

# Vidya Jyothi Institute of Technology (Autonomous)

(Accredited by NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad) (Aziz Nagar, C.B.Post, Hyderabad -500075)

# **Department of Mechanical Engineering**

#### Circular

# MED/Major Projects/01

# All the final year mechanical engineering students are informed that a project work has to be undertaken as a partial fulfillment for the award of degree. In this connection you are required to form into groups with three to four members. Grouping is done voluntarily by yourself considering the domain of interest in mechanical engineering. Hence you are required to submit the group along with the domain/project topic so that faculty member can be allocated as supervisor/guide. Also you can speak to the faculty member in choosing them as supervisors for the project work undertaken. The submission of the group to **Mr.Prasad Kumar**, Asst.Professor, who is project coordinator on or before **19.12.2019**.

HoD (Dr.G.Sreeram Reddy)

Dt: 02.12.2019

#### VIDYA WOTHI INSTITUTE OF TECHNOLOGY DEPARTMENT OF MECHANICAL ENGINEERING

IV -Year, II - Sem Section -A - Major Project Batch Allocation- 2019-20

S.No	Batch No	Roll No	Name of the Students	Name of the Project Guide	Project Title	Place of Work	Related PO/PSO	
1		16911A0332	M.SAI KUMAR				PO1. PO2. PO3. PO4. PO5. PO9. PO12.	
2	I 16915A03 17915A03 17915A03	16915A0304	B. SAI NIHAR					
3		17915A0305	A.KARAN	Dr.M.Naveen Kumar	Prototype model building of automobile component by reverse engineering	VIIT	P501, P502	
4		17915A0313	B.RAVI TEJA			The local sector of the sector		
i		16911A0349	S.RAMANUJAN					
6		17915A0307	BJAYACHNDRA		Evaluation of mechanical properties of and thermal behaviour of novel		P01, P02, P03, P04, P05, P09, P012, PS01, PS02	
,		17915A0311	B.SAIHARIHARAN	Mr. I. Pavan Kumar	composite material	TILV		
8		17915A0312	B.DEEKSHITH	1				
9		16911A0301	A.SANJAY					
0		16911A0304	A.RAVINDRA		Landren and the second states of the second states	7.055543	PO1, PO2, PO3, PO4, PO9, PO12, PSO2	
1		16911A0312	CH.SAI SRINIVAS	Dr.M.Naveen Kumar	Design and fabrication of automatic gear shifting mechanism in automobile	VIIT		
2		16911A0335	M.RAHUL	1				
3	1	16911A0314	CH.LIKITHA	Mr.S.Prasad Kumar			P01, P02, P03, P04, P05, P09, P012, PS01	
4	IV	16911A0319	E.VISHNU		Investigation on friction stir weldingof disimilar aluminium alloys (AA6061 &	τικν		
5		16911A0328	K.SRIKANTH		AA6351) using various micro powders			
6		17915A0309	B.PAVANI		×			
7		16911A0308	B.SHIVANI	Mr.C.Naveen Raj	Development of composite materials usingvarious fibers & epoxy resin		PO1, PO2, PO3, PO4, PO5, PO9, PO12, PSO1	
8	v	16911A0325	J.SWAPNA			100.022		
•		16911A0336	M.VINEELA			VIIT		
0		16911A0355	UVS CHANDAN					
		169110305	A.BALAKRISHNA		Optimal design of Basalt-Kenaf and E glass kenaf composite	тіцу	P01, P02, P03, P04, P05, P09, P012, P501, PS02	
	10	169110326	KA MALLESH YADAV	Mr.C. Downlock has				
	" [	16911A0357	V.VISHNU	Mr.S.Kamakrishna				
		17915A0308	B.SHESHI KUMAR				20140000000000000000	
Ι		16911A0323	G.AJAY REDDY					
		16911A0330	K.DURGA PRASAD	D-DVD-JE		TILV		
	V" [	16911A0331	K.RUCHITHA	Dr.B.v.Reddi	Synthesis of 1102 Nano structure with different morphologis		PS01, P02, P03, P04, P05, P09, P012, PS01, PS02	
	Г	16911A0346	P.DIVIJ					
T		16911A0337	MD.ADIL					
1		16911A0338	MD.IMAAZ	Dr. Phanindra Bogu	Impact of notch topology on the fatigue life of UNS S32760 super duplex	τιν		
1		16911A0360	ZUBAIR AHMED		stainless steel		PSO2	
		16911A0345	P.SOURAB			$\mathcal{D}$		

Criterion for Evaluation/ Rubric	Poor (1)	Satisfactory (2)	Good (3)	Very Good (4)	Excellent (5)
Requirements	Project does not adhere to its requirements.	Project minimally adheres to its requirements.	Project mostly adheres to its requirements	Project completely adheres to its requirements	Project completely adheres to its requirements and suits current day's industry needs.
Creativity	Project is significantly incomplete and lacking creativity.	Project is somewhat incomplete and slightly creative.	Project is complete and creative.	Project is complete, creative and novel.	Project is highly creative and visibly appealing.
Model Building	Contains no involvement of mechanical engineering concepts.	Contains minimal involvement of mechanical engineering concepts.	Contains involvement of mechanical engineering concepts in study- oriented approach.	Contains involvement of mechanical engineering concepts like design, fabrication, analysis etc. without any live model or simulation.	Contains involvement of mechanical engineering concepts like design, fabrication, analysis etc and working model/ simulation as well.
Quality of the work	Project is of poor quality work.	Project appears hastily created or is of poor quality work.	Project construction could benefit from more than a minimal amount of effort.	Project construction could be improved somewhat in select areas.	Project is of excellent, durable construction.

#### RUBRICS FOR EVALUATION OF PROJECTS



t.

# VIDYA JYOTHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)) (Accredited by NAAC & NBA. Approved Dy ALCLE. New Defin. Permeently Affinited to NY(U. Hyderathal) (Arv Namer CB Post, Hyderathal. 500075) Department of Mechanical Engineering

	*	IV YEAR PROJECT REVIEW MARKS	
Understanding background and topic			11

is         issues	F		E C. Bround analy (3M)					
No.         Page Statement Addit UNA           V         Process and State VI         Process and State VIII Process and VIII Process a	F	111	Specific Project goals (200)					
No.         Nome of the State Stat	H		Literature Survey (180)					
V         Consumer and 1000.         Description         Proof of the state of the st	-	IV	Project Planning (484)					
Shee         PHIOP         Phior		V	Presentation skills (4M)			Review II	Review III	Total
SN         ILLNO         NAME OF THE STREME         THORN STATUSE         THORN STATUSE <ththorn statuse<="" th="">         THORN STATUSE</ththorn>	1 33200		Second and the second sec	PROJECT TITLE	Review I (15)	(15)	(20)	(50)
1         401.1000         Fig. 1000.000         10	S.No	H.T.NO	NAME OF THE STUDENT	FROMECTITIE		(1.9		
1         101/12000         Units SUBJECK         Units All And All All All All All All All All All Al				the second s	12	14	16	42
1         01/2000         Avacass wave in the same set of the same set of the same in a same set of the same set of t	1	1691140301	ALLIRI SANIAY SREENDAS	Desum And Fabrication Of Automatic Gear Shifting Mechanism In Automobile	11	14	14	39
Image: Instruction of Particip Networks         Description of Particip Networks         Image: Particip Networks </td <td>2</td> <td>16011A0301</td> <td>AUNACADI NAVEEN KIIMAR</td> <td>communic And Budget Mini Chopper Bike</td> <td></td> <td>11</td> <td>16</td> <td>41</td>	2	16011A0301	AUNACADI NAVEEN KIIMAR	communic And Budget Mini Chopper Bike		11	16	41
Image: Proceedings of Control Contrel Control Control Control Control Control Control C		16911A0303	APNAGARI NAVELN KOMAN	And Fabrication Of Automatic Gear Shifting Mechanism In Automobile	12	17	15	37
Image: 1. 001/2005 00 X000/X000 00 generate the second		16911A0304	ATHELURAVINDRA	Internal Design OF BASALT KENAF & EGLASS- KENAF Composite	10	14		
Instrume         Name         Number         Number<		16911A0305	AVULA BALAKNOHNA	Animal Octoph Of Dechanical Properties Of Mild Steel AISI 1040 Using Mig Welding	12	14	14	40
10         10         10         12         12         13           10         10010000         Acceleration Markin         Designment Junce Mark Mark Network         10         12         44           10010000         Acceleration Mark Mark Designment Junce Mark Mark Mark Mark Mark Mark Mark Mark	5	16911A0306	BALLARY SURYAKANTH	Adentification investigation of succession of the				
bit         Instrume         12 <th12< th="">         12         12         &lt;</th12<>				Tocess Of Machineral Properties Of Stainless Steel 304 Using Tig Welding	11	12	15	38
Dist         Dist <thdis< th="">         Dist         Dist         D</thdis<>	6	1591140307	BANDA VIKAS YADAV	xperimental investigation Of Mechanical Properties Of statistical sectors				7.0
1         10110000         Nucleonization Nucleonization         10         12         4.5           1         10110000         Nucleonization         100         12         101           1         10110000         Nucleonization         100         12         101           1         10110000         Nucleonization         100         12         101           1         10110000         Nucleonization         100         12         101 <td< td=""><td></td><td>1051140307</td><td>BANDA CIRCS CADAT</td><td>TOCESS</td><td>12</td><td>12</td><td>14</td><td>30</td></td<>		1051140307	BANDA CIRCS CADAT	TOCESS	12	12	14	30
structure         Instructure	7	16911A0308	BANDREDDI SHIVANI	Development Of Composite Materials Using Various Fibers & Epoxy Reality	11	12	14	37
•         >         >         >         >         >         >         >         >         >         >         >         >         >         >	8	16911A0310	BHUKYA NAGA	Comparative Elevation Of Mild Steel Welded Joints Employed By Different Process	10	14	15	39
19         148110.01         Overtrok AMP         Processing Of Machines Register Of Machines Sole 3M of Marcines Action         10         10         10           11         19110.011         Overtrok AMP         Processing Of Machines Register Of Machines March March 19110.001         11         10         16           12         19110.001         Overtrok AMP         Processing March 19110.001         10 <td< td=""><td>9</td><td>1691140312</td><td>CHELAKALA SALSRINIVAS</td><td>Design And Fabrication Of Automatic Gear Shifting Mechanism In Automobile</td><td></td><td></td><td>10</td><td>3.6</td></td<>	9	1691140312	CHELAKALA SALSRINIVAS	Design And Fabrication Of Automatic Gear Shifting Mechanism In Automobile			10	3.6
10         Bell (AM1)         Owner         Compare the France Section of National Addenged Channelle Addenged Noting Tg Wadeng         (1)		TOSTEROSTE	CHEDIOLOUS AND	sperimental Investigation Of Mechanical Properties Of Stainless Steel 304 Using Tig Welding	11	12	Б	20
Heritability         Description for Frances Size Webling CD Description Advances Addys (Advall, a Adv.)114         11         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12         12	10	16911A0313	CHINTHA ARUN	Provess		and and and		
11         Bell (1910)         Comp. Values Month Provides         11         12         11         15           12         1911 (1902)         DNAM ANY MAX         Provides         11         12         12         12         12         12         12         12         12         12         12         12         13           14         1911 (1902)         December of the main the first firs	-			mentionation On Enclum Stir Welding Of Dissimilar Aluminium Alloys (Aa6061 & Aa 6351)	11	13	- 14	38
1991.10010         Own Name         Processed Inscingence Of Machines Food FOUNdary Revealed         12         11         19           13         1991.10010         Own Name         Processed Inscingence Of Machines Inscing Cold Database Inscig Cold Database Inscinscint Database Inscig Cold Database Inscig Cold Databa	11	16911AD314	CHIRUMALLA LIKITHA	Investigation Off Inteleer States				
12         199110303         Devine Name         None         13         12         12         13         12         13         12         13 <td></td> <td></td> <td></td> <td>Using Various Mielo Foundary</td> <td>12</td> <td>11</td> <td>16</td> <td>39</td>				Using Various Mielo Foundary	12	11	16	39
1         10110021         2012001         100000         100000         100000         100000         1000000         10000000         1000000000000000000000000000000000000	12	1691140315	D MANI RATNAM	Experimental Investigation Of Mechanical Properties of Statistics			10	20
11         Wett Ledits?         Optimization         Description         Description <thdescription< th=""> <thde< td=""><td>10.00</td><td>10511040315</td><td>D Ministration</td><td>Process</td><td>12</td><td>12</td><td>15</td><td>10</td></thde<></thdescription<>	10.00	10511040315	D Ministration	Process	12	12	15	10
14         1031.06.20         TEQUE ANAMON PROV         TEQUE OF Lange Anamy And Program And Area Station         10.<	13	16911A0317	DEVARA NAVEEN	Thermal Evaluation Of Pulsating Heat Pipe For Different Fuses	12	13	15	40
15         19871340139         Class Constraints         100 <td>14</td> <td>16911A0318</td> <td>EEDULA BHARGAV REDDY</td> <td>Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids</td> <td>100</td> <td>12</td> <td>13</td> <td>16</td>	14	16911A0318	EEDULA BHARGAV REDDY	Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids	100	12	13	16
10         10110010         10110010         10110010         101         10         10         101         10         101        <				Investigation On Friction Stir Welding Of Dissimilar Aluminium Alloys (Autore) ac Autore)	10	15		
16         1991 JAB22         GANDETED VISUALAND STATUS         Liffice Of Amening Cycle On The Mediane Magnetic Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker Marker	15	16911A0319	ETTADI VISHNU	Using Various Micro Powders			15	30
16         1001.1003         GALOR DOV VIALADADI         State Carbo         11         12         14           17         1001.1003         GALOR DOV ANY KURAR RED         Constraints         100         12         12           19         1001.1003         GALOR DOV ANY KURAR RED         Constraints         100         12         12           19         1001.1003         Constraints         Constraints         101         12         13           10         1001.1003         Constraints         Constraints         11         12         13           10         1001.1003         Constraints         Constraints         Constraints         11         12         13           10         1001.1003         Constraints         Constraints         Constraints         11         12         13           10         1001.1003         Constraints         Constraints         Constraints         11         11         15           10         101.1003         Constraints         Constraints         11         11         15           10         101.1003         Constraints         Constraints         11         11         15           10         101.1003         Constraints			Provide and the results	Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rould	11	13	13	
12         19911A022         Department And Steps Sea, Using Addies, Manufactory, Man	16	16911A0321	GANDEEDU VUAYALAXMI	Steel Colls	11	17	14	37
1         1991.00024         Description         SYNTESIS OF TEAMAL FROM TABLE         11         11         14         14           10         1001.00235         ATTALESIS OF TEAMAL FROM TABLE         1001.00235         11         12         12           10         1001.00235         ATTALESIS OF TEAMAL FROM TABLESIS         11         12         12           10         1001.00235         ATTALESIS OF TEAMAL FROM TABLESIS         11         12         13           10         1001.00235         ATTALESIS OF TEAMAL FROM TABLESIS OF TEAMA	17	1001100000	CUNDABIONA SECHANTH	Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing		14		
18         1091.06323         COMMON OF ANY RUMAN ROD         1091.01328         10         12         12         12           19         1091.01328         ATM MADA WARNA DO COMMON AND STRUCT COMMON AND AND STRUCT COM	11	10911A0322	SUNDABIUNA SESTIANTA	SYNTHESIS OF TITANIA (Two2) NANO STRUCTURES WITH DIFFERENT	11	11	14	36
Instruments	18	1691140323	GUNREDDY AJAY KUMAR REDDY	NORDIOLOGIES			1.7	24
19         101110375         ATTABANA SAVARA         Declamational Contract, Statistical Data Cale Sci REAL Composite         11         12         20           10         101110375         ATTABANA SAVARA         Declamational Contract, Statistical Data Cale Sci REAL Composite         11         12         12           10         101110375         ATTABANA SAVARA         Declamational Contract, Statistical Data Cale Sci REAL         11         12         15           12         101110327         ATTABANA SAVARA         Declamational Contract, Table Sci Real Contreact, Table Sci Real Contreact, Tabl		10511010010		MORPHOLOGIES	10	12	12	34
20         1011.0334         (AAALIGST WAAA         Obtemal Design (1) NSUL SERIOR WILL ON CONSTRUCTURES WITH DEFFERINT         11         12         13           21         1011.0336         (ACREWAAA SURVINT)         (Machine Vacuum Meer Design (1) NSUL SERIOR WITH DEFFERINT)         11         12         16           22         1011.0336         (ACREWAAA SURVINT)         (Machine Vacuum Meer Design (1) NSUL SERIOR WITH DEFFERINT)         11         12         15           23         1031.0336         (Machine Vacuum Meer Design (1) NSUL (1) NSUL SERIOR WITH DEFFERINT)         11         12         15           24         1031.0333         (MALIGST WAAD         (Machine Vacuum Meer Design (1) NSUL (1) NSUL SERIOR WITH DEFFERINT)         11         16           25         1031.0333         (MALIGST WAAD         (Machine Vacuum A) NAUK (1) NSUL	19	16911A0325	JAITHARAM SWAPNA	Development Of Composite Materials Using Various Floers & Epocy result	11	12	15	30
101130372         SHUBCHOALS SHAATT         Descingtors OP Process Rev Malling CL Nameal, Aussaultan Kost, Northerson 11         11         12         11         12           22         16011A0378         Comput ED DURGA PRAAD         MORPHOLOGUES         11         12         16           23         16911A0378         Comput ED DURGA PRAAD         MORPHOLOGUES         11         12         16           24         16911A0378         MORATALY RECOMPTION         11         12         15           24         16911A0378         MORATALY RECOMPTION         11         15           25         16911A0338         MORATALY RECOMPTION         11         15           26         16911A0338         MORATALY RECOMPTION         11         15           27         16911A0338         MORATALY RECOMPTION         11         15           28         16911A0338         MORATALY RECOMPTION         11         14         14         14           29         16911A0338         MORATALY RECOMPTION         MARCAT ON CALL AND MORATALY RECOMPTION         12         14         14           20         16911A0338         MORATALY RECOMPTION         MARCAT ON CALL AND MORATALY RECOMPTION         12         14         14           21611A10338<	20	16911A0326	K A MALLESH YADAV	Optimal Design Of BASALT-KENAF & EGLASS- KENAF Composite		12	13	37
1         1091(10000         1000000000000000000000000000000000000			CONTRACTOR OF A CONTRACTOR	Investigation On Friction Stir Welding Of Dissimilar Aluminium Alloys (Aldoor & Au 9351)	11	13		1
22         1091140336         COPPARED DURGA PROAD         SYNTHESS OF TTANK (TD) ANKO STRUCTURES WITH DIFFERENT         11         12         15           23         1991140337         COMPAGUCOS         SYNTHESS OF TTANK (TD) ANKO STRUCTURES WITH DIFFERENT         11         12         15           24         1991140337         MASK INVALUESS OF TTANK (TD) ANKO STRUCTURES WITH DIFFERENT         11         12         16           24         1991140337         MASK INVALUESS OF TTANK (TD) ANKO STRUCTURES WITH DIFFERENT         11         12         16           24         1991140337         MASK INVALUESS OF TTANK (TD) ANKO STRUCTURES WITH DIFFERENT         10         11         15           25         1991140337         MASKAN PRAVITY SWARDOF         Expensional Investigation Of Madhancal Properties Of Madhancel Strugg Widam         10         11         14         13           25         1991140337         MARCAN PREM         Expensional Investigation Of Madhancel Troperties Of Madhancel Strugg Widam         11         14         13           26         1991140337         MARAMED MADLODEN         Expensional Investigation Of Madhancel Troperties Of Madhancel Properties	21	16911A0328	KATUKOJWALA SRIKANTH	Using Various Micro Powders			14-1	20
22         16911A334         COMPACTOLOGISS         11         12         15           23         16911A331         COMPACTOLOGISS         10         11         15           24         16911A331         MARKARA         NOMPERIOLOGISS         10         11         15           24         16911A333         MARKARA         NOMPERIOLOGISS         10         11         15           25         16911A333         MARKARA         NOMPERIOLOGISS         10         11         15           26         16911A333         MARKARA         Process         Process         10         11         15           27         16911A333         MARKARA PEMU         Developmend Intergrappicator Of Matsaard Pemus Datasation Of Automatic Card Mathing Matching Matching Datasation Datasati	-	-	States and the states in the same of the states of the sta	SYNTHESIS OF TITANIA (Tio2) NANO STRUCTURES WITH DIFFERENT	11	12	16	39
21         19911A0331         AUTHAPALLY RUCHTINA         VITTIESS OF TTANIA (Tric) NANO STRUCTURES WITH DIFFERENT         11         12         15           24         16911A0332         MAS LINARA         Proteiners Mark Biology (C. Automobile Composed Engeneening In Biology (T. Automobile Composed Engeneening In Automobile Integration Of Machineal Properties Of Math Steal ASII 1040 Using Tig W4dang         10         11         15           26         16911A0334         MARCARE MONTHY MAN OF TRANIS (T. C. Automatic Core Stating In Automobile III 11         13         15           27         16911A0334         MARCARE MARKING MARCA         Design Adia Structure Core Stating In Automobile III 14         13         16         16         16         16         14         13         16         14         13         16         14         13         15         16         16         14         14         13         15         16         12         14         14         13         15         16	22	16911A0330	KOPPINEEDI DURGA PRASAD	MORPHOLOGIES				1
21         19911A0311         VIDAPAULY RUCHTRA         NODEPIDQUCCES         10         11         15           24         19911A0332         MAGARE NAMER         Postoryes Media Imagington (Chachanaci Propertor Of Sauriles Steel 304 Uning Tig Welding         10         11         15           25         16911A0333         MAGARE NAMTRI SWAMOOP         Experimental Investigation (Chachanaci Propertor Of Mad Steel ALS) 1040 Uning Ming Welding         10         11         15           26         19911A0334         MAGARE NAMTRI SWAMOOP         Experimental Investigation (Chachanaci Propertors Of Mad Steel ALS) 1040 Uning Ming Welding         11         11         15           27         19931A0334         MARGAN PREM         Experimental Investigation (O Accemace Centre Time R Expert Messin March Internation (Chachanaci Propertors Of Mad Steel ALS) 1040 Units State				SYNTHESIS OF TITANIA (Tro2) NANO STRUCTURES WITH DIFFERENT	11	12	15	38
	23	1691140331	KOTHAPALLY RUCHITHA	STNTHESIS OF TITANIA (TIO2) TRAFE STREET STARS THE STARS				1 34
22         109110032         M SA UNAM.         Producty Model Instanta D. Alluments D. Statistics Statist Statistics Teg Wolding         10         11         16           25         169110033         MARAM REMART SYMMODP         Experimental Inscitagence Of Machanical Properties Of Machanical Statist Statist Statistics         10         11         15           26         169110033         MARAM REMART SYMMODP         Experimental Inscitagence Of Machanical Properties Of Machanical Properints D. Properint Properties Prophachanical Properties Prophachani		100 10 0000		MORPHOLOGIES	10	11	15	30
25         1691140313         MARCAR REATHS SWARDOP         Experimental larvestigation Of Machanial Properties Of Mald Stard ASI 1604 Using Mig Welding         10         11         15           26         1691140314         MARCAR REEM         Process.         100         11         15           27         1691140314         MARCAR REEM         Process.         100         11         15           28         1691140314         MARCAR REEM         Process.         100         11         14         16           29         1691140315         MERNAM VERMIA         Design And Fanciano Of Ausematic Grass Milling Various Profes & Enexy Resin         12         14         14         14           29         1691140315         MORIAMME ADIL         Design And Fanciano Of Ausematic Grass Milling Various Profes & Enexy Resin         12         14         14           21         1691140324         MORIAMME DARLOW         Enexy Resin AdV Milling Malding Various Profes & Enexy Resin         12         14         13           21         1691140324         MORIAMME DRAZDOW         Enexy Resin AdV Milling Malding Profes & Enexy Resin         12         12         14         15           21         1691140324         MORIAMME MARIAME CONTON TOTOLOCOVO NTHE FATICLE LIFE OLUNES S12760 SUPER DUPLEX         11         13	24	16911A0332	M SAI KUMAR	Prototype Model Building Of Automobile Composent by Reverse Englishering			16	37
2-1         BELLOW         Process. Experiment investigation Of Mechanical Properties Of Midd Steel ASI 1000 Using Mig Welding         10         11         15           2-6         1031140334         MeddawA PERM         Design and Fabrication Of Aukanama Curs Multine Weshingm In Automobile         11         11         15           2-8         1091140334         MethANE PERM         Development Of Companies Marrial Multine Weshingm In Automobile         11         14         13           2-9         1091140334         MethANE PERM         Mittan Companies Marrial Multine Weshing         12         14         16           3-0         1091140334         MONAMMED ADU.         Mittan CO Companies Marrial Multine Weshing Multine Weshing         12         12         14         16           3-1         1091120344         MONAMARED SHOL         Experimental Investigation Of Mechanical Response Multine State ADI 1001 Using Mig Welding         11         33         16           3-1         10911200344         MONAM ARADON RECOP         Process         12         14         33         15           3-1         10911200344         MONAM ARADON RECOP         Process         12         12         12         14           3-1         10911200346         Process         MONAM ANANA         Streprimental Intraduatin Marial		1001140222	MALGARI KRANTHI SWAROOP	Experimental Investigation Of Mechanical Properties Of Statifiess Succi 504 Osting (16) (10)	10	11	10	
b         16911A0334         MARGAM PREM         Experimental investigation Of Mechanical Properties Of Mick State ASI NOLING USINg Bin Fronting         0         111         155           27         16911A0335         Michanad JABHUL         Design And Enhanced Of Mechanical Properties Of Mick State ASI Notice Sciences         12         14         14           28         16911A0335         Michanad Data         Design And Enhances         File Construction of Sciences         12         14         14           29         16911A0335         Michanad Data         STANLISS STEEL         11         12         14         14           20         16911A033         Michanado Di Alaza         Nick Asid Sciences         12         14         14           21         16911A033         Michanado Di Alaza         File Control TroOLOGY ON THE FATICUE LIPE OTINS 537260 SUPER DUPLEX         11         13         16           21         16311A033         Michanado Di Alaza         File Science Di Alaza         12         14         15           21         16311A034         Michanado Di Alaza         File Science Di Alaza         11         13         15           21         16311A045         Michanado Di Alaza         File Science Di Alaza         File Science Di Alaza         16         133         <	125	16911A0333	REDDY	Process.				26
26         1091140314         ModelM PRED         Precess           71         109314035         ModelM PRED         11         15           28         109114035         ModelM PRED         12         14         14           28         109114035         ModelM PRED         12         14         14           29         109114037         ModelM PRED         11         14         13           30         109114037         ModelM PRED         NUMARY OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OT UNS 572700 SUPER DUPLEX         12         14         16           31         1091140339         MOHAMMED MAQUE         Presenter of Model Sente Emplored Thy Different Precess         12         14         15           31         1091140329         MOHAMMED MAQUE         Experimental Inscripting Of Model Anale Prepreces         12         12         15           31         109114034         MOHAMMED MAQUE         Experimental Inscripting Of Model Anale Prepreces         12         12         15           31         109114034         MOHAM AND MAQUE         Experimental Inscripting Of Model Anale Prepreces         12         12         15           31         109114034         MAHAMED MAQUE         Experimod Inscring Preces         12         12	1.1			Experimental Investigation Of Mechanical Properties Of Mild Steel AIST 1040 Using Mild Wedning	10	11	15	50
197         1993 AD335         Metsinkan, Reituk, Desgin Add Fabrication Of Aukomatic Cerr Shifting Mechanism In Admostic         12         14         14         14           28         1093 JA0335         Mission Viewal         IMPACT OF NOTCH TOPOLOGY ON THE FATIOLE LIFE OCIDINS SISTERS DUPER DUPLEX         11         14         13           29         1693 JA0335         Mission Viewal         IMPACT OF NOTCH TOPOLOGY ON THE FATIOLE LIFE OCIDINS SISTERS DUPLEX         12         14         16           30         1691 JA0335         Mission Mission Mission Mission Mission Mission Pibe         12         14         15           31         1691 JA0345         Mission Mission Mission Mission Mission Mission Pibe         12         14         15           32         1691 JA0342         Mission RADINA         Cemperative Environ Of Mission Repetitor Of Mission Repetitor Of Mission Mission Mission Mission Mission Advector Mission Mission Mission Mission Advector Mission	26	16911A0334	MARGAM PREM	Process	11	11	15	37
169         169140038         WINNENV VENUA.         Decknown Of Company Marine Liner, Yunou Filer & Ecocy Mark S12206 SUPER DUPLEX         12         14         14           29         169114033         WOLMMED AGUL         STANLESS STEEL.         11         14         13           30         169114033         WOLMMED PARLEDIN         IMPACT OF NOTCH TOPOLOGY ON THE FATURE LIFE OF UNS 532766 SUPER DUPLEX         12         14         145           31         169114033         WOLMMED BIAQ         Envolume.         12         14         155           32         169114033         WOLMMED BIAQ         Envolume.         168         12         14         155           34         169114034         WOLMARKED RANKER REDD         The Mark Multi All Mark Multi Mark Multi All Mark Multi Mark	27	1691140335	MEGHARAJ RAHUL	Design And Fabrication Of Automatic Gear Shifting Mechanism In Automobile	11	14	14	40
100         100         100         100         100         11         14         13           29         1001/LASS         MONAMAED AGUL         MMACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$327405 SUPER DUPLEX         12         14         14           30         1691/LASS         MONAMED RAJUCOM         MMACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$327405 SUPER DUPLEX         12         14         15           31         1691/LASS         MONAMED RAJUCOM         MMACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$327405 SUPER DUPLEX         12         14         15           32         1691/LASS         MONAMED RAJUCOM         Experimental Inscription Of Medanacal Properties Of Mid Steel AISI Information         12         12         15           33         1691/LASH         MANUELSHUTH         The Relation Of National Properties Of Mid Steel AISI Information         11         13         15           34         1091/LASH         MARCT OF NOTCH TOPOLOGY ON THE FATIGUE BINK Marketing         11         13         15           35         1691/LASH         MARCT OF NOTCH TOPOLOGY ON THE FATIGUE BINK Marketing         11         13         15           36         1091/LASH         MARCT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$22760 SUPER DUPLEX         12         14           37	28	1691140336	MENNENI VEENILA	Development Of Composite Materials Using Various Fibers & Epoxy Resm	12	14		-
2*9         1651JA032         MCIAAMMED ADIL         STAILLESS STEEL.         17.0           30         1661JA038         MCAAAMED MALUDOW         IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS S32760 SUPER DUPLEX         12         14         15           31         1691JA033         MOLAMED SHAQ         Ensome And Budget Min Chorper Bids.         12         13         165           32         1691JA034         MOTAM RAKUMAR         Comparitive Elevation Of MAM Skeel ANSI 16400 Jung Mig Welding.         11         13         165           34         1691JA034         WOTAM RAKUMAR         Comparitive Elevation Of MAM Skeel ANSI 16400 Jung Mig Welding.         11         13         15           34         1691JA034         WOTAM RAKUMAR         STATHLISS STEEL.         11         13         15           35         1691JA0346         PATICULA OWI RUDOY         MORTOL TOPOLOCID VOI TUTE FATICULE LIFE OT UNS 532760 SUPER DUPLIX         11         13         15           36         1691JA0346         PATICULA OWI RUDOY         MORTOL TOPOLOCID VOI TUTE FATICULE LIFE OT UNS 532760 SUPER DUPLIX         11         12         14           37         1691JA0346         PATICULA OWI RUDOY         MORTOL TOPOLOCID VOI TUTE FATICULE LIFE OT UNS 532760 SUPER DUPLIX         11         12         12         12	10	1031140330		IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$32760 SUPER DUPLEX	11	14	13	38
30         L6511A0338         MONAMMED IMAZUDDIN         IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS S32769 SUPER DUPLEX         12         14         15           31         L6511A0338         MONAMMED ISMAQ         Exponence. And Budget Mind Chopen Bds.         12         14         15           32         L6511A0342         MONAMMED ISMAQ         Exponence. And Budget Mind Chopen Bds.         12         13         16           33         L6511A0342         MUNGI ARAVINO REDOY         Exponence Intension Of Madianual Properties Of Multi Seed AISI 1040 Using Mig Widing         11         13         16           34         L6511A0034         MUNGI ARAVINO REDOY         Exponence Intension Of Madianual Properties OF Multi Seed AISI 1040 Using Mig Widing         11         13         15           36         L6511A0034         PAMAG SOURAB KUMAR         ITMACT OF NOTCH TOPOLOCY ON ITHE FATURE DEFECT UNIT S532760 SUPER DUPLEX         11         13         15           37         L6511A0034         PAMAG SOURAB KUMAR         Dissign Of Lattice Spreame AIS Steper Sole Using AMds toward Austrian         11         14         13         15           38         L6501LOADVUI RDDOY         Design Of Lattice Spreame AIS Steper Sole Using Addiave Markfeetime         11         14         13         15           39         L651L00355 <t< td=""><td>29</td><td>16911AD337</td><td>MOHAMMED ADIL</td><td>STAINIESS STEEL</td><td></td><td></td><td></td><td></td></t<>	29	16911AD337	MOHAMMED ADIL	STAINIESS STEEL				
30         14911A0339         MOMAMMED MAND DISAUDORN         TELENT CADE AS STEEL AND ADDRESS STEEL         12         12         12         13         15           31         16911A0329         MUMRI RAWND DISAUD ADDRESS Elevation Of Mad Steel Weldel Josus Employ On CM Md Steel ANSI 1040 Using Mig Welding         11         13         16           32         16911A0342         MUMRI RAWND MROY         Experimon Of Mid Steel Weldel Josus Employ On CM Md Steel ANSI 1040 Using Mig Welding         11         13         16           34         16911A0342         MUMRI RAWND MROY         Themas Evaluation Of Platating Heat Projects Of Microst Platading         12         12         12         12         15           35         16911A0344         MUMRI SHUTCH         Themas Evaluation Of Platating Heat Projects Of Microst Platading         11         13         15           36         15911A0344         PATICLA DNU REDOV         MYTTHESIS OF TITANIA (TIA2) NAN O STRUCTURES WITH DIFFERINT         11         14         13         15           37         16911A0345         PAMBA SOURASE         Disto Of Lattice Structure Add Steel Weldel Jostis Employee Bit Mid Midding         11         14         13           38         16911A0355         APAYAN MAMIMI         Disto Of Middisteel Midding Midding Bit Midding Bit Midding         11         14         13				IN THAT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$32760 SUPER DUPLEX	17	14	16	42
Image: Stratuce of Status (Status (Stat	30	16911A0338	MOHAMMED IMAZUDDIN	INFACT OF NOTCH TOTOLOGT ON THE FILLOOD DE	12			
1         1691140339         MOHAMAGE DRAGU         Proceeding and a constraint of the second of the secon				STAINLESS STEEL	12	14	15	41
12         16911A0321         MOTAM MAJKUMAR         Comparative Elevation Of Mild Sted Wellow Different Plotting Mills Welding         11         13         15           33         18911A0321         MOTAM MAJKUMAR         Comparative Elevation Of Mild Sted Wellow Different Plots         12         12         15           34         16911A0345         PANERA SOURAR NUMAR         STAPLESS TELL         12         12         12         12           35         16911A0345         PANERA SOURAR NUMAR         STAPLESS TELL         13         15           36         16911A0346         PANTOLIA DIVU RODY         MORPHOLOCIUS NILLE FATICULES WITH DIFFERENT         11         13         15           37         16911A0346         PANTOLIA DIVU RODY         Design OTALING Comparison Metricition of Modeling Mills Metricitian         11         14         13         15           38         16911A0351         SAMANUAM         Elevation Of Metalianal Procestics Of A Nord Comparitive Matrial Statis Mills Metrial         11         14         13         16           39         16911A0351         SAMANUAM         Elevation Of Mild Sted Welded Joints Employed By Different Process.         12         13         16           41         16911A0357         MARIANT SUN         Comparative Elevation Of Mild Sted Welded Joints Employed By Diff	31	16911A0339	MOHAMMED ISHAQ	Ergonomic And Budget Mini Chopper Dike	12	11	16	39
33         1693140342         MUNG I ARAVIND FRODY         Experimental Investigation Of Mechanaral Properties Of Mal Steam (Ast) Mol Culling, Reduces         11         13         16           34         1691140344         NOMULA SHRUTHE         Thermal Evaluation Of Pulsami [lear Proge For Different Plands         12         12         12         13           35         1891140344         PAMEA SOURAB RUMARE         INPACT OF NOTCI I TOPOLOGY ON TILE FATICUL LIFE OUTONS 532760 SUPER DUPLEX         11         13         15           36         1891140344         RONDU RAVEEN         Dot Of Mal Staat Man (Truck)         11         13         15           37         1591140344         RONDU RAVEEN         Dot Of Mechanarel Properties Of More Composites Material         11         14         13         15           38         1691140345         SRMANDAM         Experimental Investigation Of Mol Steal Properties Of Mol Steam (Manufacturine         11         14         13           39         1693140355         SAMANDAM         Experimental Investigation Of Mol Steal Properties Of Mol Steam (Manufacturine)         12         12         12           40         1693140355         SAMANDAM         Experimental Investigation Of Mol Steal Properties Of Mol Steam (Mal Steal Val Advector Properties Advector Properties Advector Properties Advector Propereses         12         13	32	16911A0341	MOTAM RAJKUMAR	Comparative Elevation Of Mild Steel Welded Joints Employed By Different Freedom Freedom Welding	10			
3-3         148 Judisz         Porcess         12         12         12         15           3-4         Leis Judisz         Normal Sakuran         Thermal Evaluation Of Pulsating Heat Pripe For Different Fluids         11         13         15           3-5         Leis Judisz         SYMTHESS OF TITANIA (Tud) NOT TRUE SWITH DIFFERENT         11         12         12         12           3-6         Leis Judisz         SYNTHESS OF TITANIA (Tud) NOT STRUCTURES WITH DIFFERENT         11         13         15           3-7         Leis Judisz         SANNEAK         Design Of Lattice Structure And Stipper Sole Using Additive Material         11         14         13         15           3-7         Leis Judisz         SANNANIJAM         Experimental Investigation Of Medianal Propense Of Mal Stal All 1040 Using Mig Weding         11         14         13           3-7         Leis Judisz         SANNANIJAM         Experimental Investigation Of Medianal Propense Of Mal Stal All 1040 Using Mig Weding         11         12         14           4-0         Leis Judisz         Camparative Elevation Of Mal Stal Wedid Jones Energy Result         12         13         14           4-1         Leis Judisz         Camparative Elevation Of Mal Stel Wedid Jones Energy Result         12         14         13           <		1001110747	MUNCLARAVIND REDDY	Experimental Investigation Of Mechanical Properties Of Mild Steel AUST 1040 Using Mild Weating	11	13	16	40
44         199114084         NOMULA SHRUTHI         Thermal Revaluation Of Polatame, Head Price For Different IPE of Lifferent Process.         12         12         12         12           35         1691140345         PAMBA SOURAB KUMARA         IMPACTO FO NOTCIT TOPOLOCY ON TITE PATIGUE LIFE Of LINS S32760 SUPER DUPLEX         11         13         15           36         1691140346         PATIGUIA DAVI REDOY         Distribution Of Medianal Properties Of Manufacturing         11         13         15           37         16931140345         SAMAANUJAM         Evelution Of Medianal Properties Of Aldreid Matrial         11         14         13           38         1693140345         SAMAANUJAM         Evelution Of Medianal Properties Of Mad Steel AlSI 1040 Using Mig Welding         11         12         16           40         1693140345         SAMAANUJAM         Evelution Of Midd Steel Velded Joints Employed By Different Process.         12         12         13           41         1693140355         TLANATH SUNE Comparative Elevation Of Midd Steel Velded Joints Employed By Different Process.         12         14         13           42         1693140355         TLANATH SUNE         Comparative Elevation Of Midd Steel Velded Joints Employed By Different Proces.         12         13         14           43         1693140355         T	23	16911A0342	MONGI ADAVIND REDDI	Process	12	12	15	39
15         1691140345         PAMBA SOURAB KUMAR         IMPACT OF NOTCH TOPOLOCY ON THE FATIGUE LIFE OTURS \$32260 SUPLIC LOPICLS         11         13         15           36         1691140346         PATLOLA DAU REDDY         SYNTHESIS OF TITANIA (Tisc) NANO STRUCTURES WITH DIFFERENT         11         13         15           37         1691140346         RONDI NAVEEN         Design Of Latice Structure And Singper Sole Using Additive Manufacturing         11         14         13           39         1691140351         SANDAPALIY VAMSH         Experimental Investigation Of Middle Steel AlSI 1040 Using Mig Welding         11         14         13           40         1691140351         SANDAPALIY VAMSH         Experimental Investigation Of Middle Welded Jones Employed Bro Different Process         12         12         13           41         1691140355         SANDAPALIY VAMSH         Experimental Investigation Of Middle Velded Jones Employed Bro Different Process         12         13         16           42         1691140357         VELMAA VERKATA SAI         Development Of Composet Macrinals Using Vanious Prices & Expoxy Resin         12         13         15           44         1691140357         VELMAA VERKATA SAI         Design Of Lattice Structure And Shiper Sole Using Additive Manufacturing         9         12         14           45	34	16911A0343	NOMULA SHRUTHI	Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids	12	12	+	1
15         16511A034         PAMBA SUDIAR AUMAR         STARLESS STELL         1         12         12           36         16911A0346         PATLOLIA DIVI REDDY         SYNTHESIS OF TITANIA (Tic2) NANO STRUCTURES WITH DIFFERENT         11         13         15           37         15911A0346         ROWIN MAYEEN         Design Of Latice Structure And Slipper Sole Uning Additive Manufacturing         11         14         13           38         19811A0345         SANDAPALLY VAMSHI         Experimental Investigation Of Mechanical Properties Of Mild Steel ASI 1040 Using Mig Welding         11         12         16           40         19931A0324         SANDAPALLY VAMSHI         Comparative Elevation Of Mild Steel Welded Joints Employed Bro Ulferent Process         12         12         13           41         19931A0325         FEANATH SUML         Comparative Elevation Of Mild Steel Welded Joints Employed Bro Different Process         12         14         13           42         16911A0335         VELIAMPALLY DIRNA PAVAN         Development Of Composet Materials Using Vinione Fibers & Epoxy Resin         12         13         15           44         15911A0354         VELIAMPALL PURNA PAVAN         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         9         12         14           45         16911A0355 <t< td=""><td></td><td></td><td></td><td>IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$32760 SUPLE DUPLEX</td><td>11</td><td>13</td><td>15</td><td>39</td></t<>				IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$32760 SUPLE DUPLEX	11	13	15	39
36         16911A0346         PATLOLA DAVI REDOV         SYNTHEISIS OF TITANIA (Tio2) NANO STRUCTURES WITH DIFFERENT         11         12         12           37         16911A0348         FONDINAVERN         Design Of Lattice Structure And Sipper Sole Unan Additive Manufacturine         11         14         13           38         16911A0348         FRAMANUJAM         Experimental Investigation Of Modeland Properties Of Novel Composite Material         11         14         13           39         16911A0351         SANDAYALIY VAMSH         Experimental Investigation Of Modeland Properties Of Midd Steel Volded Joints Employed Bity Different Process.         12         13         16           40         16911A0357         VELIANA VENNETS AND Experimental Composite Materials Using Various Fibers & Epoxy Resin         12         14         13           41         16911A0357         VELIANA VENNETS AND Experiment Of Composite Materials Using Various Fibers & Epoxy Resin         12         13         15           44         16911A0357         VELIANA VENNETS         Design Of Lattice Structure And Shipper Sole Using Additive Manufacturing         9         15         15           44         16911A0355         VELIANA VENNET         Design Of Lattice Structure And Shipper Sole Using Additive Manufacturing         9         12         14           46         16911A0350	35	16911A0345	PAMEA SOURAB KUMAK	STAINLESS STEEL				+
16         1931A0346         PATIOLIA ONU REDOV         MORPHICLOGUES         MORPHICLOGUES           37         1691LA0346         RONDINAVEEN         Design Of Lattice Structure And Slipper Sole Using Addative Manufacturing         11         13         15           38         1691LA0346         SAMAANLIAM         Exploring Of Lattice Structure And Slipper Sole Using Addative Manufacturing         11         14         13         15           39         1691LA0352         SAMAANLIAM         Experimental Investigation Of Mechanical Properties Of Midd Steel Alki I Idva Using Ming Welding         11         12         13           40         1691LA0352         SAPAVATH SUNIL         Comparative Devalues Of Midd Steel Welded Joints Employed Br. Different Process.         12         12         13           41         1691LA0357         VELVART SANU         Development Of Composite Materials Using Vinious Phers & Epoxy Resin         12         14         13           42         1691LA0357         VELVARA VENRATA SAU         Optimal Desein Of DASALT-KENAF & EGLASS: KENAF Composite         12         13         15           44         1691LA0350         VELVARA VENRAF ANAM         Design Of Latice Structure And Shiper Sole Using Additive Manufacturing         9         15         15           45         1691LA0350         VERABAPANI LXXMI PRASANNA				SYNTHESIS OF TITANIA (Tio2) NANO STRUCTURES WITH DIFFERENT	11	12	12	35
37         16911A0348         RONDINAVEEN         Design Of Lattice Structure And Slipper Sole Using Madeive Manufacturing         11         13         15           38         16911A0348         SRMANUJAM         Experimental Investigation Of Mechanical Properties Of Al Novel Composite Material         11         14         13           39         16911A0355         SAMANUJAM         Experimental Investigation Of Mechanical Properties Of Mild Steel Welded Joints Employed Bv: Different Process.         12         12         13           40         16911A0355         MANANUMAGUNT VERNATA SAI         Development Of Composite Materials Using Vanious Fibers & Epoxy Resin         12         14         13           41         16911A0355         VELAMORINT VERNATA SAI         Development Of Composite Materials Using Vanious Fibers & Epoxy Resin         12         14         13           42         16911A0355         VELAMORINT VERNATA SAI         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         9         15         15           44         16911A0356         VELAMORINT VERNATA SAINA         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         9         12         14           45         16911A0356         VELAMORAIL VINAR AVAN         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         9         12         <	36	16911A0346	PATLOLLA DIVU REDDY	MORPHOLOGIES			1000	-
19         16311A338         RUMUNAVERS         Design Of Mechanical Properties Of A Need Comparis di Alsti 1040 Using Mig Welding         11         14         13           18         16511A0349         StandAVIJAA         Exclusion Of Mechanical Properties Of Midd Stacl Alsti 1040 Using Mig Welding         11         12         16           40         16511A0355         SARVATH SUNIL         Comparative Elevation Of Midd Steel Welded Joints Employed B: Different Process.         12         13         16           41         16511A0355         FUNANT SANGEP         Comparative Elevation Of Midd Steel Welded Joints Employed B: Different Process.         12         13         15           42         16911A0355         FUNANT SANGEP         Comparative Elevation Of Midd Steel Welded Joints Employed B: Different Process.         12         13         15           43         16911A0355         VELUAA USHNU         Optimal Design Of BASALT-KENAF & EGLASSS.         Epoys Resin         12         13         15           44         16911A0355         VELUAA USHNU         Design Of Lattice Structure And Stipper Sole Using Additive Manufacturing         9         12         14           45         16611A0355         VELUAA USHNPA ESANNA         Design Of Cottex Structure And Stipper Sole Using Additive Manufacturing         9         12         14           46 </td <td></td> <td></td> <td>DONIDI NAVEENI</td> <td>Decision Of Lattice Structure And Slinner Sole Using Additive Manufacturing</td> <td>11</td> <td>13</td> <td>15</td> <td>39</td>			DONIDI NAVEENI	Decision Of Lattice Structure And Slinner Sole Using Additive Manufacturing	11	13	15	39
38       16911A039       SAMARAUADO       Experimental investigation Of Medianeal Properties Of Mild Steel AISI 1040 Using Milg Welding       11       12       16         39       16911A0351       SANARAULY VAMSHI       Experimental investigation Of Medianeal Properties Of Mild Steel AISI 1040 Using Milg Welding       11       12       13         41       16911A0352       SARAVATH SUNIL       Comparative Elevation Of Mild Steel Welded Joints Employed By Different Process.       12       13       166         42       16911A0355       USIANGUNT VENATA SAI CHANDAN       Development Of Composite Materials Using Various Fibers & Epoxy Resin       12       13       15         43       16911A0359       VELLAM PARLI PURNA PAVAN SUDHAAAN       Design Of Latice Structure And Stipper Sole Using Additive Manufacturing       9       15       15         44       16911A0359       VELLAM PARLI PURNA PAVAN SUDHAAAN       Design Of Latice Structure And Stipper Sole Using Additive Manufacturing       9       12       14         45       16911A0359       VELAMPARLI PURNA PAVAN SUDHAAAN       Design Of Latice Structure And Stipper Sole Using Additive Manufacturing       9       12       14         46       16911A0359       VELAMPARLI PURNA PAVAN SUGA ATMILES SCIED OF The Mechanical Properties And Micro Structure Of The Cold Rolled       11       11       11       11       11	37	16911A0348	RUNDINAVEEN	Evolution Of Mechanical Properties Of A Novel Composite Material	11	14	13	38
39         16911A0351         SANDAPALLY VAMSHI         Experiment introduction of interlandia (Fundation of interlandia) (Fundation of interlandia)         11         12         18           40         16911A0352         SAPAXITY SUNIL         Comparative Elevation Of Mid Steel Welded Joints Employed By Different Process.         12         13         36           41         16911A0355         CHANTA SANDEP         Comparative Elevation Of Mid Steel Welded Joints Employed By Different Process.         12         13         15           42         16911A0355         ULLANCUNTA VENNATA SAI         Development Of Composite Materials Using Various Fibers & Epoxy Resin         12         13         15           44         16911A0355         VELIMAPAULPURNA PAVAN         Design Of Lattice Structure And Stipper Sole Using Additive Manufacturing         9         15         15           45         16911A0355         VERRABAPANI LAXMI PRASANNA         Design Of Lattice Structure And Stipper Sole Using Additive Manufacturing         9         12         14           46         16911A0356         ZUBARA AHMED         STANL SSS STEEL         Columb Structure Of The Cold Rolled         11         10         14           47         17915A0303         AULVINAV KUMAR	38	16911A0349	STANIANUANI	Experimental Investigation Of Mechanical Properties Of Mild Steel AISI 1040 Using Mig Welding			15	20
40         16911A0352         SAPAVATH SUNIL         Comparative Elevation Of Mild Steel Welded Joints Employed Bv Different Process.         12         12         13           41         16911A0354         TEAVATH SANDEEP         Comparative Elevation Of Mild Steel Welded Joints Employed Bv Different Process.         12         13         16           42         16911A0354         TEAVATH SANDEEP         Comparative Elevation Of Mild Steel Welded Joints Employed Bv Different Process.         12         13         15           43         16911A0357         VELUANGUNTA WENKATSAI         Development Of Composite Materials Using Various Fibers & Epoxy Resin         12         13         15           44         15911A0359         VELAMAPALL PURNA PAVAN SUDHAKAR         Design Of Latuce Structure And Shipper Sole Using Additive Manufacturing         9         15         15           45         16911A0360         ZUBAIR AHMED         Engrao Of Latuce Structure And Shipper Sole Using Additive Manufacturing         11         11         14           46         16911A0360         ZUBAIR AHMED         Engrao Of Latuce Structure And Shipper Sole Using Additive Manufacturing         9         12         14           47         17915A030         A VUAY KUMAR         Effect Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled         11         11         15	39	16911A0351	SANDAPALLY VAMSHI	Despanse	1 11	12	10	59
40         16911A032         SAPAVATH SUNU.         Comparative Exclusion Of Multi Select Weided Joint: Empored B: Different Process.         12         13         16           41         16911A035         TELVANTH SANDEEP         Comparative Exclusion Of Multi Select Weided Joint: Empored B: Different Process.         12         13         16           42         16911A0355         ULLANGUNTA VERKATA SAI ANDOB         Development Of Composite Materials Using Various Fibers & Epoxy Resin         12         14         13           43         16911A0355         VELIANA VISINU         Optimal Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         9         15         15           44         16911A0355         VELIANA VISINU         Optimal Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         11         11         14           46         16911A0356         VERABARAPANI LAXMI PRASANNA         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         11         11         14           46         16911A0350         ZUBAIR AHMED         STAINLESS STEEL         9         12         14           47         17915A0303         AULY KUMAR         Effects Of Annaeling Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled         11         10         14           48				Process	12	12	13	37
41         16911A0354         IFLAVATH SANDEEP         Comparative Elevation QI Multi Steet Welded Jouris Employed BW Uniferent Process.         12         13         14           42         16911A0354         ULLANGUNTA VENNATA SAI         Development Of Composite Materials Using Various Fibers & Epoxy Resin         112         114         133           43         16911A0357         VELLAMPALLI PURNA PAVAN SUPHAKAR         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         9         15         15           44         16911A0359         VERABAPANI LAXMI PRASANNA         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         111         11         14           45         16911A0350         VERABAPANI LAXMI PRASANNA         Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing         111         11         14           46         16911A0360         ZUBAR AHMED         IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE Of UNS \$32760 SUPER DUPLEX         9         122         14           47         17915A030         AULY KUMAR         Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled         111         113         14           48         17915A0305         AULY KUMAR         Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled         10	40	16911A0352	SAPAVATH SUNIL	Comparative Elevation Of Mild Steel Welded Joints Employed By Different Process.	12	12	16	41
4216911A035ULLANGUNTA VENKATA SAI Development Of Composite Materials Using Various Fibers & Epoxy Resin1214134316911A0357VELUALA VISHNUOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1213154415911A0358VELUAMPALU PUNA PAVAN DUMHARADesign Of Lattice Structure And Slipper Sole Using Additive Manufacturing915154516911A0359VERABAPANI LAXMI PRASANNA Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing1111144616911A0350ZUBAIR AHMEDIMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIPE Of UNS \$32760 SUPER DUPLEX STAILESS STEEL912144717915A0301A VIIAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Colls1111154917915A0304ALIVINAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Colls1111155017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering Steel Colls1113145117915A0306AW/MALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Colls9131555217915A0305AREKATIKE KARANPrototype Model Building Of Automobile Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design of BASALT-KENAF & EGLASS- KENAF Composite1	41	16911A0354	TEJAVATH SANDEEP	Comparative Elevation OI Mild Steel Welded Joints Employed By Different Process.	14			1
42         Instrument of the provide and the p	1	1001110075	ULLANGUNTA VENKATA SAI	Development Of Composite Materials Using Various Fibers & Epoxy Resin	12	14	13	39
43       16911A0357       VELUALA VISHNU       Optimal Design OF Lattice Structure And Slipper Sole Using Additive Manufacturing       9       15       15         44       16911A0358       VELAMPAULI PURNA PAVAN SUDHAGAR       Design OF Lattice Structure And Slipper Sole Using Additive Manufacturing       9       15       15         45       16911A0350       VERABAPANI LAXMI PRASANNA       Design OF Lattice Structure And Slipper Sole Using Additive Manufacturing       11       11       14         46       16911A0360       ZUBAIR AHMED       IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS S32760 SUPER DUPLEX       9       12       14         47       17915A0301       A VIAY KUMAR       Effects Of Anneoling Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled       11       10       14         49       17915A0303       ALU VINAY KUMAR       Effects Of Anneoling Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled       10       10       13         50       17915A0305       AREKATIKE KARAN       Protextype Model Building Of Automobile Component By Reverse Engineering       11       13       14         51       17915A0306       AWSHALA SAGAR       Effects Of Anneoling Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled       9       13       15         52       17915A0306	42	1031140332	CHANDAN		1.12	13		1 10
4416911A0358VELLAMPALLI PURNA PAVAN SUDHAKARDesign Of Lattice Structure And Slipper Sole Using Additive Manufacturing915154516911A0350VERRABAPANI LAXMI PRASANNADesign Of Lattice Structure And Slipper Sole Using Additive Manufacturing1111144616911A0350ZUBAIR AHMEDIMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE Of UNS S32769 SUPER DUPLEX STAINLESS STEEL912144717915A0301A VUAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Colls1111154917915A0303ALLI VINAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled 1010135017915A0305ALWAIA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled 911135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering Steel Colls11125117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled 9913155217915A0306BARDHA SHAKIH KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS-KENAF Composite1211125417915A0308BARDHA SHAKHAR REDDYOptimal Design Of BASALT-KENAF & EGLASS-KENAF Composite1212155517915A0318BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Mechanical Properties Of A Novel Composite M	43	16911A0357	VELUALA VISHNU	Optimal Design Of BASALT-KENAF & EGLASS- KENAF Composite	12	13	15	40
4416911A0358SUDHAKARDesign OF Lattice Structure And Slipper Sole Using Additive Manufacturing1111144516911A0359YERABAPANI LAXMI PRASANNADesign Of Lattice Structure And Slipper Sole Using Additive Manufacturing111111144616911A0360ZUBAIR AHMEDIMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE Of UNS \$32760 SUPER DUPLEX912144717915A0301A VIJAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1110144817915A0303ALULVINAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135017915A0305AREKATIKE KARANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135117915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering1111125217915A0306AWSHALA SAGAREvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation Of Priction Stir Welding Of Automobile Component By Reverse Engineering1012155517915A0309BASMA PAVANIInvestigation Of Priction Stir Welding Of Automobile Composite Material1012155617915A03			VELLAMPALLI PURNA PAVAN	Design Of Lattice Structure And Slipper Sole Lising Additive Manufacturing	9	15	15	39
4516911A0359VERABAPANI LAXMI PRASANNADesign Of Lattice Structure And Slipper Sole Using Additive Manufacturing1111144616911A0360ZUBAIR AHMEDIMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE Of UNS \$32760 SUPER DUPLEX \$71.NLESS STEEL912144717915A0301A VUAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Coils1110144817915A0303ALLI VINAY KUMARErgonomic And Budget Mini Chopper Bike1111154917915A0303ALUAY KUMARErgonomic And Budget Mini Chopper Bike1111135017915A0304ALWALA SAI KIRANSteel Coils1010135017915A0305AREKATKE KARANPrototype Model Building Of Automobile Component By Reverse Ensineering1113145117915A0306AWYSHALA SAGARSteel Coils1113155217915A0307BANCHANDRAErolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Automobile Composite Material1012155517915A0310BATHLA RAJSHEKHAR REDDYThermal Evaluation Of Mechanical Properties Of A Novel Composite Material1012155617915A0313BATHLA RAJSHEKHAR REDDY<	44	16911A0358	SUDHAKAR	Design of bable substate rind supplet one using robuits maintaining				
4516911A0359YERABAPANI LAXMI PRASANNADesign Of Lattice Structure And Shipper Sole Using Additive Manufacturing111111114616911A0360ZUBAIR AHMEDIMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE Of UNS S32760 SUPER DUPLEX912144717915A0301A VUAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1110144817915A0303ALLI VINAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135017915A0305AREKATIKE KARANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS-KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evolution Of Pulsating Heat Pipe For Different Fluids121	-				1 12		1 14	36
4616911A0360ZUBAIR AHMEDIMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$32760 SUPER DUPLEX \$TAINLESS STELL.912144717915A0301A VUAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled \$teel Colds1110144817915A0303ALLI VINAY KUMARErgonomic And Budget Mini Chopper Bike1111154917915A0304ALWALA SAI KIRANErgonomic And Budget Mini Chopper Bike Steel Colls1111135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering 	45	16911A0359	YERRABAPANI LAXMI PRASANNA	Design Of Lattice Structure And Slipper Sole Using Additive Manufacturing	1 11	11	14	30
4616911A0360ZUBAIR AHMEDInterfect on Order for Annealing Cycle On The Machanical Properties and Micro Structure Of The Cold Rolled912144717915A0301A VIJAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1110144817915A0303ALLI VINAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1111154917915A0304ALUAIA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1610135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component Bv Reverse Engineering111113145117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Picetines Of A Novel Composite Material1012155617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material10	-			IMPACT OF NOTCH TOPOLOGY ON THE FATIGUE LIFE OF UNS \$32760 SUPER DUPLET	c .	1000		
ATIntercests of LAUX-LESS of LEEL4717915A0301A VUAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1110144817915A0303ALU VINAY KUMARErgenomic And Budget Mini Chopper Bike111111154917915A0304ALWALA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component Bv Reverse Engineering1113145117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIUsing Varicus Micro Powders1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Plusating Heat Pipe For Different Fluids1211125617915A0318BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155617915A0318BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0318BAVIRISETTI SA	46	1691140360	ZUBAIR AHMED	INTACT OF NOTCH TO OLOGT ON THE FATIGUE LIVE OF ONS SEEN OUT LEA	9	12	14	35
4717915A0301A VIJAY KUMAREffects Of Annealing Cycle On The Mechanical Properties And Micro Studente Of The Cold Rolled Steel Coils1110144817915A0303ALLI VINAY KUMARErgenomic And Budget Mini Chopper Bike11111154917915A0304ALWALA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Coils1010135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering1113145117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Coils913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminium Alloys (Aa6061 & Aa 6351) Using Various Micro Powders1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1211125617915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Automobile Composite Material1012155717915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material101215 <td>40</td> <td></td> <td>and the state of the</td> <td>STAINLESS STEEL</td> <td>4</td> <td></td> <td>1</td> <td>+</td>	40		and the state of the	STAINLESS STEEL	4		1	+
47Steel Colls1111154817915A0303ALLI VINAY KUMARErgonomic And Budget Mini Chopper Biko111111154917915A0304ALWALA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component Bv Reverse Engineering111113145117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1211125617915A0311BAVIRISETTI SAI HARINEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOLIA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1012155817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering111115 <t< td=""><td>17</td><td>1701540201</td><td>A VHAY KUMAR</td><td>Effects of Annealing Cycle on The Mechanical Properties And Micro Structure of The Cold Rolle</td><td>11</td><td>10</td><td>14</td><td>35</td></t<>	17	1701540201	A VHAY KUMAR	Effects of Annealing Cycle on The Mechanical Properties And Micro Structure of The Cold Rolle	11	10	14	35
4817915A0303ALLI VINAY KUMARErgonomic And Budget Mini Chopper Bike11111111114917915A0304ALWALA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled1010135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering1113145117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Alumunum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsatung Heat Pipe For Different Fluids1211125617915A0311BAYRITEJAEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering912145916915A0314BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering912145916915A0314BOMPALLY RAVITEJAPrototype Model	47	1791540501		Steel Colls				
4917915A0304ALWALA SAI KIRANEffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled Steel Coils10135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering1113145117915A0306AWSHALA SAGAREffects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1211125617915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1211125617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOUA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1211125817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Composent Material1211125817915A0313BOMPALLY RAVITEJAProto	48	17915A0303	ALLI VINAY KUMAR	Ergonomic And Budget Mini Chopper Bike	1 11	11	15	37
4917915A0302ALWALA SALKINAWSteel Coils10135017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering1113145117915A0306AWSHALA SAGAREffects Of A nanceling Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Alumunum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1211125617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0311BOMPALLY RAVITEJAPrototype Model Building Of Automobile Composite Material1012155817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Composite Material1111135916915A0304B SAI NIHAR (Re-Admn 30/06/2017)Prototype Model Building Of Automobile Composite Material111113156016911A0361A HITESH KUMARRocker Bogie Suspension System11111131561<				Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolle	10	10	12	22
5017915A0305AREKATIKE KARANPrototype Model Building Of Automobile Component By Reverse Engineering1113145117915A0306AWSHALA SAGAREffects Of Anneoling Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Alummum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsatung Heat Pipe For Different Fluids1211125617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOJJA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1012155817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering912145916915A0304B SAI NIHAR (Re-Admn 30/06/2017)Prototype Model Building Of Automobile Component By Reverse Engineering1111156016911A0361A HITESH KUMARRocker Bogie Suspension System111113156116911A0361A HITESH KUMARDesign And CFD Analvsis Of A Car Rear A	49	17915A0304	ALWALA SALKIKAN	Steel Coils	10	10	13	33
30       AVESHALS       Instant AL SAGAR       Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled       9       13       15         51       17915A0306       AWSHALA SAGAR       Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolled       9       13       15         52       17915A0307       B JAYACHANDRA       Evolution Of Mechanical Properties Of A Novel Composite Material       11       12       16         53       17915A0308       BARDHA SHASHI KUMAR REDDY       Optimal Design Of BASALT-KENAF & EGLASS- KENAF Composite       12       11       16         54       17915A0309       BASWA PAVANI       Investigation On Friction Stir Welding Of Dissimilar Alumunum Alloys (Aa6061 & Aa 6351)       10       12       15         55       17915A0310       BATHULA RAJASHEKHAR REDDY       Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids       12       12       15         56       17915A0311       BAVIRISETTI SAI HARI HARAN       Evolution Of Mechanical Properties Of A Novel Composite Material       10       12       15         57       17915A0312       BOJIA DIKSHITH       Evolution Of Mechanical Properties Of A Novel Composite Material       12       11       12         58       17915A0313       BOMPAILY RAVITEJA       Prototype Model Build	60	1701540305	AREKATIKE KARAN	Prototype Model Building Of Automobile Component By Reverse Engineering	11	13	14	38
5117915A0306AWSHALA SAGARSteel Coils913155217915A0307B JAYACHANDRAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminum Alloys (Aa6061 & Aa 6351)1012155417915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1212155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids1012155617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOUJA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1012145817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering912145916915A0304B SAI NIHAR (Re-Admn 30/06/2017)Prototype Model Building Of Automobile Component By Reverse Engineering1111156016911A0361A HITESH KUMARRocker Bogie Suspension System1112156116911A0364A HITESH KUMARDesign And CFD Analysis Of A Car Rear Aerofoil11111215	50	1751540505		Effects Of Annealing Cycle On The Mechanical Properties And Micro Structure Of The Cold Rolle	d			
5217915A0307B JAYACHANDRAAEvolution Of Mechanical Properties Of A Novel Composite Material1112165317915A0308BARDHA SHASHI KUMAR REDDYOptimal Design Of BASALT-KENAF & EGLASS- KENAF Composite1211165417915A0309BASWA PAVANIInvestigation On Friction Stir Welding Of Dissimilar Aluminum Alloys (Aa6061 & Aa 6351)1012155417915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Mechanical Properties Of A Novel Composite Material1012155617915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Mechanical Properties Of A Novel Composite Material1012155617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOJIA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1012115817915A0313BOMPALIY RAVITEJAPrototype Model Building Of Automobile Composite Material912145916915A0304B SAI NIHAR (Re-Admn 30/06/2017)Prototype Model Building Of Automobile Composite By Reverse Engineering1111156016911A0361A HITESH KUMARRocker Bogie Suspension System1113156116911A0364A HITESH KUMARDesign And CFD Analysis Of A Car Rear Aerofoit11111215	51	17915A0306	AWSHALA SAGAR	Steel Coils	9	13	15	37
52       17915A0307       B JAVACHANDRA       Evolution Of Mechanical Properties OF Note: Composite Material       11       12       16         53       17915A0308       BARDHA SHASHI KUMAR REDDY       Optimal Design Of BASALT-KENAF & EGLASS- KENAF Composite       12       11       16         54       17915A0309       BASWA PAVANI       Investigation On Freition Stir Welding Of Dissimilar Alumunum Alloys (Aa6061 & Aa 6351)       10       12       15         55       17915A0310       BATHULA RAJASHEKHAR REDDY       Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids       12       12       15         56       17915A0310       BATHULA RAJASHEKHAR REDDY       Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids       12       12       15         56       17915A0311       BAVIRISETTI SAI HARI HARAN       Evolution Of Mechanical Properties Of A Novel Composite Material       10       12       15         57       17915A0312       BOJIA DIKSHITH       Evolution Of Mechanical Properties Of A Novel Composite Material       12       11       12         58       17915A0313       BOMPALLY RAVITEJA       Prototype Model Building Of Automobile Component By Reverse Engineering       9       12       14         59       16915A0304       B SAI NIHAR (Re-dmn 30/06/2017)       Prototype Model Building Of Automobile Component	-			Evolution Of Mechanical Properties Of A Novel Composite Material	11	17	1	
53       17915A0308       BARDHA SHASHI KUMAR REDDY       Optimal Design Of BASALT-KENAF & EGLASS- KENAF Composite       12       11       16         54       17915A0309       BASWA PAVANI       Investigation On Eriction Stir Welding Of Dissimilar Alumnium Alloys (Aa6061 & Aa 6351)       10       12       15         55       17915A0310       BATHULA RAJASHEKHAR REDDY       Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids       12       12       15         56       17915A0311       BAVIRISETTI SAI HARI HARAN       Evolution Of Mechanical Properties Of A Novel Composite Material       10       12       15         57       17915A0312       BOJJA DIKSHITH       Evolution Of Mechanical Properties Of A Novel Composite Material       10       12       14         58       17915A0313       BOMPALLY RAVITEJA       Prototype Model Building Of Automobile Component By Reverse Engineering       9       12       14         59       16915A0304       B SAI NIHAR (Re-Admn 30/06/2017)       Prototype Model Building Of Automobile Component By Reverse Engineering       11       11       15         60       16911A0361       A HITESH KUMAR       Rocker Bogie Suspension System       111       13       15         61       16911A0361       A HITESH KUMAR       Design And CFD Analysis Of A Car Rear Aerofoil       111 <t< td=""><td>52</td><td>17915A0307</td><td>BJAYACHANDKA</td><td>Evolution of Archanical Properties of 15 mores Comparing Watching</td><td></td><td>12</td><td>10</td><td>39</td></t<>	52	17915A0307	BJAYACHANDKA	Evolution of Archanical Properties of 15 mores Comparing Watching		12	10	39
53       AVERAGE       Investigation On Friction Stir Welding Of Dissimilar Aluminium Alloys (Aa6061 & Aa 6351)       10       12       15         54       17915A0310       BATHULA RAJASHEKHAR REDDY       Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids       12       12       15         55       17915A0310       BATHULA RAJASHEKHAR REDDY       Thermal Evaluation Of Pulsating Heat Pipe For Different Fluids       10       12       15         56       17915A0311       BAVIRISETTI SAI HARI HARAN       Evolution Of Mechanical Properties Of A Novel Composite Material       10       12       15         57       17915A0312       BOJIA DIKSHITH       Evolution Of Mechanical Properties Of A Novel Composite Material       12       11       12         58       17915A0313       BOMPALIY RAVITEJA       Prototype Model Building Of Automobile Composite Material       9       12       14         59       16915A0304       B SAI NIHAR (Re-Admn 30/06/2017)       Prototype Model Building Of Automobile Composite By Reverse Engineering       11       11       15         60       16911A0361       A HITESH KUMAR       Rocker Bogie Suspension System       11       13       15         61       1991A0262       Alys BRADAR       Design And CFD Analysis Of A Car Rear Aerofoil       11       12       15 <td>63</td> <td>1791540308</td> <td>BARDHA SHASHI KUMAR REDDY</td> <td>Optimal Design Of BASALT-KENAF &amp; EGLASS- KENAF Composite</td> <td>12</td> <td>11</td> <td>16</td> <td>39</td>	63	1791540308	BARDHA SHASHI KUMAR REDDY	Optimal Design Of BASALT-KENAF & EGLASS- KENAF Composite	12	11	16	39
5417915A0309BASWA PAVANIInvestigation On Freion Stir Welding Of Dissimilar Atumunum Alloys (Aa6061 & Aa 6351)1012155517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsating Heat Pipe For Different Fluids121212155617915A0310BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOJIA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1012155817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering912145916915A0304B SAI NIHAR (Re-dmn 30/06/2017)Prototype Model Building Of Automobile Component By Reverse Engineering1111156016911A0361A HITESH KUMARRocker Bogie Suspension System1113156119911A0362AlAY BIRADARDesign And CFD Analysis Of A Car Rear Aerofoil11111215	33	131340308			-	-		
34     1791540309     BARYA FANON     Using Various Micro Powders     10     12     15       55     17915A0310     BATHULA RAJASHEKHAR REDDY     Thermal Evaluation Of Pulsatung Heat Pipe For Different Fluids     12     12     15       56     17915A0311     BAVIRISETTI SAI HARI HARAN     Evolution Of Mechanical Properties Of A Novel Composite Material     10     12     15       57     17915A0312     BOJA DIKSHITH     Evolution Of Mechanical Properties Of A Novel Composite Material     12     11     12       58     17915A0313     BOMPALLY RAVITEJA     Prototype Model Building Of Automobile Component By Reverse Engineering     9     12     14       59     16915A0304     B SAI NIHAR (Re-Admn 30/06/2017)     Prototype Model Building Of Automobile Component By Reverse Engineering     11     11     15       60     16911A0361     A HITESH KUMAR     Rocker Bogie Suspension System     11     13     15       61     16911A0362     AIAY BRADAR     Design And CFD Analysis Of A Car Rear Aerofoil     11     12     15		10000	BASWA PAVANI	Investigation On Friction Stir Welding Of Dissimilar Aluminium Alloys (Aa6061 & Aa 6351)	10	12	15	27
5517915A0310BATHULA RAJASHEKHAR REDDYThermal Evaluation Of Pulsatung Heat Pipe For Different Fluids1212155617915A0311BAVIRISETTI SAI HARI HARANEvolution Of Mechanical Properties Of A Novel Composite Material1012155717915A0312BOJIA DIKSHITHEvolution Of Mechanical Properties Of A Novel Composite Material1211125817915A0313BOMPALLY RAVITEJAPrototype Model Building Of Automobile Component By Reverse Engineering912145916915A0304B SAI NIHAR (Re-Adrmn 30/06/2017)Prototype Model Building Of Automobile Component By Reverse Engineering1111156016911A0361A HITESH KUMARRocker Bogie Suspension System1113156116911A0362AIAY BIRADARDesign And CFD Analysis Of A Car Rear Aerofoil111215	54	17915A0309	DADATA PARAMI	Using Various Micro Powders	10	14	15	3/
55     17915A0310     BATHULA RAJASHEKHAR REDUT     Thermal Evaluation of Plasming Properties Of A Novel Composite Material     12     12     15       56     17915A0311     BAVIRISETTI SAI HARI HARAN     Evolution Of Mechanical Properties Of A Novel Composite Material     10     12     15       57     17915A0312     BOJIA DIKSHITH     Evolution Of Mechanical Properties Of A Novel Composite Material     12     11     12       58     17915A0313     BOMPALLY RAVITEJA     Prototype Model Building Of Automobile Composite Material     9     12     14       59     16915A0304     B SAI NIHAR (Re-dmn 30/06/2017)     Prototype Model Building Of Automobile Composite By Reverse Engineering     11     11     15       60     16911A0361     A HITESH KUMAR     Rocker Bogie Suspension System     11     13     15       61     16911A0362     AIAY BIRADAR     Design And CPD Analysis Of A Car Rear Aerofoil     11     12     15		The second se		Thermal Evaluation Of Dulcating Heat Dires For Different Fluide		1. 1.		
56       17915A0311       BAVIRISETTI SAI HARI HARAN       Evolution Of Mechanical Properties Of A Novel Composite Material       10       12       15         57       17915A0312       BOJIA DIKSHITH       Evolution Of Mechanical Properties Of A Novel Composite Material       12       11       12         58       17915A0313       BOMPALLY RAVITEJA       Prototype Model Building Of Automobile Component By Reverse Engineering       9       12       14         59       16915A0304       B SAI NIHAR (Re-Admn 30/06/2017)       Prototype Model Building Of Automobile Component By Reverse Engineering       11       11       15         60       16911A0361       A HITESH KUMAR       Rocker Bogie Suspension System       11       13       15         61       16911A0362       AIAY BIRADAR       Design And CFD Analysis Of A Car Rear Aerofoil       11       12       15	55	17915A0310	BATHULA RAJASHEKHAR REDDY	Fuctional Evaluation of Fulsating from type For Different Fulles	12	12	15	39
56         17915A0311         Devinds Fit and a registration of Mechanical Properties Of A Novel Composite Material         12         12         15           57         17915A0312         BOJIA DIKSHITH         Evolution Of Mechanical Properties Of A Novel Composite Material         12         11         12           58         17915A0313         BOMPALLY RAVITEJA         Prototype Model Building Of Automobile Component By Reverse Engineering         9         12         14           59         16915A0304         B SALNIHAR (Re-Admn 30/06/2017)         Prototype Model Building Of Automobile Component By Reverse Engineering         11         11         15           60         16911A0361         A HITESH KUMAR         Rocker Bogie Suspension System         11         13         15           61         16911A0362         ALAY BRADAR         Design And CFD Analysis Of A Car Rear Aerofoil         11         12         15		1202540244	RAVIRISETTI SALHARI HARAN	Evolution Of Mechanical Properties Of A Novel Composite Material	10	12	15	37
57         17915A0312         BOJA DIGHTH         Distance of measure connection and the product of measure connecting of a sector and the product of measure connecting of a sector and the product of measure connecting of a sector and the product of measure connecting of a sector and the product of measure connecting of a sector and the product of the pro	56	1/915A0311		Evolution Of Mechanical Properties Of A Novel Composite Material	12	12	- 15	3/
58         17915A0313         BOMPALLY RAVITE/A         Fromage model building of relationer component by reverse Engineering         9         12         14           59         16915A0304         B SAI NIHAR (Re-Admn 30/06/2017)         Prototype Model Building Of Automobile Component By Reverse Engineering         11         11         15           60         16911A0361         A HITESH KUMAR         Rocker Bogie Suspension System         11         13         15           61         16911A0362         AIAY BIRADAR         Design And CFD Analysis Of A Car Rear Aerofoil         11         12         15	57	17915A0312	BUIADIKSHITH	Prototone Model Building Of Automobile Component By Reverse Regionseine	12	11	12	35
59         16915A0304         B SAJ NIHAR (Re-Admn 30/06/2017)         Prototype Model Building Of Automobile Component By Reverse Engineering         11         11         15           60         16911A0361         A HITESH KUMAR         Rocker Bogie Suspension System         11         13         15           61         16911A0362         AHITESH KUMAR         Rocker Bogie Suspension System         11         13         15	58	17915A0313	BOMPALLY RAVITEJA	From the model building of Automobile component by reverse engineering	9	12	14	35
59         1693 BADD         Cite         11         15           60         1691 LA0361         A HITESH KUMAR         Rocker Bogie Suspension System         11         13         15           61         1691 LA0362         AIAY BIRADAR         Design And CPD Analysis Of A Car Rear Aerofoil         11         12         15		1601640204	B SALNIHAR (Re-Admn 30/06/2017)	Prototype Model Building Of Automobile Component By Reverse Engineering	11	11	15	17
60         16911A0361         A HITESH KUMAR         Rocker Bogie Suspension System         11         13         15           61         16911A0362         AJAY BIRADAR         Design And CFD Analysis Of A Car Rear Aerofoil         11         12         15	39	1091540304		N. L. N. D. Martin Barra				
61 1601140362 AJAY BIRADAR [Design And CFD Analysis Of A Car Rear Aerofoil 11 12 15	60	16911A0361	A HITESH KUMAR	Kneker Bogie Suspension System	11	13	15	39
1071 Provok	61	16911A0362	AJAY BIRADAR	Design And CFD Analysis Of A Car Rear Aerofoil	11	12	15	38

Code and .

mach HOD

# VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

# DEPARTMENT OF MECHANICAL ENGINEERING

Date: 06.10.2020

#### CIRCULAR

As an initiative by the department of mechanical engineering in the identification of best projects, a selection committee has been constituted to review and scrutinize all the projects for the academic year 2019-2020, based on following factors.

- 1. Creativity
- 2. Type of Materials used
- 3. Manufacturing Methods Employed
- 4. Experimentation results through design of experiments
- 5. Analysis of results
- 6. Conclusion

The prospective projects selected are taken for award to be conferred on graduation day.

The committee members are:

Dr.V.V.Satyanarayana
 Dr.B.V.Reddy
 Mr.J.Jagadesh Kumar



# VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

# **DEPARTMENT OF MECHANICAL ENGINEERING**

Date: 15.10.2020

HoD/MECH

# **CIRCULAR**

After thorough reviewing of all the projects by considering following factors, the committee members has selected the best projects for which award is to be conferred on 12.10.2020.

- 1. Creativity
- 2. Type of Materials used
- 3. Manufacturing Methods Employed
- 4. Experimentation results through design of experiments
- 5. Analysis of results
- 6. Conclusion

The Best Projects are:

S.NO	H.T.No.	NAME OF THE STUDENT	PROJECT TITLE	GUIDE
	16911A0314	CH.LIKITHA	Investigation On Friction	
T	16911A0319	E.VISHNU	Stir Welding Of Dissimilar	Mr.S.Prasad
1	16911A0328	K.SRIKANTH	(Aa6061) Using Various	Kumar
	17915A0309	B.PAVANI	Micro Powders	
	16911A03K9	MAHESH	Investigation on the	
п	16911A03H9	ANIL	properties of magnetic	Me Herei
п	16911A03L7	RANJITH	discharge method	Mr. Hasan
	16911A03H4	NITHISH		
	16911A0395	MD.ZOHAIB	Experimental investigation	
	16911A0394	MD.ARBAZ	of dual fuel diesel engine	Mr.K.Ravi
111	16911A03B0	SHAMIN BASHEER	with alternate fuels	Kumar
	16911A03A2	P.SRIKANTH		

			Vidya Jy	othi Institute of Tech	nology
			DEPARTME	NT OF MECHANICAL ENGIN	NEERING
			MAINTROJECT	SECTION-A	JES 2019-2020
Batch	Roll No	Name of the Student	Marks/Grade	Name of the Project Guide	Project Title
	16911A0332	M.SAI KUMAR	A		
a	16915A0304	B. SAI NIHAR	Â	D. M.M.	Destations model of automobile component by reverse engineering
÷.	17915A0305	A.KARAN	A	Dr.M.Naveen Kumar	Prototype model of automobile component by reverse engineering
	17915A0313	B.RAVI TEJA	A		
	16911A0349	S.RAMANUJAN	B		
п	17915A0307	<b>B.JAYACHNDRA</b>	ß	Mr T Davan Vumar	Evaluation of mechanical properties of and thermal behaviour of
n	17915A0311	B.SAIHARIHARAN	B	Ivii, I.F avan Kuma	novel composite
	17915A0312	B.DEEKSHITH	B		
	16911A0301	A.SANJAY	A		
	16911A0304	A.RAVINDRA	A	Dr M Naveen Kumar	Design of automatic gear shifting
m	16911A0312	CH.SAI SRINIVAS	A	DI IVI IVaveen Kuma	Design of untoinance gear strining
	16911A0335	M.RAHUL	A		
	16911A0314	CH.LIKITHA	0	Mr.S.Prasad Kumar	
IV	16911A0319	E.VISHNU	0		Investigation On Friction Stir Welding Of Dissimilar Aluminium
IV	16911A0328	K.SRIKANTH	0		Alloys (Aa6061 & Aa 6351) Using Various Micro Powders
	17915A0309	B.PAVANI	0		
	16911A0308	B.SHIVANI	B	D. J	Development of composite Materials using various fibres
v	16911A0325	J.SWAPNA	1	Mr.C.Naveen Raj	And enoxy resin
X	16911A0336	M.VINEELA	B		And opping ream
	16911A0355	UVS CHANDAN	ß		
	169110305	A.BALAKRISHNA	ß		
1/1	169110326	KA MALLESH YADAV	Д	Mr.S.Ramakrishna	Optimal Design Of Basalt-Kenaf And E Glass -Kenaf Composite
VI	16911A0357	V.VISHNU	ß		
	17915A0308	B.SHESHI KUMAR	4		
	16911A0323	G.AJAY REDDY	A		
	16911A0330	K.DURGA PRASAD	A	Dr.B.V.Reddi	Synthesis of TiO2 Nano structure with different morphologis
VII	16911A0331	K.RUCHITHA	A		
	16911A0346	P.DIVIJ	A		
	16911A0337	MD.ADIL	A		
	16911A0338	MD.IMAAZ	4	Dr Phanindra Boou	Fatigue analysis UNS S32760
/III	16911A0360	ZUBAIR AHMED	A	Dr.Fnannuta Dogu	
ł	1601140345	PSOURAB	A		
	10911/00945			00	

40.43

Bush

Ø.

10

A Proposed Project Report on

# INVESTIGATION ON FRICTION STIR WELDING OF DISSIMILAR ALUMINIUM ALLOYS (AA6061 & AA 6351) USING VARIOUS MICRO POWDERS

Submitted in partial fulfillment of the requirement for the award of the degree of

# **BACHELOR OF TECHNOLOGY**

#### IN

#### **MECHANICAL ENGINEERING**

#### BY

CH LIKITHA	16911A0314
E VISHNU	16911A0319
K SRIKANTH	16911A0328
<b>B</b> PAVANI	17915A0309

Under the guidance of

#### Mr. S PRASAD KUMAR

(Assistant Professor)

Submitted to

## DEPARTMENT OF MECHANICAL ENGINEERING

#### VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

(Autonomous)

(Affiliated To Jawaharlal Nehru Technology University, Hyderabad)

Aziz nagar gate, CB Post, Hyderabad – 500075

(2016-20)

# VIDYA JYOTHI INSTITUTE OF TECHNOLOGY DEPARTMENT OF MECHANICAL ENGINEERING



## **BONAFIDE CERTIFICATE**

This is to certify that the project work entitled "INVESTIGATION ON FRICTION STIR WELDING OF DISSIMILAR ALUMINIUM ALLOYS (AA6061 & AA6351) USING VARIOUS MICRO POWERS" is bonafide project work submitted by a

CH LIKITHA	16911A0314
E VISHNU	16911A0319
K SRIKANTH	16911A0328
<b>B PAVANI</b>	17915A0309

In the department of MECHANICAL ENGINEERING in partial fulfilment of requirements for the award of degree of bachelor of technology in "Mechanical Engineering" for the academic year 2017-18. This work has been carried under my guidance and has not been submitted the same for any university/institution for award of any degree/diploma.

PROJEĆT ĠUIDE Mr. S. PRASAD KUMAR

Internal Examiner

HEAD OF DEPARTMENT Mr. G.SREERAM REDDY

m ternal Examiner:

ii

# **DECLARATION**

We hereby declare that the whole work done in completing this project is our own effort and we have not copied it from anywhere. During our project, our project guide **Mr. S. PRASAD KUMAR** guided us to complete our project taking his valuable time. We are very thankful to "**VIDYA JYOTHI INSTITUTE OF TECHNOLOGY**" for giving us opportunity to do our project in this esteemed organization. For the award of the degree of **BACHELOR OF TECHNOLOGY** in mechanical engineering.

Project associates:

CH LIKITHA	16911A0314
E VISHNU	16911A0319
K SRIKANTH	16911A0328
<b>B PAVANI</b>	17915A0309

# ACKNOWLEDGMENT

The project entitled "INVESTIGATION ON FRICTION STIR WELDING OF DISSIMILAR ALUMINIUM ALLOYS (AA 6061 & AA 6351) USING VARIOUS MICRO POWDERS" is sum of total effort of our batch. It is our duty to bring forward each and every one who is directly and indirectly in relation with our project and without whom it would not have gained a structure. We express our deep sense of gratitude to our respected guide, assistant professor Mr. S. Prasad Kumar for his valuable help and guidance, we are thankful to him for the encouragement he has given us to complete the project. We also owe a great thanks to our institution VJIT, Moinabad and HOD Professor G. Sree Ram Reddy for his encouragement and also fine support in achieving success. Finally we thank our professors, our parents, workshop technicians for their fine motivation and inspiration.

CH LIKITHA
E VISHNU
K SRIKANTH
<b>B PAVANI</b>

16911A0314 16911A0319 16911A0328 17915A0309

# ABSTRACT

Friction stir welding is a joining process in which two or more work parts are weld in solid state by means of frictional heating and plastic deformation typically below the melting temperature of the materials to be joined. This technique has a wide metallurgical advantages compared to fusion and resistance welding.

This research work deals with investigation of friction stir welding of dissimilar Aluminum alloys (AA 6061 and AA 6351) with and without silicon carbide, aluminium oxide, titanium nano particles. Tool required to weld will be designed using CAD software and will be fabricated. Friction stir weld will be done using fabricated tool on the dissimilar metals at various process parameters with and without silicon carbide, aluminium oxide, titanium nano particles and welded joints are investigated for hardness, tensile strength, microstructure and impact tests.

Mechanical properties obtained from different tests are analyzed and compared for friction stir welding done with and without titanium nano particles.

#### Keywords: Friction stir welding, frictional heating, plastic deformation

# CONTENT

Title page	i
Certificates	ii
Declaration	iii
Acknowledgement	iv
Abstract	v
List of content	vi
CHAPTER 1: INTRODUCTION	1-4
CHAPTER 2: LITERATURE REVIEW	5-15
2.1 PROCESS VARIABLE IN FSW	5
2.2 TEMPERATURE DISTRIBUTION	6
2.3 TOOL GEOMETRY	7
2.4 MATERIAL FLOW IN FSW	10
2.5 MICROSTRUCTURE ZONE	11
2.6 TYPICAL FSW DEFECTS	13
2.7 DEFECTS FROM TOO HOT WELDS	13
2.8 DEFECTS FROM TOO COLD WELDS	14
CHAPTER 3: OBJECTIVE	16
CHAPTER 4: RESEARCH WORK	17-28
4.1 MATERIAL USED	17
4.1.1 PROPERTIES OF ALUMINIUM ALLOY 6061	18
4.1.2 PROPERTIES OF ALUMINIUM ALLOY 6351	18
4.2 TOOL DESIGN AND FABRICATION 4.3 SILICON CARBIDE, ALUMINIUM OXIDE, TITANIUM	18
POWDER	21
4.4 FSW MACHINE AND EQUIPMENTS	22

4.5 EXPERIMENTAL PROCEDURE	23
4.6 PROCESS PARAMETERS	25
4.7 WELD JOINTS	25
4.8 TENSILE TEST	26
4.9 ROCKWELL HARDNESS TEST	27
4.10 CHARPYS IMPACT TEST	28
CHAPTER 5: RESULTS AND DISCUISSION	30-36
5.1 TENSILE PROPERTIES	30
5.2 HARDNESS AND IMPACT TEST PROPERTIES	33
CHAPTER 6: CONCLUSION	34
CHAPTER 7: FUTURE SCOPE	35
REFERENCES	36

# LIST OF FIGURES

Fig. no.	Caption	Pg. no.
1.1	Steps in friction stir welding process	2
1.2	Schematic representation of FSW process	2
1.3	Friction stir welding tool	3
2.1	Detailed view of FSW tool	7
2.2	Tool shoulder geometries, viewed from underneath the Shoulder	9
2.3	Showing metal flow pattern and metallurgical zones developed during FSW	11
2.4	Showing the microstructure zones	13
4.1	Images of material AA6061 & AA6351	18
4.2	2-d model of designed tool in cad software in front view	19
4.3	2-d model of designed tool in cad software in isometric view	20
4.4	Showing the 3-d model of tool in CAD software	20
4.5	Actual image of friction stir welding tool	21
4.6	Silicon carbide, Aluminium oxide, Titanium powder	21
4.7	Welding plates clamped over fixture	22
4.8	HMT vertical milling machine	23
4.9	AA6061 &AA6351 plates being welded without titanium powder	23
4.10	Image (a) showing the groove made in the plates & image (b)	24
	showing the Silicon carbide powder filled in the grooves	
4.11	Showing the weld joint produced	25

4.12	Specimen mounted over the universal testing machine (instron)	26
4.13	Image showing the samples for tensile test	27
4.14	Tensile test specimen with dimensions	27
4.15	Image showing hardness testing machine	28
4.16	Image showing impact testing machine	29
5.1	Tensile test specimen for welded material	30

# LIST OF TABLES

Table. No.	Caption	Pg. No.
1.1	Key benefits of friction stir welding	4
2.1	Selection of tools designed at TWI [5]	8
4.1	Type of work material used in present study	17
4.2	Nominal chemical composition of AA6061	17
4.3	Nominal chemical composition of AA6351	17
4.4	Physical properties of AA6061 &AA6351	17
4.5	Chemical composition of H13 tool steel	19
4.6	Properties of titanium powder	22
4.7	Showing the process parameters used for welding	24
	joints with and without Silicon carbide powder	
5.1	Tensile strength test results	32
5.2	Hardness test results	33
5.3	Impact test results	33

#### **CHAPTER -1**

#### **INTRODUCTION**

The friction stir welding (fsw) is a new welding technique in domain of welding. it is solid state welding process and invented by the welding institute (twi) of Cambridge, England in 1991 [1]. this process is simple, environment friendly, energy efficient and becomes major attraction for an automobile, aircraft, marine and aerospace industries due to the high strength of the fsw joints as near as base metal. It allows considerable weight savings in light weight construction compared to conventional joining technologies. in contrast to conventional joining welding process, there is no liquid state for the weld pool during fsw, the welding takes place in the solid phase below the melting point of the materials to be joined. thus, all the problems related to the solidification of a fused material are avoided [2]. Materials which are difficult to fusion weld like the high strength aluminum alloys can be joined with minor loss in strength.

In friction stir welding a non-consumable rotating tool with a specially profiled threaded/unthreaded pin and shoulder is rotated at a constant speed. The tool plunges into the two pieces of sheet or plate material and through frictional heat it locally plasticized the joint region. The tool then allowed to stir the joint surface along the joining direction. During tool plunge, the rotating tool undergoes only rotational motion at only one place till the shoulder touches the surface of the work material, this is called the dwelling period of the tool. During this stage of tool plunge it produces lateral force orthogonal to welding or joining direction. The following diagram depicts the procedures of fsw/fsp.

The upper surface of the weld consists of material that is dragged by the shoulder from the retreating side of the weld, and deposited on the advancing side. After the dwell period the tool traverse along the joining direction, the forward motion of the tool produces force parallel to the direction of travel known as traverse force. After the successful weld, the tool reaches to termination phase where it is withdrawn from the work piece [4]. This is shown in fig. 1.1(d). During the welding process the parts have to be clamped rigidly onto a backing bar in a manner that prevents the abutting joint faces from being forced apart. The length of the tool pin is slightly less than the weld depth required and the tool shoulder should be in intimate contact with the work surface.



Fig. 1.1 Schematic representation of FSW [3]

Besides tight clamping of the members to be welded, the key to success is to select the optimum parameters which include rotational speed, welding speed, axial force, and tool pin as well as shoulder profile. Detailed description of FSW process is shown in Fig.1.2.



Fig. 1.2 Friction stirs welding [5]

Above diagram of friction stir welding indicates two terms advancing side and retreating side, when rotation of tool is the same as the tool traverse direction along weld line is called advancing side and when rotation of tool is opposite to the tool traverse direction is called retreating side. Non consumable tool is most important tool in friction stir welding process, it serves following function like heating of the work piece, movement of material to produce joint and containment of

the hot metal beneath the tool shoulder. Friction stir welding tool consist pin and shoulder and both has individual purposes.



#### Fig.1.3 FSW Tool

In recent development, the FSW has found application into the welding of the circumference, cylinders, curvilinear, three dimensional objects and objects which require finer executing movements. FSW is considered to be the most significant development in metal joining in a decade and is a "green" technology due to its energy efficiency, environment friendliness, and versatility. The process has the unique characteristics, as there is no melting of parent material, the alloying elements are not lost and thus mechanical properties are preserved. Therefore, the degree of combining different materials is high and hence increases the possibility of welding materials which was difficult to weld. As compared to the conventional welding methods, FSW consumes considerably less energy. No cover gas or flux is used, thereby making the process environmentally friendly. Key benefits of FSW process are enlisted in table 1.1 [5].

	Solid phase process
	• Low distortion of work piece
	• Good dimensional stability and repeatability
Metallurgical benefits	• No loss of alloying elements
	• Excellent metallurgical properties in the joint area
	• Fine microstructure
	• Absence of cracking
	• Replace multiple parts joined by fasteners

	• No shielding gas required
	No surface cleaning required
Environmental henefite	Eliminate grinding wastes
Environmental benefits	• Eliminate solvents required for degreasing
	• Consumable materials saving, such as rugs, wire
	or any other gases
	Improved materials use
	• Only 2.5% of the energy needed for a laser weld
Energy herefits	• Decreased fuel consumption in light weight aircraft,
Energy benefits	automotive and ship applications

 Table 1.1: Key benefits of friction stir welding

#### CHAPTER-2

#### LITERATURE REVIEW

Aluminium and its alloys show unique characteristics like light weight, high strength, high toughness, extreme temperature capability, versatility of extruding, and excellent corrosion resistance. Those make it the obvious choice of material by engineers and designers for the variety of engineering applications.

Many researchers, they have given copious attention towards the parameters optimization like rotational speed (N), traverse speed (v) and axial force (F) and apart from parameters optimization they have also given sufficient focus to find out the effect of tool pin profile on friction stir welding joints that yields optimum characteristics of joint. But very less work has been done on tool shoulder like effect of tool shoulder profiles and tool shoulder geometry on microstructure and mechanical properties of friction stir welded joint.

#### 2.1 Process variables in FSW

The tool rotational speed (N), welding speed (v) and the axial force (F) are the three important welding variables in FSW. The study of the effect of welding variables on the friction stir welding process is important because it directly decides the weld quality of the FSW joint. The welding process affects the joint properties primarily through heat generation and material flow. The rotation speed (N) results in stirring and mixing of material around the rotating pin and the translation of the tool moves the stirred material from the front to the back of the pin. The axial force (F) is another important parameter to avoid the frictional slippage at the tool work piece interface.

Mandal et al.[6] investigated the axial force during plunging of AA2024 aluminium alloy of thickness 12.5mm. It is observed that plunging is completed in 14 seconds, the peak load of 25 KN is observed at 5 seconds mark. At the end of the 14 sec., the load dropped to approximately 8 KN where it remains steady. During the initial stage of welding, high force values act on the material due to tool penetration, since the material temperature is still low and consequently its yield strength is high only when tool penetration is completed and the travel motion is not yet started, the softening of material induces a drop in axial force.

Kumar and Kailas[7] studied the role of axial force on weld nugget defect. They conclude that with the increase of axial load the defect size decreases. During the investigation they shows that the shoulder contact increases with the base material as the axial load increases and the transferred of material from the leading edge is confined in the weld cavity, and sufficient amount of frictional heat and hydrostatic pressure is generated to produce a defect free weld.

For FSW, two parameters are very important: tool rotation in clockwise or counter clockwise direction and tool traverse speed along the line of joint. The rotation of tool results in stirring and mixing of material around the rotating pin and the translation of tool moves the stirred material from the front to the back of the pin and finishes welding process. Higher tool rotation generates higher temperature because of higher friction heating and results in more intense stirring and

mixing of material as will be discussed later. However, it should be noted that frictional coupling of tool surface with work piece is going to govern the heating. So, a monotonic increase in heating with increasing tool rotation is not expected as the coefficient of friction at interface will change with increasing tool rotation rate.

Han et al.[8] investigated the optimum condition by mechanical characteristic evaluation in friction stir welding for 5083-O Al alloy. The mechanical characteristics for friction stir welding (FSW) of 5083-O Al alloy were evaluated. The results show that in FSW at 800 r/min and 124 mm/min, a weld defect is observed at the start point. However, the button shape at the end point is good and the stir zone has a soft appearance. At 267 mm/min, a void occurs at the button. A slight weld defect and rough stir zone are seen both at the start and end points at 342 mm/min. Moreover, at the bottom, a tunnel-type void is observed from an early stage to the end point, and at 800 r/min, a weld defect can be found from an early stage to the end point. These defects are rough with imperfect joining due to excessive rotation speed and high physical force. Weld fractures relative to rotational and travel speeds are observed at the stir zone. The optimum FSW conditions are a welding speed of 124 mm/min and a rotational speed of 800 rpm.

Arora et al.[9] studied to design a tool shoulder diameter based on the principle of maximum utilization of supplied torque for traction. Optimum tool shoulder diameter computed from this principle using a numerical heat transfer and material flow model. Pin diameter was fixed  $\phi$ 6mm and shoulder diameters were varied  $\phi$ 15, 18, and 21 mm and best weld joint strength was got in shoulder diameter of  $\phi$ 18 mm.

Preheating or cooling can also be important for some specific FSW processes. For materials with high melting point such as steel and titanium or high conductivity such as copper, the heat produced by friction and stirring may be not sufficient to soften and plasticize the material around the rotating tool. Thus, it is difficult to produce continuous defect-free weld. In these cases, preheating or additional external heating source can help the material flow and increase the process window. On the other hand, materials with lower melting point such as aluminium and magnesium, cooling can be used to reduce extensive growth of recrystallized grains and dissolution of strengthening precipitates in and around the stirred zone.

#### 2.2. Temperature distribution and Heat transfer in FSW

As discussed earlier, the welding parameters plays very significant role in deciding the temperature distribution as it directly influences the microstructure of welds, such as grain size, grain boundary character, coarsening and dissolution of the strengthening precipitates. Therefore, the study of temperature distribution and the resulting heat input within the work piece material is very important during FSW process.

Hwang and coworkers[10] experimentally explore the thermal histories and temperature distribution within butt joint welds of 6061-T6 aluminium alloy. Four thermocouples of K-type with data acquisition system connected to a personal computer were used to record the temperature histories during welding. The different types of thermocouple layout same side and equal distance, opposite side and equal distance and same side and unequal distance) are devised at different locations on the work piece to measure the temperature distribution during welding process. They

concluded that the temperature inside the pin can be regarded as a uniform distribution and that the heat transfer starts from the rim of the pin to the edge of the work piece. For the successful welds temperature lies between 365 oC and 390 oC respectively.

Maeda et al.[11] studied experimental observation that the temperature distribution are not symmetrical about the joint line. The temperature at fifteen points of the top and the bottom surfaces were recorded using K-type thermocouple for the material of AA7075 and dissimilar materials of AA6061 with AA5083 aluminium alloys. They concluded that there is asymmetric temperature distribution between the advancing side and retreating side in both of the cases. For the defect free welding conditions the advancing side shows higher temperature distribution than the retreating side.

#### 2.3. Tool Geometry

Tool geometry is the most influential aspect of process development. The tool geometry plays critical role in material flow and in turn governs the traverse rate at which FSW can be conducted. An FSW tool consists of a shoulder and a pin as shown schematically in Fig. 2.1.



Fig.2.1 Schematic diagram of the FSW tool [5]

As mentioned earlier, the tool has two primary functions: (a) localized heating, and (b) material flow. The friction between the shoulder and work piece results in the biggest component of heating. From the heating aspect, the relative size of pin and shoulder is important. The shoulder also provides confinement for the heated volume of material. The second function of the tool is to 'stir' and 'move' the material. It is desirable that the tool material is sufficiently strong, tough and hard wearing at the welding temperature.

Tool shoulders are designed to produce heat (through friction and material deformation) to surface and subsurface regions of the work piece. The tool shoulder produces a majority of the heating in thin sheet, while the pin produces a majority of the heating in thick work pieces. Also, the shoulder produces the downward forging action necessary for weld consolidation. Tool pin is designed to disrupt the faying, or contacting, surface of the work piece, shear material in front of the tool, and move material behind the tool.

In recent years several new features have been introduced in the design of tools. Several tools designed at TWI are shown in table 2.1. The Whorl and MX-Triflute have smaller pin volumes than the tools with cylindrical pins. The tapered threads in the whorl design induce a vertical component of velocity that facilitates plastic flow. The flute in the MX-Triflute also increases the interfacial area between tool and the work piece, leading to increased heat generation rates, softening and flow of material. Consequently, more intense stirring reduces both the traversing force for the forward tool motion and the welding torque. Although cylindrical, Whorl and Triflute designs are suitable for butt welding; they are not useful for lap welding, where excessive thinning of the upper plate can occur together with the trapping of adherent oxide between the overlapping surfaces. Flared-Triflute and Askew tools were developed to ensure fragmentation of the interfacial oxide layer and a wider weld than is usual for butt welding. The Flared-Triflute tool is similar to MX-Triflute with an expanded flute, while A-skewTM tool is a threaded tapered tool with its axis inclined to that of the machine spindle. Both of these tools increase the swept volume relative to that of the pin, thus expanding the stir region and resulting in a wider weld and successful lap joints. Motion due to rotation and translation of the tool induces asymmetry in the material flow and heating across the tool pin. To overcome this problem, TWI devised a new tool, Re-stir, which applies periodic reversal of tool rotation. This reversal of rotation eliminates most problems associated with inherent asymmetry of conventional FSW. With the exception of FSW with Re-stir tool, material flow is essentially asymmetric about joint interface. Understanding the asymmetry in material flow is important for optimal tool design [5].

Tool	Cylindrical	Whorl <sup>M</sup>	MX triflute <sup>m</sup>	Hared tnflute™	A-skew <sup>ar</sup>	Re-stir <sup>w</sup>
Schematics		F	Ş		Ţ	CJ-
Tool pin shape	Cylindrical with threads	Tapered with threads	Threaded, tapered with three flutes	753 Tri-flute with flute ends flared cost	Inclined cylindrical with threads	Tapered with threads
Ratio of pin volume to cylindrical pin volume	1	0.4	6.9	0.3	1	0.4
Swept volume to pin volume tatio	1.1	1.8	2.6	2.6	Depends on pin angle	1.8
Rotary reversal Application	No Butt welding: fails in Iap welding	No Butt welding with lower welding torque	No But: welding with further lower welding torque	No Lap welding with lower thinning of opper plate	No Lap welding with lower thinning of upper plate	Yes When minimum asymmetry in weld property is desired

Table 2.1 Selection of tools designed at TWI [5]

Elangovana et al.[12] studied the influences of tool pin profile and welding speed on the formation of friction stir processing zone in AA2219 aluminium alloy. AA2219 aluminium alloy has gathered wide acceptance in the fabrication of light weight structures requiring a high strength to weight ratio. Compared to the fusion welding processes that are routinely used for joining structural aluminium alloys, friction stir welding (FSW) process is an emerging solid state joining process in which the material that is being welded does not melt and recast. This process uses a non-consumable tool to generate frictional heat in the abutting surfaces. The welding parameters and tool pin profile play major roles in deciding the weld quality. In this investigation, an attempt has been made to understand the effect of welding speed and tool pin profile on FSP zone formation in AA2219 aluminium alloy. Five different tool pin profiles (straight cylindrical, tapered cylindrical, threaded cylindrical, triangular and square) have been used to fabricate the joints at three different welding speeds. The formation of FSP zone has been analyzed macroscopically. Tensile properties of the joints have been evaluated and correlated with the FSP zone formation. From this investigation it is found that the square pin profile tool produces mechanically sound and metallurgically defect free welds compared to other tool pin profiles.

Fujii et al.[13] investigated the effect of tool shape on mechanical properties and microstructure of friction stir welded aluminium alloys. Prospecting the optimal tool design for welding steels, the effect of the tool shape on the mechanical properties and microstructures of 5mm thick welded aluminium plates was investigated. The simplest shape (column without threads), the ordinary shape (column with threads) and the triangular prism shape probes were used to weld three types of aluminium alloys. For 1050-H24 whose deformation resistance is very low, a columnar tool without threads produces weld with the best mechanical properties, for 6061-T6 whose deformation resistance is relatively low, the tool shape does not significantly affect the microstructures and mechanical properties. For 5083-O, whose deformation resistance is relatively high, the weldablity is significantly affected by the rotation speed. For a low rotation speed (600 rpm), the tool shape does not significantly affect the microstructures and mechanical properties.

Apart from tool pin design there is significant impact of tool shoulder profile and tool shoulder geometries on weld quality. Various tool shoulder geometries have been designed by TWI. These geometries increase the amount of material deformation produced by the shoulder, resulting in increased work piece mixing and higher-quality friction stir welds. Following figure consists of scrolls, ridge or knurling, grooves, and concentric circles and can be machined on any tool shoulder profile.



Fig.2.2 Tool shoulder geometries, viewed from underneath the shoulder [5]

Scialpi et al.[14] studied the effect of tool shoulder geometries on microstructure and mechanical properties of 6082 aluminium alloy joint welded by friction stir welding. In this study, we used three different tool shoulder geometry (fillet, fillet+scrolled, and fillet+cavity shoulder geometry tool) with 1810rpm rotational speed and 460 mm/min welding speed. Welding surface appearance and flash formation observed visually and observed that tool shoulder with fillet+scrolled produces less flash formation and rough surface finishing and tool shoulder with fillet and fillet+cavity produces little flash and good surface finishing. In the transverse tensile test the three joints showed good strength and non-considerable differences were observed, while great differences were observed in the longitudinal tensile tests of the stirred zone, because tool shoulder with fillet+cavity and fillet+scrolled showed an higher and higher strength and elongation with respect to fillet tool. Tool shoulder with fillet+cavity considered the best tool because that increases traverse and longitudinal strength, elongation and good surface appearance.

Galvao et al.[15] studied the influence of tool shoulder geometry on properties of friction stir welds in thin copper plate. The welds were produced using three different shoulder geometries like flat shoulder, conical shoulder and scrolled shoulder with varying the rotational and welding speed of tool. After experiment we observed that scrolled tool provides the best flow of material that yield defect free welding and scrolled tool also provides greater grain refinement that gives better weld strength and hardness with respect to flat and conical tool.

Zhang et al.[16] investigation has been carried out by rotational tool without pin but different geometry over bottom surface of tool shoulder. The experiments of FSW are carried out by using inner-concave-flute shoulder, concentric-circles-flute and threespiral- flute shoulder with welding speed of 20mm/min and 50mm/min and constant rotational speed of 1800rpm. In case of three-spiral-flute shoulder tensile strength of joint increases with decreasing of welding speed while the value of tensile strength attended by the welding speed of 20mm/min and rotational speed of 1800mm/min is about 398Mpa, which is more than parent material strength. This verify that tool with three-spiral-flute shoulder can be used to join the thin plate of aluminium alloy.

Leal at el.[17] studied to see the influence of tool geometry on material flow in heterogeneous friction stir welding of 1 mm thin plate of AA5812-H111 and AA-6016- T4 aluminum alloys. Two types of tool shoulders were used: a shoulder with conical cavity and scrolled shoulder. Pin driven flow was predominant in welds produced with the conical cavity shoulder, which are characterized by an onion ring structure. The interaction between pin-driver and shoulder-driver flow is restricted to the crown other weld, at the trailing side of the tool, and extends throughout the weld thickness, at the leading side. Although no onion ring structure was formed in welds done with scrolled shoulder, extensive mixing of the base material occurred in a plasticized layer flowing through the thickness around the rotating pin. Shoulder-driven flow is intense and continuous around the tool.

#### 2.4. Material flow in FSW

The FSW process can be modeled as a metalworking process in terms of five conventional metal working zones: (a) preheat, (b) initial deformation, (c) extrusion, (d) forging, and (e) post heat/cool down. Typical zones obtained during the process are shown in Fig 2.3. In the preheat zone ahead

of the pin, temperature rises due to the frictional heating of the rotating tool and adiabatic heating because of the deformation of material. The thermal properties of material and the traverse speed of the tool govern the extent and heating rate of this zone. As the tool moves forward, an initial deformation zone forms when material is heated to above a critical temperature and the magnitude of stress exceeds the critical flow stress of the material, resulting in material flow. The material in this zone is forced both upwards into the shoulder zone and downwards into the extrusion zone, as shown in Fig.2.3.



Fig.2.3 Showing (a) Metal flow pattern and (b) Metallurgical processing zones developed during friction stir welding [5]

A small amount of material is captured in the swirl zone beneath the pin tip where a vortex flow pattern exists. In the extrusion zone with a finite width, material flows around the pin from the front to the rear. A critical isotherm on each side of the tool defines the width of the extrusion zone where the magnitudes of stress and temperature are insufficient to allow metal flow. Following the extrusion zone is the forging zone where the material from the front of the tool is forced into the cavity left by the forward moving pin under hydrostatic pressure conditions. The shoulder of the tool helps to constrain material in this cavity and also applies a downward forging force. Material from shoulder zone is dragged across the joint from the retreating side toward the advancing side [18].

#### 2.5. Microstructure zones

A typical FSW weld was produces four distinct microstructural zones: the heat affected zone (HAZ), the thermal mechanically affected zone (TMAZ), the stir zone, and the unaffected zone or base metal. A transverse section from a FSW welded joint is shown in Fig.2.4. The heat affected zone is characterized by a change in the microstructure without plastic deformation of the original grain structure. The mechanical properties are changes in this region, but there is no change in grain size or chemical properties. The TMAZ can be further divided into the non-recrystallized TMAZ and the nugget or recrystallized TMAZ. In the non-recrystallized zone, the strain and the

temperature are lower and the effect of welding on the microstructure is correspondingly smaller. The detailed description about all the distinct microstructure zones is given below.

#### A. Unaffected material Or Parent Metal

This is material remote from the weld, which has not been deformed, and which although it may have experienced a thermal cycle from the weld is not affected by the heat in terms of microstructure or mechanical properties.

#### **B.** Heat affected Zone (HAZ)

In this region, which clearly will lie closer to the weld centre, the material has experienced a thermal cycle which has modified the microstructure and/or the mechanical properties. However, there is no plastic deformation occurring in this area. In the previous system, this was referred to as the "thermally affected zone". The term heat affected zone is now preferred, as this is a direct parallel with the heat affected zone in other thermal processes, and there is little justification for a separate name.

#### C. Thermo-mechanically affected zone (TMAZ)

In this region, the material has been plastically deformed by the friction stir welding tool, and the heat from the process will also have exerted some influence on the material. In the case of aluminium, it is possible to get significant plastic strain without recrystallization in this region, and there is generally a distinct boundary between the recrystallized zone and the deformed zones of the TMAZ. In the earlier classification, these two sub-zones were treated as distinct microstructural regions. However, subsequent work on other materials has shown that aluminium behaves in a different manner to most other materials, in that it can be extensively deformed at high temperature without recrystallization. In other materials, the distinct recrystallized region (the nugget) is absent, and the whole of the TMAZ appears to be recrystallized. This is certainly true of materials which have no thermally induced phase transformation which will in itself induce recrystallization without strain, for example pure titanium,  $\beta$  titanium alloys, austenitic stainless steels and copper. In materials such as ferritic steels and  $\alpha$ - $\beta$  titanium alloys (e.g.Ti-6Al-4V), understanding the microstructure is made more difficult by the thermally induced phase transformation, and this can also make the HAZ/TMAZ boundary difficult to identify precisely.

#### **D.** Weld nugget

The recrystallized area in the TMAZ in aluminium alloys has traditionally been called the nugget. Although this term is descriptive, it is not very scientific. However, its use has become widespread, and as there is no word which is equally simple with greater scientific merit, this term has been adopted. A schematic diagram is shown in the above Figure which clearly identifies the various regions. It has been suggested that the area immediately below the tool shoulder (which is clearly part of the TMAZ) should be given a separate category, as the grain structure is often different here. The microstructure here is determined by rubbing by the rear face of the shoulder, and the material may have cooled below its maximum. It is suggested that this area is treated as a separate sub-zone of the TMAZ.



Fig 2.4: Showing the microstructure zones

#### 2.6 Typical friction stir welding defects

Compare to fusion welding process of aluminium and its alloys, the FSW does not suffer from problems such as weld porosity, solidification cracking, and heat affected liquation cracking. This is because in FSW there is no bulk melting of the parent material. The defects in the FSW are either due to imbalance in material flow or geometrical factors associated with the position of the tool in relation to the joint. The optimal parameters settings during welding balance mass both in terms of material volume and energy. This facilitates constant volume processing while ensuring minimal impact on the pre-existing microstructure. The temperature below melting point of the parent material is the main source of plastic deformation of the material at the joint line. This facilitates microstructural change like recrystallization, coarsening and or dissolution of strengthening precipitates, grain orientation and growth. The process parameters in FSW giving rise to too hot or too cold welding condition. Too cold weld condition responsible for insufficient material flow and giving rise to defects like void formation and nonbonding. Too hot weld condition, giving rise to excessive material flow leading to material expulsion like flash formation and the collapse of the nugget within the stir zone.

#### 2.7 Defects from too hot welds

The defects which are generated under such processing conditions are visually identified through the surface appearance of the welded joint. The improper parameter settings cause too much thermal softening. The surface of welded joint appears to contain blisters or surface galling. Furthermore, excessive heat generation can lead to thermal softening in the work piece material beyond the boundary of tool shoulder. Therefore, the tool shoulder, rather than actively participating as a mean of material containment, it is giving rise to material expulsion in the form of excessive flash formation. Too much thermal softening can also lead to the thinning of the work piece material. The work piece material below the tool shoulder will reaches a point where it is no longer able to support the axial load placed upon it. Such a condition during processing causes 'excessive flash' of the work piece material.

A weld nugget collapse under too hot welding condition is another serious defect in FSW joints. It is not expected all the times that increase of tool rotational speed at constant tool travel speed causes increase in the size of weld nugget.

Colegrove et al.[19] author has observed that the nugget region for an Al-Cu-Mg-Mn 2024 alloy can actually decrease in size rather than increase in size when tool rotational speed is sufficiently increased. The thermal softening brought about by very hot processing condition can lead to slip between the tool pin and the work piece material, and thus decreases strain rates within the immediate vicinity of the tool pin. The weld nugget appears distorted. This weld nugget collapse is generally occurred in the retreating side of the stir zone.

#### **2.8 Defects from too cold welds**

Tool cold welding condition results in work hardening of the workpiece material. This causes the dry slip between the tool pin and the workpiece material. The lack of surface fills or voids and channel defect are the main defects arising due to insufficient heat generation. The insufficient heat generation causes improper material mixing and thus responsible for non-bonding [20].

Cavaliere et al.[21] studied the FSW joint cross-sections and SEM observations of the fractured surfaces to characterize the weld performances. He studied the effect of the welding speed on the fractured surface of the tensile and fatigue tested specimens. The workpiece material investigated is AA 6082. The fractured surface appears populated of very fine dimples revealing a very ductile behavior of the material before failure. All the fatigue tested specimens was observed to fracture in the advancing side of the tool. It was observed that, at higher stresses the fatigue cracks started from the surface. Such big defects are often associated with the vortex formed in the material in the advancing side where a more chaotic flow is formed leading to the presence of voids of the mean dimension of hundreds of microns that represent the site of fatigue cracks initiation. By decreasing the stress amplitude a strong change in the crack behavior was detected, the crack appear to start from the forging defects inside the joints which are always present in this kind of welding. The failure is also related to the coalescence of many small voids and defects in the material. The presence of dimples on the surface revealed a local ductile behavior of the material prior to fracture. This is the case of such conditions in which the optimal solution between material

mixing and grain refinementis obtained. By increasing the advancing speed of the tool the material is extruded too fast (high strain rates) and then they are not reached the conditions for the optimal mixing. The coupling of a high rotation speed and high advancing speed leads to a good material mixing but to a non-optimal grain structure. The too high strain rate, acting on the material during deformation, causes a boundary weakening of the recrystallized structure which can be visualized by cleavage fracture.

## CHAPTER – 3

#### **OBJECTIVE – METHODOLOGY**

After extensive literature survey, it was found that very less work has been done on FSW of dissimilar alloys (AA 6061 and AA6351).So on the basis of literature survey project topic was finalized, research topic is "INVESTIGATION OF FRIFCTION STIR WELDING OF DISSIMILAR ALUMINIUM ALLOYS of AA 6061 and AA6351 USING SILICON CARBIDE, ALUMINIUM OXIDE, TITANIUM POWDER". Aluminium has following characteristics like high strength to weight ratio, easy availability on earth crust, high thermal and electric conductivity etc. Aluminium alloys are widely used in aerospace, automobile, and marine industries.

#### Methodology: the methodology adopted in this research work is as shown in figure below.



# **CHAPTER – 4**

#### **EXPERIMENTAL WORK**

#### 4.1 Materials Used

The materials Chosen for FSW in this research work are commercial AA6061 and AA6351 aluminium alloys and their dimensions are shown in table below.

NO.	ITEM	SPECIFICATION	NO.OF SHEETS
1	AA6061 sheet metal	100mm(length) x 100mm(width) x 5mm(thick)	4
2	AA6351 sheet metal	100mm(length) x 100mm(width) x 5mm(thick)	4

#### Table4.1: Type of work material used in present study

The chemical composition and physical properties of work materials are listed below in Table 4.2

Element	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Al
Wt. (%)	0.59	0.38	0.26	0.03	0.96	0.25	0.02	0.04	Balance

**Table4.2:** Nominal chemical composition of AA6061

Element	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Al
Wt. (%)	1.3	0.5	0.1	0.8	0.8	0.0	0.2	0.2	Balance

 Table4.3: Nominal chemical composition of AA6351

Properties	Melting point	Solidus temperature	Thermal conductivity (W/m-K)	Tensile strength (Mpa)/hardness
AA6061	652*C	582*C	167	353/96hv
AA6351	600*C	477*C	180	320/155hv

Table4.4: physical properties of AA6061 &AA6351

## 4.1.1 Properties of aluminium alloy 6061

- □ It is a precipitation hardened aluminium alloy containing magnesium &silicon as major alloy components.
- □ It has good mechanical properties and good weldability.
- □ It is one of the most common alloys of aluminium for general purpose use.

#### 4.1.2 Properties of aluminium alloy 6351

- □ It is a aluminium alloy, with zinc as the primary alloying element.
- $\Box$  It is strong, with strength comparable to many steels.
- □ It has good machinability and good fatigue strength.
- $\Box$  It has low resistance to corrosion.
- $\Box$  It is relatively high cost.



Figure 4.1: images of material AA6061 & AA6351

#### 4.2 Tool design and fabrication

Chemical composition of work piece AA6061 & AA6351 aluminium alloy is non-heat treatable series of aluminum alloys so non consumable tool with H13 tool steel has been designed using CAD software and has been fabricated and heat treated up to 54HRB.

H13 steel composition		
Elements	Weight in %	
Carbon	0.32-0.45	
Chromium	4.75-5.50	
Molybdenum	1.10-1.75	
Vanadium	0.80-1.20	
Iron	Balance	
Silicon	0.80-1.25	
Sulpher	0.30 max	
Phosphorus	0.30 max	
Manganese	0.25-0.50	

#### Table4.5: Chemical composition of H13 tool steel

The below figure shows CAD model of friction stir tool Dimensions which was used in welding.



Fig4.2: 2-d model of designed tool in cad software in front view

The shoulder diameter was taken as 20 mm and the pin diameter was 6 mm.



Fig4.3: 2-d model of designed tool in cad software



Figure 4.4: showing the 3-d model of tool in CAD software

Friction stir welding tool (with convex shoulder), has been used for welding purpose. Using the tool, 8 welding joints have been fabricated with combination of 4 rotational speed and 4 welding speed and in total 8 experiments have been carried out on vertical milling machine. Dimensions of all tools have been kept same for all experiments and set up of vertical milling machine is kept same.



Figure 4.5: Actual image of friction stir welding tool

# 4.3 Titanium, Silicon Carbide, Aluminium oxide powder

The powders used in the experimental procedure standard is 159 mesh and the properties are listed in the below table.



Properties	Titanium	Silicon Carbide	Aluminum oxide
Appearance	Silvery	Black	White
Melting Point	1668°C	660.3°C	2000 °C
Boiling Point	3560°C	2519°C	2980 °C
Density	4.54 g/cm <sup>3</sup>	3.1 g/m <sup>3</sup>	3.39 g/m <sup>3</sup>
Poisson's Ratio	0.32	0.14	0.21
Specific Heat	0.125 Cal/g/k @ 25°C	750 J/Kg *k	1430 J/Kg *k
Tensile Strength	140 Mpa	240 Mpa	240 Mpa
Thermal Conductivity	21.9 W/(m-k) @ 298.2 k	45 W/(m-k)	30 W/(m-k)
Vickers Hardness	830-3420 Mpa	2400-2800 Mpa	1440 Mpa
Young's Modulus	116 Gpa	300 Gpa	375 Gpa

#### Table4.6: Properties of Titanium, Silicon Carbide, Aluminium oxide powder

#### 4.4 FSW machine and equipment

For conducting actual experiments it requires a fixture which can hold the welding plates firmly and prevents the rotary and translator motions. Fixture has been properly installed over milling machine bed is as shown in Fig (a).Fixture has been properly installed over the bed of VF3.5 knee type vertical milling machine which is shown in Fig. Material used to make a fixture is cast iron which has higher damping coefficient and shock absorbing capabilities so that it will sustain during the actual experiments and provides best clamping.



Figure 4.7: Welding plates clamped over fixture

A HMT knee type vertical milling machine has been used to fabricate the joints is shown in Fig. Friction stir welding setup has been installed over this milling machine knee type vertical milling machine. This has a facility of rpm ranges from 50 to 1800 rpm and traverse speed ranges from 16 to 800 mm/min which made possible to do number of experiments by varying welding speed and rotational speed and tool holding spindle can be rotated either direction (clockwise or counter clockwise direction), maximum traverse length of machine table is 500 mm over which work piece is kept.



Figure 4.8: HMT vertical milling machine

# **4.5 Experimental procedure**

The AA6061 & AA6351 aluminium alloy sheet have been cut into desired dimensions of 100 x100x5 mm by power hacksaw and then milling. Square butt joint configuration, has been prepared to fabricate FSW joints. Single pass welding procedure has been used to fabricate the joints with friction stir welding tool with and without titanium, Silicon Carbide, Aluminium oxide powder and attempt has been made to find out effect of difference on mechanical properties of FSW joints. No preprocessing treatment was carried out before welding and testing. Non-consumable tools made ofH13 tool steel has been used to fabricate the joint.

AA6061 being the hard metal was placed on the advancing side and AA6351 being the soft metal was placed on the retreating side and the weld was carried out using the required parameters.



Figure 4.9: AA6061 & AA6351 plates being welded without powder

For the joints made with powder a 2mm groove was made from the center of the plates i.e 5mm and to a depth of 1.5mm and the titanium powder was filled into the grooves manually and then the plates were fixed on to the fixture using the backing plate and fastened using bolts.



Figure4.10: image (a) showing the groove made in the plates & image (b) showing the powder filled in the grooves

#### 4.6 process parameters

There were totally four different process parameters used in the experimental procedure and 8 experiments were conducted in total four with titanium powder and four without titanium powder. The parameters are listed in the below table.

S. NO.	SPEED (RPM)	FEED RATE (mm/min)	Tilt Angle
			(degrees)
01	710	25	2
	(without powder)		
02	710	25	2
	(with Sic powder)		
03	710	25	2
	(with Tio2 powder)		
04	710	25	2
	(with Al203)		

#### 4.7 Weld joints

The weld joints produced using these parameters are shown in the below figure.



Figure 4.11: showing the weld joint produced

#### 4.8 Tensile test

The welded joints are sliced using power hacksaw and then machined to the required dimensions to prepare tensile specimens according to, American Society for Testing of Materials (ASTM E8M-04) guidelines is followed for preparing the test specimens. Tensile test has been carried out in 100 kN, electro-mechanical controlled Universal Testing Machine (INSTRON) as shown in Fig. The specimen is loaded at the strain rate of 2mm/min as per ASTM specifications, so that tensile specimen undergoes deformation as shown in Fig. The specimen finally fails after necking and the load versus displacement has been recorded. The 0.2% offset yield strength; ultimate tensile strength and percentage of elongation have been evaluated. Instron Ultimate Tensile Machine (UTM) is used for performed tensile test, and so on.



#### Figure 4.12: specimen mounted over the universal testing machine (instron)

Tensile testing is also known as tension testing, which is a fundamental materials science test in which a sample is subjected to uniaxial tension until failure. Properties that are directly measured via a tensile test are ultimate tensile strength, maximum elongation and reduction in area. From these measurements the following properties can also be determined like Young's modulus, Poisson's ratio, yield strength, and strain-hardening characteristics.

Following figure is actual image of specimen for Ultimate tensile test and also 2Ddrawing of tensile test specimen with standard dimensions respectively.



Figure 4.13: image showing the samples for tensile test



Fig 4.14: Tensile test specimen with dimensions

#### 4.9 Rockwell hardness testing

The Rockwell test is generally easier to perform, and more accurate than other type of hardness methods. The Rockwell test method is used on all metals, except in condition where the test metal structure or surface conditions would introduce too much variations; where the indentations would be too large for the application; or where the sample size or sample shape prohibits its use.

The Rockwell method measures the permanent depth of indentation produced by a force/load on an indenter. First, a preliminary test force (commonly referred to as preload or minor load) is applied to a sample using a diamond or ball indenter. This preload breaks through the surface to reduce the effects of surface finish. After holding the preliminary test force for a specified dwell time, the baseline depth of indentation is measured.



Figure 4.15: image showing hardness testing machine

The test was conducted on the Rockwell hardness testing machine with a load of 150kg and using a 1/16 inch ball indenter and the values were observed in HRF scale

# 4.10 Charpy's impact testing

The Charpy Impact Test entails striking a notched impact specimen with a swinging weight or a "tup" attached to a swinging pendulum. The specimen breaks at its notched cross-section upon impact, and the upward swing of the pendulum is used to determine the amount of energy absorbed (notch toughness) in the process. Energy absorption is directly related to the brittleness of the material. Since temperature can affect the toughness of a material, the charpy test is performed at a series of temperatures to show the relationship of ductile to brittle transition in absorbed energy.

Several machined bar specimens, sized at 1cm x 1cm x 5.5cm with a 2mm deep U-shaped notch at the middle of a specified flat surface, are required to perform some methods of charpy testing. The charpy V-notch impact test is also very common and requires a specimen with a V-shaped notch.



Figure 4.16: image showing impact testing machine

## CHAPTER – 5

#### **RESULTS AND DISCUISSION**

#### **5.1 Tensile strength:**

The welded plates with titanium and without titanium powder are sliced using power hacksaw and then machined in vertical milling machine to the required dimensions to prepare for tensile test and the specimens are as shown below in Fig.5.1. American Society for Testing of Materials (ASTME8M-04) guidelines were followed while preparing the specimens for test.



Fig.5.1 Tensile test specimen for welded material

Tensile test were carried out over UTM and 0.2% offset yield strength, ultimate tensile strength and percentage of elongation have been evaluated. Engineering stress-strain curve for welded specimens s were obtained and are as shown in figure below.



Graph.1 without powder



Graph.2 With Sic powder



Graph.3 With Al203 powder



Graph.4 With Ti02 powder

Transverse tensile properties of FSW joints such as ultimate tensile strength, yield Strength and percentage of elongation have been evaluated as shown in Table. Specimens were tested at each condition. It can be inferred that the tool shoulder geometry, welding speed and rotational speed are having influence on tensile properties of the FSW joints. Of the four joints, the joints fabricated with Silicon carbide powder exhibited superior tensile properties compared to joints produced using other powders.

Process	Tensile Strength (N/mm2)		
Without powder	80.7		
With Sic powder	136.4		
With Al203 powder	102.2		
With Tio2 powder	94.4		

 Table 5.1: Tensile test results

The tensile strength values were observed to be lower in the joints made with Titanium and Aluminium oxide powder compared to the joints made with Silicon carbide powder. Due to the grooves made in the plates there were air gaps created in between the weld joint. Second reason is that because of more stirring in nugget zone at high rotational speed and low welding speed that reduces grains size of particles thus hardness increases which cause brittleness in joint. Ultimate tensile stress as well as % of elongation is more in case of the weld joints made without Silicon carbide powder because there were no air gaps created in the weld zone. The best results were observed in the joint made with Silicon carbide powder at rpm 710 at a feed rate of 25 mm/min.

#### **5.2 Hardness and Impact test properties**

The hardness was best observed in the weld joint made with Aluminium oxide powder introducing it in the weld joint increased the hardness compared to the joints weld without powder.

Process	Vickers Hardness
Without powder	54.5
With Sic powder	58.8
With Al203 powder	68.1
With Tio2 powder	51.2

#### Table 5.2: hardness test results

Process	Impact Energy		
	(Joules)		
Without powder	8		
With Sic powder	12		
With Al203 powder	10		
With Tio2 powder	8		

Table 5.3:	Impact	test	results
------------	--------	------	---------

## CHAPTER – 6

#### CONCLUSION

In this investigation an attempt has been made to study the effect of three different kind of powders are titanium powder, Silicon carbide powder, Aluminium oxide powder in the weld joint of dissimilar aluminium alloys AA6061 and AA6351. The tensile properties, hardness and impact properties have been obtained, it is concluded that

The tensile strength is higher in the joints made with Silicon carbide micro powder.

By using powder in the friction stir weld joints only the hardness has been improved and the other properties of the weld joint have reduced.

The optimum parameters that were observed in the investigation are were at 710 RPM, feed rate of 25 mm/min and tool angle 2 degrees.

## CHAPTER – 7

#### **FUTURE SCOPE**

In this investigation an attempt has been made to study the effect of titanium powder, Silicon carbide powder, Aluminium oxide powder in the weld joint of dissimilar aluminium alloys AA6061 and AA6351. The tensile properties, hardness and impact properties have been obtained.

The investigation can be done by pre heating the powder and introducing it in the weld joint.

The welding parameters can be changed and also different tool geometries can be used to do the research.

#### REFRENCES

[1] W.M. Thomas, E.D. Nicholas, J.C. Needham, M.G. Murch, P. Templesmith, C.J. Dawes, G.B. Patent Application No.9125978.8 (December 1991).

[2] Hofmann Douglas C, Vecchio Kenneth S. "Thermal history analysis of friction stir processed and submerged friction stir processed aluminium". Material Science Engineering, 2007, Pages 165–75.

[3] <u>http://www.hitachi.com/rd/hrl/interview/monozukuri\_platform-ks.html</u>.

[4] M. Ericsson, R. Sandstrom, "Influence of welding speed on the fatigue of friction stir welds, and comparison with MIG and TIG" International Journal of Fatigue, Volume 25, 2003, pages 1379–1387.

[5] R.S. Mishra, Z.Y. Ma, "Friction stir welding and processing" Materials Science and Engineering" Volume 50, Issues 1-2, 31 August 2005, Pages 1-78.

[6] S. Mandal, J. Rice, A.Elmustafa, "Experimental and numerical investigation of the plunge stage in friction stir welding" Materials Processing Technology, Volume 203, Issues 1-3, 18 July 2008, Pages 411-419.

[7] K. Kumar, S. Kailas, "On the role of axial load and the effect of interface position on the tensile strength of a friction stir welded aluminium alloy" Materials & Design, Volume 29, Issue 4, 2008, Pages 791-797.

[8] M. Han, S. Lee, J. Park, S. Ko, Y. Woo, S. Kim "Optimum condition by mechanical characteristic evaluation in friction stir welding for 5083-O Al alloy" Nonferrous material Society, China, Volume 19, 2009, Pages 17-22.

[9] A. Arora, A .De and T. DebRoy, "Toward optimum friction stir welding tool shoulder diameter" Scripta materialia, Volume 64, 2011, pages 9-12.

[10] Y. Hwang, Z. Kang, Y. Chiou, H. Hsu, "Experimental study on temperature distributions within the workpiece during friction stir welding of aluminum alloys" Machine Tools and Manufacture, Volume 48, Issues 7-8, June 2008, Pages 778-787.

[11] H. Fujii, L. Cui, M. Maeda, K.Nogi, "Effect of tool shape on mechanical properties and microstructure of friction stir welded aluminum alloys, Materials Science and Engineering, Volume 419, Issues 1-2, 15 March 2006, Pages 25-31

[12] K. Elangovana, V. Balasubramanianb, "Influences of tool pin profile and welding speed on the formation of friction stir processing zone in AA2219 aluminium alloy" Processing technology, Volume 20, 2008, Pages 163–175.

[13] H. Fujii, L. Cui, M. Maeda, K.Nogi, "Effect of tool shape on mechanical properties and microstructure of friction stir welded aluminum alloys" Materials Science and Engineering, Volume 419, Issues 1-2, 15 March 2006, Pages 25-31

[14] A. Scialpi , L.A.C. De Filippis , P. Cavaliere "Influence of shoulder geometry on microstructure and mechanical properties of friction stir welded 6082 aluminium alloy" Material & design, Volume 28, 2007, Pages 1124–1129.

[15] I. Galvao, R.M. Leal, D.M. Rodrigues, A. Loureiro "Influence of tool shoulder geometry on properties of friction stir welds in thin copper sheets" Materials Processing Technology, Volume 213, 2013, Pages 129–135.

[16] Liguo Zhang, Shude Ji, Guohong Luan, Chunlin Dongand *Li Fu*, "Friction Stir Welding of Al Alloy Thin Plate by Rotational Tool without Pin"2011.

[17] R.M. Leal, C. Leitao, A. Loureiro, D.M. Rodrigues, P. Vilac, "Material flow in heterogeneous friction stir welding of thin aluminium sheets:Effect of shoulder geometry" Science and Engineering ,volume A 498, 2008, Pages 384–391.

[18] O. Lorrain, V. Favier, H. Zahrouni, D.Lawrjaniec, "Understanding the material flow path of friction stir welding process using unthreaded tools" Materials Processing Technology, Volume 210, Issue 4, 1 March 2010, Pages 603-609.