy auditing and conservation opportunities in energy efficient buildings.
4. Analyze economic viability with respect to real world problems using depreciation methods.
5. Examine the check lists for energy conservation in boilers, heat pumps, cooling systems, compressors and fans.

UNIT I

BASIC PRINCIPLES OF ENERGY AUDIT:

Energy audit-definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Energy audit of industries, Energy saving potential, Energy audit of process industry, and thermal power station.

UNIT II

ENERGY EFFICIENT MOTORS, POWER FACTOR IMPROVEMENT& LIGHTING:

Energy efficient motors, factors affecting efficiency, variable speed, variable duty cycle systems, effect of Voltage variation on motors, motor energy audit. Power factor- methods of improvement, location of capacitors, Pf with nonlinear loads- Good Lighting system design and practice, lighting control, lighting energyaudit.

UNIT III

ENERGY EFFICIENT BUILDINGS:

Green Buildings, Intelligent Buildings, Rating of Buildings, Efficient use of Buildings, Ventilation Solar Passive Architecture. Adoption to sustainable resources such as PV modules, solar heating, Cooling Techniques, Energy audit and conservation opportunities.

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UNIT IV
ECONOMIC ASPECTS AND ANALYSIS:

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis-calculation of simple payback method, net present worth method-Applications of cycle costing analysis, return of investment.

UNIT V
ENERGY CONSERVATION OPPORTUNITIES:

Energy conservation checklist, Energy conservation opportunities in boilers, Heat pumps and cooling systems, chilled water Plants and Central air- conditioning systems, Water Heaters and coolers, Compressors and Fans.

TEXT BOOKS:

1. BEE Guide Books Volume 1 to Volume 4
2. Energy management, W.R. Murphy and G. McKay Butter worth, Heinemann publications.

REFERENCE BOOKS:

1. Energy management hand book, W.C.Turner, John Wiley and sons-7thEdition.
2. Energy management, Paul o' Callaghan, McGraw Hill Book company-1stEdition.
3. Internet Resources: https://beeindia.gov.in/content/buildings-0, https://www.worldgbc.org/what-green-building

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PRINCIPLES OF ELECTRIC POWER UTILIZATION

(Open Elective - 2)

B. Tech. III Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand terms and concepts of illumination.
2. Apply the concepts of different electric lamps and good lighting Practices for artificial lighting systems.
3. Classify the methods of electric heating and welding
4. Categorize the concepts of different electric traction systems and existing traction system in India.
5. Analyze the mechanics of train movement.

UNIT I
ILLUMINATION FUNDAMENTALS:

Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

UNIT II
VARIOUS ILLUMINATION METHODS:

Discharge lamps, MV and SV lamps- comparison between tungsten filament lamps and fluorescent tubes, Basic Principles of Light Control, Types and design of lighting and flood lighting. Energy efficient Lights.

UNIT III
ELECTRIC HEATING & WELDING:

Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric Welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. welding.

UNIT IV
ELECTRIC TRACTION - I:

System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, Methods of electric braking-plugging Rheostatic braking and regenerative braking.

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UNIT V

ELECTRIC TRACTION – II:

Mechanics of train movement, Speed-time curves for different services- trapezoidal and quadrilateral speed time curves.

TEXT BOOKS:

1. Utilization of electrical power, Er.R.K. Rajput, Laxmi Publications (P) Ltd-1st Edition.
2. Utilization of electric power and electric traction, J.B.Gupta, S.K.Kataria& Sons publication-10th Edition.

REFERENCE BOOKS:

1. Utilization of electric energy, E. Openshaw Taylor, Orient Longman (P) Ltd.
2. Generation, distribution and utilization of electrical energy, C.L.Wadhwa, New Age International (P) Ltd.-3rd Edition.
3. Utilization of electric power, N. V. Suryanarayana, New Age International (P) Ltd.

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CONTROL SYSTEMS AND SIMULATION LAB

B. Tech. III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Examine the time response of second order systems, Synchros, and truth tables verification by PLC.
2. Design of AC servomotor and DC servomotor to find out their transfer function practically.
3. Design of DC motor, DC generator, and finding out their transfer function practically.
4. Analyze magnetic amplifier characteristics.
5. Explain stability analysis through bode, Nyquist and root locus plots using Simulation Software.

Any Ten of the following experiments are to be conducted

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple. Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servomotor.
5. Transfer function of DC motor.
6. Transfer function of DC Shunt generator.
7. Characteristics of magnetic amplifiers.
8. Characteristics of AC servomotor.
9. Simulation of Op-Amp based Integrator and Differential circuits.
10. Linear system analysis (Time domain analysis, Error analysis).
11. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation software.
12. State space model for classical transfer function– Verification using simulation software.

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POWER ELECTRONICS AND SIMULATION LAB

B. Tech. III Year II Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Examine the characteristics of SCR, MOSFET, & IGBT, and analyze triggering circuits.
2. Analyze input and output chrematistics of AC-DC converters.
3. Synthesize input and output chrematistics of Cycloconverters.
4. Examine input and output chrematistics of DC-DC Converters.
5. Design of converters and inverters using P-Spice software.

Any ten of the following experiments are required to be conducted.

1. Study of the characteristics of SCR, MOSFET &IGBT.
2. Gate Firing Circuits for SCRs (R- Triggering, RC Triggering & UJT Triggering).
3. Single Phase AC voltage Controller with R & RL Loads.
4. Single Phase fully Controlled Bridge Converter with R& RL Loads.
5. DC Jones Chopper with R & RL Loads.
6. Single Phase Parallel Inverter with R& RL Loads.
7. Single Phase Cycloconverter with R& RL Loads.
8. Single Phase Series Inverter with R& RL Loads.
9. Single Phase Half controlled converter with R Load.
10. Simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
11. Simulation of resonant pulse commutation circuit and Buck Chopper.
12. Simulation of single phase Inverter with PWM control.

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R20 B.TECH FOURTH YEAR COURSE STRUCTURE

B. Tech. IV Year I Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -14	Electrical Measurements & Instrumentation	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE – 3	Electric Vehicles/Power Quality & FACTS/ Embedded Systems & IOT	3	0	0	3
4	PE – 4	Advanced Control of Electric Drives/ Programmable Logic Controllers & SCADA/ Smart Grids	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab - 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	PW-1	Mini Project	0	0	0	3
Total			**15**	**0**	**4**	**20**

B. Tech. EEE IV Year II Semester

S. No	Course Category	Course Title	L	T	P	Credits
1	PC -16	Utilization of Electrical Energy	3	0	0	3
2	PC -17	Renewable Energy and Energy Storage Technologies	3	0	0	3
3	TS	Technical Seminar	2	0	0	2
4	CVV	Comprehensive Viva-Voce	0	0	0	2
5	PW-2	Major Project	0	0	0	10
Total			**8**	**0**	**0**	**20**

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COURSE STRUCTURE (for FAST TRACK)

B. Tech. IV Year I Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	PC -14	Electrical Measurements & Instrumentation	3	0	0	3
2	PC -15	Power Systems Operation and Control	3	0	0	3
3	PE – 3	Electric Vehicles/ Power Quality & FACTS/ Embedded Systems & IOT	3	0	0	3
4	PE – 4	Advanced Control of Electric Drives/ Programmable Logic Controllers & SCADA/ Smart Grids	3	0	0	3
5	OE-3	Electric Vehicles and Hybrid Vehicles/ Energy Storage Systems	3	0	0	3
6	PC Lab - 9	Microprocessors and Interfacing Lab	0	0	2	1
7	PC Lab - 10	Electrical Measurements Lab	0	0	2	1
8	PW-1	Mini Project	0	0	0	3
9	PC – 17	Renewable Energy and Energy Storage Technologies	3	0	0	3
Total			**18**	**0**	**4**	**23**

B. Tech. IV Year II Semester

S.No.	Course Category	Course Title	L	T	P	Credits
1	TS	Technical Seminar	2	0	0	2
2	CVV	Comprehensive Viva-Voce	0	0	0	2
3	PW-2	Major Project	0	0	0	10
Total			**2**	**0**	**0**	**14**

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ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand all types of measuring instruments and error compensations.
2. Discuss the operation of DC Crompton potentiometer; compare the CT and PT with phasor diagram.
3. Describe the concepts of power and energy measurement by using wattmeter and energy meter.
4. Outline the concept of DC and AC bridges for the measurement of resistance, inductance & capacitance.
5. Analyze the concepts of transducers and cathode ray oscilloscopes.

UNIT I
INTRODUCTION TO MEASURING INSTRUMENTS:

Classification-deflection, control and damping torques- Ammeters and Voltmeters- PMMC and moving iron type instruments- expression for the deflecting torque and control torque- Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters, electrometer type and attracted disc type voltmeters.

UNIT II
POTENTIOMETERS& INSTRUMENT TRANSFORMERS:

Principle and operation of D.C. Crompton's potentiometer - standardization, Measurement of unknown resistance, current and voltage. A.C. Potentiometers: polar and coordinate types, standardization and applications. CT and PT- Ratio and Phase angle errors (of CT only).

UNIT III
MEASUREMENT OF POWER & ENERGY:

Single phase dynamometer, LPF and UPF watt meters, Double element and three element dynamometer watt meter- expression for deflecting and control torques, extension of range of wattmeter using instrument transformers. Measurement of reactive power. Single phase Induction type energy meter- driving and braking torques-errors and compensations, testing by phantom loading using RSS meter. Three phase energy meter- Maximum demand meters.

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UNIT IV

D.C BRIDGES & A.C BRIDGES:

Methods of measuring low, medium and high resistances, sensitivity of wheat- stone Bridge, Carey foster's Bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance - loss of charge method. Measurement of inductance and Q Factor - Maxwell's Bridge, Hay's bridge, Anderson's bridge and Owen's bridge. Measurement of capacitance and loss angle – Dessuty's Bridge and Schering Bridge. Wien's Bridge.

UNIT V

TRANSDUCERS & OSCILLOSCOPES:

TRANSDUCERS: Definition of transducer, classification of transducers, advantages of electrical transducers, characteristics and choice of transducers. Principle of operation of LVDT and capacitor transducers, LVDT Applications, Strain guage and its principle of operation, guage factor, Thermistors, Thermo-couples, Piezo-electric transducers, photo-voltaic, photo-conductive cells and photo-diodes.

OSCILLOSCOPES-Cathode Ray Oscilloscope (CRO)- Cathode Ray tube, time base generator, horizontal and vertical amplifiers and Lissajous Patterns.

TEXT BOOKS:

1. A course in electrical and electronic measurements and instrumentation by A. K. Sawhney, Puneet Sawhney, DhanpatRai&Co.
2. Electrical & electronic measurements and instrumentation, R.K.Rajput, S.Chand & Company Ltd.

REFERENCE BOOKS:

1. Electrical measurements and measuring instruments, Golding E.W, Widdis F.C, Publisher: AH Wheeler &Company.
2. Electrical and electronic measurements, G.K. Banerjee, PHI Learning Pvt.Ltd.
3. Electrical Measurements and Measuring Instruments, N. V. Suryanarayana, Tata McGraw Hill.

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POWER SYSTEM OPERATION AND CONTROL

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand economic operation of power systems.
2. Analyze and compute optimal loading of generators for a particular load demand.
3. Develop mathematical models of turbines and governors.
4. Address load frequency control problem.
5. Explain how series and shunt compensation helps in reactive power control.

UNIT I
ECONOMIC OPERATION OF POWER SYSTEMS:

Optimal operation of Generators in Thermal Power Stations – Heat rate Curve - Cost Curve - Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses - Loss Coefficients, General transmission line loss formula.

UNIT II
HYDROTHERMAL SCHEDULING:

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems- Short term hydrothermal scheduling problem.

UNIT III
MODELING:

Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Modeling of Governor: Mathematical Modeling of Speed Governing System - Derivation of small signal transfer function.

Modeling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model

UNIT IV
LOAD FREQUENCY CONTROL:

Single Area Load Frequency Control: Necessity of keeping frequency constant. Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias control.

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Load Frequency Controllers: Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

UNIT V
REACTIVE POWER CONTROL:

Overview of Reactive Power control – Reactive Power compensation in transmission systems– advantages and disadvantages of different types of compensating equipment for transmission systems. Load compensation–Specifications of load compensator, Uncompensated and compensated transmission lines: Shunt and Series Compensation.

TEXT BOOKS:

1. Modern Power System Analysis, I.J. Nagarath & D.P. Kothari, Tata McGraw Hill Publishing Company Ltd -4th Edition.
2. Power systems analysis and stability, S.S Vadhera, Khanna Publications- 4thEdition.

REFERENCE BOOKS:

1. Power generation, operation and control, Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble, Wiley -3rdEdition.
2. Power system stability and control, Prabha Kundur, McGraw Hill companies-Indean Edition.
3. Power system operation and control, Dr. K. Uma Rao, Wiley India Pvt. Ltd.

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ELECTRIC VEHICLES

(Professional Elective – 3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the components of Electric Vehicles and Fundamentals of Electric Vehicles.
2. Explain the types of batteries and principles of operation of batteries.
3. Analyze the control techniques of Electric motors which are used in Electric vehicles.
4. Apprehend the transmission of the drive system and the components of transmission.
5. Assess various modes of Hybrid vehicles for different conditions.

UNIT- I

ELECTRIC VEHICLES:

Introduction to Electric Vehicles - History of Electric and Hybrid Vehicles - Component's vehicle mechanics - Roadway fundamentals - vehicle kinetics - Dynamics of vehicle motion - Propulsion System Design.

UNIT -II

BATTERIES:

Basics Types -Parameters - Capacity- Discharge rate - State of charge - State of Discharge - Depth of Discharge - Technical characteristics - Battery pack - Design Properties of Batteries - Fuel Cells - Types - Fuel Cell -Electric Vehicle.

UNIT III

DC & AC ELECTRICAL MACHINES (Speed control Techniques):

Motor and Engine rating - Requirements - Speed control techniques of DC machines in Electric Vehicles - Speed control techniques of three phase A/c machines, Induction machines, Permanent Magnet Machines, Switched Reluctance Machines.

UNIT IV

ELECTRIC VEHICLE DRIVE TRAIN:

Transmission configuration Components, gears, differential, clutch, brakes, regenerative braking- motor sizing, Gear Ratio, Torque- speed characteristics, EV Motor Sizing, Initial Acceleration, Rated Vehicle Velocity, Maximum Velocity – Maximum Gradability.

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UNIT V

HYBRID ELECTRIC VEHICLES:

Types of Hybrid Vehicles- series and parallel Hybrid Electric Vehicles, series- parallel configuration, Internal Combustion Engines -Reciprocating Engines- Practical and Air-Standard Cycles Air- Standard Otto Cycle Air-Standard Diesel Cycle Example IC Engines in HEVs Design Drive train sizing of components.

TEXT BOOKS:

1. Electric & hybrid vehicles Design Fundamentals, Iqbal Hussain, CRC Press 2nd Edition.
2. Electric vehicle technology explained, James Larminie, John Lowry, Wiley& Sons-2nd Edition.

REFERENCE BOOKS:

1. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory and design, MehrdadEhsani, YiminGao, Ali Emadi, CRC Press - 2nd Edition.
2. Electric vehicle battery systems,Sandeep Dhameja - KindleEdition.

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POWER QUALITY AND FACTS
(Professional Elective-3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes: After completion of this course, the student will be able to

1. Understand the severity of power quality problems in distribution system
2. Illustrate the concept of transmission line reactive power compensation
3. Choose proper shunt compensators for reactive power compensation
4. Apply the control circuits of static series compensators for various functions
5. Classify combined compensators.

UNIT - I

POWER QUALITY PROBLEMS IN DISTRIBUTION SYSTEMS:

Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement.

UNIT- II

TRANSMISSION LINES AND SERIES/SHUNT REACTIVE POWER COMPENSATION:

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

UNIT- III

STATIC SHUNT COMPENSATORS:

Objectives of shunt compensation, Methods of controllable VAR generation, Static Var Compensator, its characteristics, TCR, TSC, FC-TCR configurations, STATCOM, basic operating principle, control approaches and characteristics

UNIT- IV

STATIC SERIES COMPENSATORS:

Objectives of series compensator, variable impedance type of series compensators, TCSC, TSSC-operating principles and control schemes, SSSC, Power Angle characteristics, Control range and VAR rating, Capability to provide reactive power compensation, external control

UNIT-V:

COMBINED COMPENSATORS:

Introduction to Unified Power Flow Controller, Basic operating principles, Conventional control capabilities, independent control of real and reactive power.

TEXT BOOKS:

1. Electrical Power Systems Quality, Dugan Roger C, Santoso Surya, Mc Granaghan, Marks F.Beaty and H. Wayre, Mc Graw Hill
2. Power Systems Quality Assessment, J. Arillaga, N.R. Watson, S.Clon, John Wiley.

REFERENCE BOOKS:

1. Power Quality, C.Sankaran, CRC Press 4. Understanding power quality problems, Math H.Bollen, IEEE press.
2. "Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems" Narain G.Honorani, Laszlo Gyugyi

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EMBEDDED SYSTEMS & IOT

(Professional Elective-3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes

At the end of the Course, the student will be able to

1. Understand the differences between the embedded system and general computing system identify the purpose of embedded systems.
2. Examine embedded systems using different memory devices and communications interfaces
3. Explain the communication/Synchronization issues with a view to choose the best RTOS
4. Understand the concepts of IoT
5. Design IoT devices for real time applications

UNIT I:
INTRODUCTION TO EMBEDDED SYSTEMS:

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT II:
TYPICAL EMBEDDED SYSTEM:

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT III:
RTOS &TASK COMMUNICATION:

RTOS: OS Basics-Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

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UNIT IV:

INTRODUCTION TO IOT AND ARCHITECTURE

Introduction, Characteristics, Physical design, Logical design, Evolution of IoT, enabling technologies, IoT Levels, Domain Specific IoTs, IoT and Machine to machine communication, Need for cloud in IoT

UNIT V:

IoT COMMUNICATION PROTOCOLS AND IOT SYSTEMS USE CASES

IoT nodes, IoT Edge, 6LOWPAN, ipv4/ipv6, MQTT, COAP, Smart cities, smart homes, automotive, agriculture, Healthcare, Activity Monitoring, and Industrial IoT

TEXT BOOKS:

1. Embedded Systems: Architecture, Programming and Design , Raj Kamal , Tata McGraw-Hill, 2011
2. 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024', Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, Yole Development Copyrights ,2014

REFERENCE BOOKS:

1. Introduction to Embedded Systems, Shibu K V, McGraw-Hill Education, 2009.
2. 'Learning Internet of Things', Peter Waher, Packt Publishing, 2015
3. 'Internet of Things – From Research and Innovation to Market, Editors OvidiuVermesan Peter Friess,

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ADVANCED CONTROL OF ELECTRIC DRIVES

(Professional Elective - 4)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student will be able to:

1. Understand the operation of power electronic converters and their control strategies.
2. Apply the vector control strategies for ac motor drives
3. Examine the control of Synchronous Motor Drives
4. Analyze the speed control of Permanent Magnet motors and Switched Reluctance Motors.
5. Distinguish the implementation of the control strategies using digital signal processors.

UNIT - I
POWER CONVERTERS FOR AC DRIVES:

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H Bridge as a 4-Q drive.

UNIT - II
INDUCTION MOTOR DRIVES:

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control (DTC).

UNIT - III
SYNCHRONOUS MOTOR DRIVES:

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

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UNIT - IV
PERMANENT MAGNET MOTOR DRIVES:

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.
Switched Reluctance Motor Drives: Evolution of switched reluctance motors- various topologies for SRM drives, comparison, closed loop speed and torque control of SRM.

UNIT - V
DSP BASED MOTION CONTROL:

Use of DSPs in motion control, various DSPs available, and realization of some basic blocks in DSP for implementation of DSP based motion control.

TEXT BOOKS:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.

REFERENCE BOOKS:

1. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.
1. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press,2009.

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Programmable Logic Controllers & SCADA

(Professional Elective-4)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes: At the end of this course, students will be able to

1. Understand the concepts of PLC.
2. Illustrate the fundamentals of PLC for electrical devices
3. Analyze the operation of counters
4. Apply instructions in PLCs.
5. Investigate implementation of SCADA.

UNIT I:

Programmable Logic Controllers: Introduction, parts of PLC, principles of operation, modifying the operation, PLCs versus computers, PLC size and application.

PLC Hardware Components: The I/O section, discrete I/O modules, analog I/O modules, special I/O modules, I/O specifications, central processing unit (CPU), memory design, memory types, programming terminal devices, recording and retrieving data human machine interfaces (HMIs).

Basics of PLC programming: Processor memory organization, program scan, PLC programming languages, relay-type instructions, instruction addressing, branch instructions, internal relay instructions, programming examine if-closed and if-open instructions, entering the latter diagram.

UNIT II:

Developing fundamental PLC wiring diagrams and ladder logic programs: Electromagnetic control relays, contactors, motor starters, manually operated switches, mechanical operated switches, sensors, output control devices, seal-in circuits, latching relays, converting relay schematics into PLC ladder programs.

UNIT III:

Programming counters: Counter's instructions, up-counter, down-counter, cascading counters, incremental encoder-counter applications, combining counter and timer functions.

Program control instructions: Master control reset instruction, jump instruction, subroutine functions, immediate input and immediate output instructions, forcing external I/O addresses, safety circuitry, fault routine, temporary end instruction, suspend instruction.

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UNIT IV:

Data manipulation instructions: Data manipulation, data transfer operation, data compare instructions, data manipulation programs, numerical data I/O interfaces, closed-loop control.

Math instructions: Match instructions, addition instruction, subtraction instruction, multiplication instruction, division instruction, file arithmetic operations.

UNIT –V:

Sequencer and shift register instructions: Mechanical sequencers, sequencer instructions, sequencer programs, bit shift registers, word shift operations.

Process control network system and SCADA: Types of processes, structure of control systems, ON/OFF control PID control, Motion control, data communications, supervisory control and data acquisition (SCADA).

TEXT BOOKS:

1. Programmable Logic Controllers, W. Bolton, 5th edition, Newnes ELSEVIER, 2009
2. PLCs & SCADA: Theory and Practice, Rajesh Mehra, Laxmi Publications, 2012.

REFERENCE BOOKS:

1. Industrial applications of programmable logic controllers and SCADA, Kunal Chakraborty, Palash De, Indranil Roy, Anchor Academic Publishing, 2016
2. Ladder logic programming fundamentals, A.J. Wright, 2nd edition, AB Prominent publisher, 2020

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SMART GRIDS

(Professional Elective-4)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the features of Smart Grid.
2. Illustrate the smart grid architecture.
3. Explain tools and techniques for smart grid and Distribution systems.
4. Justify operation and importance of PMUs,WAMS.
5. Imagine control techniques for micro grid and smartgrid.

UNIT I
INTRODUCTION TO SMART GRID:

Introduction to Smart Grid - Working - definitions of Smart Grid and Associated Concepts - Smart Grid Functions -Traditional Power Grid and Smart Grid - New Technologies for Smart Grid - Advantages - Indian Smart Grid - Key Challenges for Smart Grid.

UNIT II
SMART GRID ARCHITECTURE:

Components and Architecture of Smart Grid Design - Review of the proposed architectures for Smart Grid, fundamental components of Smart Grid designs, Transmission Automation, Distribution Automation - Renewable energy Integration.

UNIT III
COMPUTATIONAL TECHNIQUES FOR SMART GRIDS:

Tools and Techniques for Smart Grid: Computational Techniques Static and Dynamic Optimization Techniques, Computational Intelligence Techniques, Evolutionary Algorithms and Artificial Intelligence techniques.

Distribution Generation Technologies: Introduction to Renewable Energy Technologies- Micro grids - Storage Technologies -Electric Vehicles and plug in hybrids Environmental impact and Climate Change Economic Issues.

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UNIT IV

COMMUNICATION TECHNOLOGIES AND SMART GRID:

Introduction to Communication Technology - Synchro-Phasor Measurement Units (PMUs) - Wide Area Measurement Systems (WAMS) - Introduction to Internet of Things (IOT) - Applications of IOT in Smart Grid.

UNIT V

CONTROL OF SMART POWER GRID SYSTEM:

Load Frequency Control (LFC) in Micro Grid System - Voltage Control in Micro Grid System - Reactive Power Control in Smart Grid, Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

1. Smart grids, infrastructure, technology and solutions, Stuart Borlase, CRC Press - 1st Edition.
2. Renewable and efficient electric power system, Gil Masters, Wiley IEEE Press 2nd Edition.

REFERENCE BOOKS:

1. Synchronized Phasor measurements and their applications, A.G. Phadke and J.S Thorp, Springer 2nd Edition.
2. Wind power in power systems, T. Ackermann, Hoboken, NJ, USA, John Wiley 2nd Edition.

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ELECTRIC VEHICLES AND HYBRID VEHICLES

(Open Elective – 3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the components of electric vehicles and fundamentals of electric vehicles.
2. Demonstrate the types of batteries, fuel cells and its characteristics.
3. Understand the basic principles of electric motors which can be used in electric vehicles.
4. Apprehend the transmission of the drive system and the components of transmission.
5. Design and analyze the performance of hybrid vehicles.

UNIT I
ELECTRIC VEHICLES:

Introduction to Electric Vehicles - History of Electric Vehicles -Components - vehicle mechanics - Roadway fundamentals - vehicle kinetics - Dynamics of vehicle motion - Propulsion System Design.

UNIT II BATTERIES:

Basics - Types - Parameters - Capacity - Discharge rate - State of charge - state of Discharge - Depth of Discharge - Technical characteristics - Battery pack Design - Properties of Batteries. Fuel Cells - Types - Fuel Cell Electric Vehicle.

UNIT III
DC & AC ELECTRICAL MACHINES (Basics Principle of Operation Only):

Motor and Engine rating - Requirements - DC machines - Three phase A/c machines -Induction machines - Permanent Magnet Machines, Switched Reluctance Machines.

UNIT IV
ELECTRIC VEHICLE DRIVE TRAIN:

Transmission configuration - Components gears, differential, clutch, brakes regenerative braking- motor sizing- Gear Ratio Torque speed characteristics - EV Motor Sizing Initial Acceleration - Rated Vehicle Velocity - Maximum Velocity – Maximum Gradeability.

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UNIT V

HYBRID ELECTRIC VEHICLES:

Types of Hybrid Vehicles - series and parallel Hybrid Electric Vehicles, series- parallel configuration- Internal Combustion Engines - Reciprocating Engines - Practical and Air-Standard Cycles - Air- Standard Otto Cycle - Air-Standard Diesel Cycle - Example IC Engines in HEVs - Design - Drive train - sizing of components.

TEXT BOOKS:

1. Electric & hybrid vehicles - design fundamentals, Iqbal Hussain, CRC Press 2ndEdition.
2. Electric vehicle technology explained, James Larminie and John Lowry, Wiley&Sons-2nd Edition.

REFERENCE BOOKS:

1. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory and design, Mehrdad Ehsani, Yimin Gao, Ali Emadi,", CRC Press - 2nd Edition.
2. Electric vehicle battery systems, Sandeep Dhameja – Kindle Edition.

ENERGY STORAGE SYSTEMS

(Open Elective – 3)

B. Tech. IV Year I Semester

L	T	P	C
3	0	0	3

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

1. Understand the concepts and roles of electrical energy storage technologies.
2. Analyze the needs for electric energy storage.
3. Identify the types of energy storage systems and various devices used for this purpose.
4. Evaluate the performance of electrical energy storage systems.
5. Apply the concepts of energy storage systems to real time problems.

UNIT I
ELECTRICAL ENERGY STORAGE TECHNOLOGIES:

Characteristics of electricity - The roles of Electric Energy Storage - High generation cost during peak demand periods - Need for continuous and flexible supply - long distance between generation and consumption- Congestion in power grids - Transmission by cables.

UNIT II
NEEDS FOR ELECTRICAL ENERGY STORAGE:

Emerging needs for Electric Energy Storage –Utilization of more renewable energy - less fossil fuel - Smart Grid uses - The roles of electrical energy storage technologies - The roles from the view point of a utility, from the view point of consumers, from the view point of generators of renewable energy.

UNIT III
FEATURES OF ENERGY STORAGE SYSTEMS:

Classification of Electric Energy Storage systems - Mechanical storage systems - Pumped Hydro Storage (PHS) - Compressed Air Energy Storage (CAES) - Flywheel Energy Storage (FES) - Electrochemical storage systems - Secondary batteries - Flow batteries - Chemical energy storage, - Hydrogen (H2) - Synthetic Natural Gas (SNG).

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UNIT IV
TYPES OF ELECTRICAL ENERGY STORAGE SYSTEMS:

Electrical storage systems - Double-layer capacitors (DLC) - Superconducting magnetic energy storage (SMES) - Thermal storage systems - Standards for Electric Energy Storage - Technical comparison of EES technologies.

UNIT V
APPLICATIONS:

Present status of applications - Utility use (conventional power generation, grid operation & service) - Consumer use (uninterruptable power supply for large consumers) - New trends in applications - Renewable energy generation - Smart Grid - Smart Micro grid, Smart House - Electric vehicles - Management and control hierarchy of storage systems - Internal configuration of battery storage systems - External connection of EES systems - Aggregating EES systems and distributed generation (Virtual Power Plant) - Battery SCADA -Aggregation of many dispersed batteries.

TEXT BOOKS:

1. Electrical energy storage, IEC Market Strategy Board.
2. Energy storage benefits and market analysis, James M. Eyer, Joseph J. Jannucci and Garth. P.Corey, Sandia National laboratories, 2004.

REFERENCE BOOKS:

1. Energy storage for the electricity grid-benefits and market potential assessment guide, Jim Eyer, Garth Corey, Sandia National laboratories, 2010.
2. Power system energy storage technologies, Paul Breeze, Academic Press.
3. Electric energy storage systems, Przemyslaw Komarnicki, PioLombardi, Zbigniew Styczynski, Springer.

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ELECTRICAL MEASUREMENTS LAB

B. Tech. IV Year I Semester

L	T	P	C
0	0	2	1

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Calibrate voltmeters, ammeters and single phase energy meter.
2. Design the scale of PMMC voltmeter, LPF wattmeter, LVDT and resistance strain gauge.
3. Calculate resistance, inductance and capacitance using bridges.
4. Compute 3-Φ reactive power.
5. Test single phase energy meter and dielectric strength of oil of transformers.

Any ten of the following experiments are required to be conducted

1. Calibration and Testing of single phase energy Meter.
2. Calibration of dynamometer type power factor meter.
3. Crompton D.C. Potentiometer - Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge - Measurement of resistance - Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 Phase reactive power with single-phase wattmeter.
8. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods.
9. LVDT and capacitance pickup - characteristics and Calibration.
10. Resistance strain gauge - strain measurements and Calibration.
11. Transformer turns ratio measurement using A.C. Bridge.
12. Measurement of ratio error and phase angle of given C.T. by comparison.

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UTILIZATION OF ELECTRICAL ENERGY

(Professional Core – 16)

B. Tech. IV Year II Semester

L	T	P	C
3	0	0	3

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

1. Understand the importance of illumination and various illumination techniques.
2. Examine the performance of simple resistance furnaces, modern welding techniques.
3. Apply the concepts of Electrolytic process
4. Categorize different types of Electric Traction systems
5. Evaluate different types of traction mechanics

UNIT – I
ILLUMINATION

Definition – Laws of illumination – Polar curves – Calculation of MHCP and MSCP. Lamps: Incandescent lamp, Sodium Vapour lamp, Fluorescent lamp. Requirement of good lighting scheme – Types, Design and Calculation of illumination. Street lighting and Factory lighting – Numerical Problems.

UNIT – II
ELECTRICAL HEATING & ELECTRIC WELDING

Advantages. Methods of Electric heating – Resistance, arc, Induction and dielectric heating. Types of electric welding – Resistance, Electric arc, gas welding and Ultrasonic welding, Welding electrodes of various metals, Defects in welding.

UNIT – III
ELECTROLYTIC PROCESS

Basic principle of Electrolysis, Faradays laws of Electrolysis – Numerical problems, Applications of Electrolysis – Electro deposition-manufacturing of chemicals – anodizing – electro polishing – electro cleaning – electro parting – electro metallurgy, Power supply for Electrolysis.

UNIT – IV
ELECTRIC TRACTION

Introduction –Traction Systems, Systems of Electric Traction- Advantages of Electric Traction, Systems of Track Electrification, Desirable features of Traction Motors – Suitability of D.C. series motor, A.C. series motor, 3 phase induction motor and linear induction motor for traction. Electric Braking in traction– Plugging, Rheostatic and Regenarative types – Suitability of different motors for braking, Temperature Rise and Load Equalization.

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UNIT – V

TRACTION MECHANICS

Types of services – urban – sub-urban and main line services, Speed-time curves of different services – trapezoidal and quadrilateral speed-time curves – Numerical Problems, Tractive effort, Power, Specific Energy Consumption- factors affecting Specific Energy Consumption, Mechanics of train movement - Adhesive weight and coefficient of adhesion – Problems.

TEXT BOOKS:

1. "Utilization of Electric Power" by Er. R. K. Rajput, Laxmi Publications, 2nd Edition
2. Utilization of Electric Power and Electric Traction" by J.B. Gupta, S.K. Kataria and sons,Delhi. Art & Science of Utilization of electrical Energy – by H. Partab, Dhanpat Rai & Sons.

REFERENCE BOOKS:

1. Generation, Distribution and Utilization of Electrical Energy" by C. L. Wadhwa, Eastern . Wiley Ltd.
2. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited Publishers, 1996.
3. A text book on Power System Engineering" by A. Chakraborti, M. L. Soni, P. V. Gupta, U.S.Bhatnagar, Dhanpat Rai and Co.(P) Ltd – Delhi.

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RENEWABLE ENERGY AND ENERGY STORAGE TECHNOLOGIES

(Professional Core- 17)

B. Tech. IV Year II Semester

L	T	P	C
3	0	0	3

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

1. Discuss the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Explain the basic physics of wind and wind generation topologies
3. Describe the basics of solar power generation
4. Express the power electronic interfaces for solar PV generation.
5. Generalize the issues related to the grid-integration of solar and wind energy systems.

UNIT I

PHYSICS OF WIND POWER:

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

UNIT II

WIND GENERATOR TOPOLOGIES:

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator - Converter configurations, Converter Control.

UNIT III

THE SOLAR RESOURCE:

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar thermal power generation:

Technologies - Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis

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UNIT IV
SOLAR PHOTOVOLTAIC:

Technologies - Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

UNIT V
ENERGY STORAGE TECHNOLOGIES:

Role of Electrical Energy storage system -Electro chemical storage systems, secondary batteries, Management and control hierarchy of storage systems - Internal configuration of battery storage systems, design of electric energy storage system for solar and wind plants (block diagram).

TEXT BOOKS:

1. Renewable energy technologies: A practical guide for beginners, Chetan Singh Solanki, PHI,2008
2. Non Conventional Energy Sources , G.D.Rai, Khanna Publications

REFERENCE BOOKS:

1. Wind power in power systems, T. Ackermann, John Wiley and Sons Ltd.,2005.
2. Solar energy: Principles of thermal collection and storage, S.P.Sukhatme, McGraw Hill, 1984.
3. Renewable energy applications, G. N.Tiwari and M. K. Ghosal Narosa Publications, 2004.

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Annexure – II

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ELECTRICAL TECHNOLOGY

(B. Tech. Electronics and Communication Engineering)

II Year B. Tech II semester

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

At the end of the course the student should be able to

1. Understand the concept of network topology
2. Apply the concepts of the filters, attenuators to real-world problems.
3. Synthesize the electrical networks using different techniques.
4. Analyze the basic concepts of DC machines & AC Machines.
5. Assess concepts of some special machines.

UNIT I:

Network topology:

Definitions, Graph, Tree, Basic cutest and Basic Tie set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Dependent & Independent Voltage and Current Sources, Duality & Dual Networks.

UNIT II:

Filters and attenuators:

Filters:

Classification of Filters, Filter Network, Classification of Pass band and Stop Band, Characteristic Impedance in the Pass and Stop bands, Constant-k Low Pass Filter, High Pass Filter, m-derived T-Section, Band Pass Filter and Band Elimination filter, Illustrative problems.

Attenuators:

T-Type Attenuator, p-Type Attenuator, Bridged T-Type Attenuator, Lattice Attenuator.

UNIT III:

Network synthesis:

Reliability Concept, Hurwitz Property, Positive Realness, Properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions, Foster and Cauer forms.

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UNIT IV:

Dc generators and dc motors:

DC Generators:

Principle of Operation, EMF equation, Introduction to armature reaction and commutation, Types of Generators, Magnetization (OCC) characteristics - critical field resistance and critical speed, Applications.

DC Motors:

Principle of operation - Back E.M.F. - Torque equation, Types of DC Motors, Losses and Efficiency, Brake Test, Speed control of DC Motor - Flux and Armature Voltage control methods, Applications.

UNIT V:

Special machines:

Principles of operation of Reluctance Motors, Stepper Motors, Universal Motors, Permanent magnet Brushless DC Motors

TEXT BOOKS:

1. Chakrabarti A , Circuit Theory: Analysis & Synthesis, Dhanpat Rai & Sons, 2008.
2. Gupta J B, Theory and performance of Electrical machines, S K Kataria, 2009.

REFERENCE BOOKS:

1. William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, Engineering Circuits Analysis, McGraw Hill Company, 2019.
2. Bimbra P S, Electric Machinery, Khanna Publishers, 2010

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CONTROL SYSTEMS ENGINEERING

(B.Tech. Electronics and Communication Engineering)

III B.Tech I semester

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

At the end of the Course, the student will be able to:

1. Understand and analyzing different linear-time-invariant systems using transfer function.
2. Analyze system response in time domain for first and second order systems and evaluate static error.
3. Understand the concept of stability and its assessment for linear-time invariant systems.
4. Analyze system response in frequency domain and understanding compensation networks.
5. Realize the concept of state variable, state space and analyze the stability of linear Time discrete systems.

UNIT I:

Introduction to control Systems:

Concepts of control systems, open & closed loop control systems-examples, Industrial Control systems examples, Mathematical models of physical systems.

Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples- Block diagram algebra – Representation by signal flow graph- Reduction using Manson's gain formula

UNIT II:

Time Response Analysis: Standard test signals – Time response of first order systems- Characteristic Equation of feedback controls systems, Transient response of second order systems – Time domain specifications - Steady state response – Steady state errors & error constants – Effects of proportional derivative, proportional integral systems and PID controllers, Application of Proportional, Integral and Derivative Controllers.

UNIT III:

Stability analysis in S- Domain:

The concept of stability – Routh's stability criterion – qualitative stability & conditional stability – limitations of Routh's stability.

Root Locus technique: The root locus concept – construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT IV:

Frequency-response analysis:

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.Introduction to compensation techniques

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UNIT V:

State space analysis:

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization-Solving the Time invariant state Equation- State Transition Matrix and it's Properties-Concepts of Controllability and Observability.

TEXT BOOKS:

1. Nagoorkani A, Control Systems Engineering, CBS PUB & DIST,2020
2. Nagrath I J & Gopal M, Control Systems Engineering, New Age International, 2009.

REFERENCE BOOKS:

1. Anand Kumar, Control Systems, PHI Publications, Second Edition,2014.
2. Jagan N. C, Control Systems, BS Publications, 2014.

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BASIC ELECTRICAL ENGINEERING
(II B. Tech Mechanical Engineering)

II Year B. Tech II Sem

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the course, students will be the able to

1. Understand basic principles of electrical elements.
2. Apply the concepts of AC Circuits to various elements and combinations
3. Examine Magnetic properties and principle of transformer
4. Contrast the working of DC Machines and Induction Motors.
5. Assess working principle of AC generator and 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

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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 - by T.K. Nagasarkar and M.S. Sukhija, Oxford University press.
2. Basic Electrical Engineering – by S.K Bhattacharya, Pearson Publication, 1st Edition.

REFERENCE BOOKS:

1. Network Analysis by Sudhakar & Shyam Mohan.
2. Basic Electrical Engineering by K.Uma Rao and A.Jayalakshmi, IK Publications.
3. Basic Electrical Engineering-By M.S. Naidu and S. Kamakshiah-TMH.

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BASIC ELECTRICAL ENGINEERING LABORATORY

(II B .Tech Mechanical Engineering)

B. Tech. Mechanical II Year II semester

L	T	P	C
0	0	2	1

Pre requisite: Basic Electrical Engineering

Course Outcomes: At the end of the course, students will be the able to

1. Understand basic electrical laws.
2. Analyse the response of different types of electrical circuits to different excitations.
3. Apply electric laws and find out performance of various electrical machines
4. Asses the losses in 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. Sudhakar and Shyam Mohan, "Circuits and Networks" Tata Mc Graw Hill Companies.
2. P.S.Bimbra, "Electrical Machines", Khanna Publishers.

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PRINCIPLES OF ELECTRICAL ENGINEERING

B. Tech Civil Engineering II Year II Semester (B. Tech Civil Engineering)

Prerequisites: Mathematics, Physics

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the course, students will be the able to

1. Understand basic principles of electrical elements.
2. Apply the concepts of AC Circuits to various elements and combinations
3. Examine principle and operation of transformer
4. Contrast the working of DC Machines and Induction Motors.
5. Assess working of measuring instruments.

UNIT I

INTRODUCTION TO ELECTRICAL ENGINEERING

Ohm's law , basic circuit components, Kirchhoff's laws, simple problems.

NETWORK ANALYSIS

Basic definitions, types of elements, types of sources, resistive networks, inductive networks, capacitive networks, and series parallel circuits, star delta and delta star transformation. , Network theorems- Superposition, Thevenin's, Maximum power transfer theorems and simple problems.

UNIT II

ALTERNATING QUANTITIES

Principle of ac voltages, waveforms and basic definitions, root mean square and average values of alternating currents and voltage, form factor and peak factor, phasor representation of alternating quantities, the J operator and phasor algebra, analysis of ac circuits with single basic network element, single phase series circuits.

UNIT III

TRANSFORMERS

Principles of operation, Constructional Details, Ideal Transformer and Practical Transformer, Losses, Transformer Test, Efficiency and Regulation Calculations (All the above topics are only elementary treatment and simple problems).

UNIT IV

D.C. MACHINES

D.C GENERATORS

Principle of operation of dc machines, types of D.C generators, EMF equation of D.C generator.

D.C MOTORS

Principle of operation of dc motors, types of D.C motors, torque equation, simple problems

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UNIT V

BASIC INSTRUMENTS

Introduction, classification of instruments, operating principles, essential features of measuring instruments, Moving coil permanent magnet (PMMC) instruments, Moving Iron of Ammeters and Voltmeters (elementary Treatment only).

TEXT BOOKS:

1. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.
2. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications.

REFERENCE BOOKS:

1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudiptanath, Chandrakumar Chanda, Tata-McGraw- Hill.
2. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

Annexure – III

Vidya Jyothi Institute of Technology

(An Autonomous Institution)

(Accredited by NAAC & NBA, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)

Aziz Nagar Gate, C.B. Post, Hyderabad-500 075

For Students detained in R15 regulations and rejoined in R20 regulations (subjects in addition to the existing subjects of corresponding semesters) the following subjects are proposed as substitute subjects:

Courses Offered to those who are Re-admitted in II-I Sem.

No courses

Courses Offered to those who are Re-admitted in II-II Sem.

S.No.	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.			PC		

PC: Professional Communication

Courses offered for those who are Re-admitted in III-I Sem.

S.No.	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.			PC		
2.			GS		
3.			PEE		
4.			NMPD		

PC: Professional Communication **NMPD:** Numerical Methods and Partial Differential Equations
GS: Gender Sensitization **PEE:** Python for Electrical Engineers

Courses Offered to those who are Re-admitted in III-II Sem.

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.			PC		
2.			GS		
3.			PEE		
4.			NMPD		

PC: Professional Communication **NMPD:** Numerical Methods and Partial Differential Equations
GS: Gender Sensitization **PEE:** Python for Electrical Engineers

Courses Offered to those who are Re-admitted in IV-I Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.			ECN		
2.			MPID		
3.			PC		
4.			GS		
5.			PEE		
6.			NMPD		

PC: Professional Communication **NMPD:** Numerical Methods and Partial Differential Equations
GS: Gender Sensitization **PEE:** Python for Electrical Engineers
ECN: Essentials of Computer Networks
MPID: Microprocessors and Interfacing Devices

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Courses Offered to those who are Re-admitted in IV-II Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.			PC		
2.			GS		
3.			PEE		
4.			NMPD		

PC: Professional Communication
GS: Gender Sensitization
NMPD: Numerical Methods and Partial Differential Equations
PEE: Python for Electrical Engineers

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For Students detained in R-18 regulations and rejoined in R20 Regulation (subjects in addition to the existing subjects of corresponding semesters)

Courses offered to those who are Re-admitted in II-I Sem.

No courses

Courses offered to those who are Re-admitted in II-II Sem.

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.	PS - I	EDC		-	-

EDC : Electronics Devices and Circuits
PS –I: Power Systems I

Courses offered to those who are Re-admitted in III-I Sem.

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1	PS - II	PEE		-	-
2			STLD	-	-
3				-	-

PS-II: Power Systems-II
PEE: Python for Electrical Engineers
STLD: Switching Theory and Logic Design

Courses offered to those who are Re-admitted in III-II Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1			PEE	-	-
2	QMLR	PDBS		-	-
3	EECA	PE-I			

PEE: Python for Electrical Engineers
EECA: Electrical Energy Conservation and Auditing **PE- 1:** Professional Elective 1
PDBS: Personality Development and Behavioral Skills
QMLR: Quantitative Methods and Logical Reasoning

Courses offered to those who are Re-admitted in IV-I Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1			ECN	-	-
2			PE-I	-	-
3			PEE		

ECN: Essential of Computer Networks
PE-1 : Professional Elective - 1
PEE: Python for Electrical Engineers

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Courses offered to those who are Re-admitted in IV-II Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1	-	-	PE – 1	-	-
2	-	-	PE – 4	-	-
3	-	-	PEE	-	-
4			ECN		

ECN: Essential of Computer Networks
PE-1 : Professional Elective - 1
PE-4: Professional Elective - 4
PEE: Python for Electrical Engineers

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For Students detained in R-19 regulations and rejoined in R20 Regulation (subjects in addition to the existing subjects of corresponding semesters)

Courses offered to those who are Re-admitted in II-I Sem

No courses

Courses offered to those who are Re-admitted in II-II Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1.	PS - I	PC		-	-
2.	GS	ES			

PC : Professional Communication
PS –I: Power Systems I
GS: Gender Sensitization
ES: Environmental Sciences

Courses offered to those who are Re-admitted in III-I Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1			PEE	-	-
2			STLD	-	-

STLD: Switching Theory and Logic Design
PEE: Python for Electrical Engineers

Courses offered to those who are Re-admitted in III-II Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1	PE-2	PE-1		-	-
2			PEE	-	-
3	QMLR	PDBS			

PE-1: Professional Elective -1
PE-2: Professional Elective -2
PEE: Python for Electrical Engineers
PDBS: Personality Development and Behavioral Skills
QMLR: Quantitative Methods and Logical Reasoning

Courses offered to those who are Re-admitted in IV-I Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1			PEE	-	-
2			ECN	-	-
3			PE – 1		

PEE: Python for Electrical Engineers
PE-1: Professional Elective -1
ECN: Essentials in Computer Networks

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Courses offered to those who are Re-admitted in IV-II Sem

S.No	Current Subject	Substitute Subjects	Additional Subjects	Subject Code	Credits
1	-	-	PEE	-	-
2	-	-	ECN	-	-
3	-	-	PE-1	-	-
4			ISP		
5			PE-4		

PEE: Python for Electrical Engineers

ECN: Essentials in Computer Networks

PE-4: Professional Elective - 4

PE-1: Professional Elective -1

ISP: Introduction to Signal Processing

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