



**Bharath**  
INSTITUTE OF HIGHER EDUCATION AND RESEARCH  
(Declared as Deemed - to - be - University under section 3 of UGC Act 1956)



DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM AND SYLABUS (R2018)

CHOICE BASED FLEXIBLE CREDIT SYSTEM

(Applicable to the batches admitted from July 2018)

B.Tech –Mechanical Engineering

FULL TIME

I – VIII SEMESTERS

SEMESTER I								
Sl.No	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18HSEN101	HS	Communicative English	4	2	0	2	3
2	U18BSMA101	BS	Engineering Mathematics –I	4	4	0	0	4
3	U18BSPH 101	BS	Waves and Optics	3	3	0	0	3
4	U18BSCH101	BS	Engineering Chemistry	3	3	0	0	3
5	U18ESCS101	ES	Problem Solving and Python Programming	3	3	0	0	3
6	U18ESME101	ES	Engineering Graphics & Design	5	1	0	4	3
<b>PRACTICAL</b>								
7	*U18BSPH2L1	BS	Wave Optics and Mechanics Lab	3	0	0	3	0
	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	0
8	U18ESCS1L1	ES	Problem Solving and Python Programming Laboratory	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
9	U18MCAB101	MC	Physical health – Sports & Games	2	0	0	2	0
10	U18MCAB102	MC	Gardening & Tree Plantation -	2	0	0	2	0
Total				35	17	0	14	20.5

**\* Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER II								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18HSEN201	HS	Technical English	3	2	1	0	3
2	U18BSMA201	BS	Engineering Mathematics- II	4	4	0	0	4
3	U18BSPH201	BS	Introduction to Mechanics	3	3	0	0	3
4	U18BSCH201	BS	Environmental Sciences	3	3	0	0	3
5	U18BSBT101	BS	Biology for Engineers	2	2	0	0	2
6	U18ESEE101	ES	Basic Electrical & Electronics Engineering	3	3	0	0	3
<b>PRACTICAL</b>								
7	*U18BSPH2L1	BS	Wave Optics and Mechanics Lab	3	0	0	3	1.5
8	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	1.5
9	U18ESME1L2	ES	Workshop/Manufacturing Practices Lab	5	1	0	4	3
10	U18ESEE1L3	ES	Basic Electrical & Electronics Engineering Laboratory	3	0	0	3	1.5
<b>ACTIVITY BASED COURSES</b>								
11	18MCAB203	MC	Yoga	2	0	0	2	0
12	18MCAB204	MC	Physical health – NCC	2	0	0	2	0
Total				36	17	1	12	25.5

**\*Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER III								
Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18BSMA302	BS	Partial Differential Equations, Probability and Statistics	4	3	1	0	4
2	U18ESME 301	ES	Engineering Mechanics	4	3	1	0	4
3	U18PCME302	PC	Materials Engineering	3	3	0	0	3
4	U18PCME303	PC	Thermodynamics	4	3	1	0	4
5	U18PCME304	PC	Manufacturing Processes	3	3	0	0	3
6	U18PCME305	PC	Fluid Mechanics and Machinery	4	3	1	0	4
<b>PRACTICAL</b>								
7	U18PCME3L1	PC	Machine Drawing	2	0	0	2	1
<b>ACTIVITY BASED COURSES</b>								
8	U18MCAB305	MC	Culture- Learning an art form	2	0	0	2	0
9	U18MCAB306	MC	Culture – Intangible Cultural, heritage(festivals, Food ways, Local games)	2	0	0	2	0
Total				28				23

SEMESTER IV								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18PCME401	PC	Applied Thermodynamics	4	3	1	0	4
2	U18BSMA401	BS	Numerical Methods	4	3	1	0	4
3	U18PCME 402	PC	Strength of Materials	4	3	1	0	4
4	U18PCME403	PC	Manufacturing Technology	3	3	0	0	3
5	U18PCME404	PC	Instrumentation and Control	3	3	0	0	3
6	U18PCME405	PC	Theory of Machines	4	3	1	0	4
7	U18MCTH401	MC	Constitution of India	2	2	0	0	0
<b>PRACTICAL</b>								
8	U18PCME4L1	PC	Strength of Materials and Fluid Mechanics Lab	2	0	0	2	1
9	U18PCME4L2	PC	Metallurgy and Metrology Lab	2	0	0	2	1
<b>ACTIVITY BASED COURSES</b>								
10	U18MCAB407	MC	Literature & Media – Literature, Cinema & Media	2	0	0	2	0
11	U18MCAB408	MC	Literature & Media – Group Reading of Classics	2	0	0	2	0
Total				32				24

SEMESTER V								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18PCME501	PC	Heat Transfer	4	3	1	0	4
2	U18PCME502	PC	Computer Aided Design	3	3	0	0	3
3	U18PCME503	PC	Machine Design –I	4	3	1	0	4
4	U18HSBA501	HS	Organizational Behavior	3	3	0	0	3
5		PE	PEC-I	3	3	0	0	3
6		PE	PEC-II	3	3	0	0	3
7	U18MCTH502	MC	Universal Human Values	2	2	0	0	0
<b>PRACTICAL</b>								
8	U18PCME5L1	PC	Thermal and Heat Transfer Engineering Laboratory	2	0	0	2	1
9	U18PCME5L2	PC	Instrumentation and Dynamics Lab	2	0	0	2	1
10	U18PCME5L3	PC	Manufacturing Technology lab	2	0	0	2	1
<b>ACTIVITY BASED COURSES</b>								
11	U18MCAB611	MC	Self Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
12	U18MCAB612	MC	Self Development - religion and Inter-faith	2	0	0	2	0
Total				32				23

SEMESTER VI								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18PCME601	PC	Machine Design –II	4	3	1	0	4
2		PE	PEC-III	3	3	0	0	3
3		PE	PEC-IV	3	3	0	0	3
4	U18PCME602	PC	Finite Element Analysis	4	3	1	0	4
5	U18BSMA601	BS	Operational Research	3	3	0	0	3
5	U18MCTH603	MC	Essence of Indian Knowledge Tradition	2	2	0	0	0
<b>PRACTICAL</b>								
6	U18PCME6L1	PC	CAD/CAM Lab	2	0	0	2	1
7	U18EEEA6L2	EEC	Soft Skill	2	0	0	2	1
8	U18EEME6L3	EEC	Summer Internship	0	0	0	0	1
<b>ACTIVITY BASED COURSES</b>								
9	U18MCAB509	MC	Social Services – Social Awareness	2	0	0	2	0
10	U18MCAB510	MC	Social Services – NSS	2	0	0	2	0
Total				27				20

SEMESTER VII								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18PCME701	PC	Automation in Manufacturing	3	3	0	0	3
2		PE	PEC-V	3	3	0	0	3
3		OE	OEC-I	3	3	0	0	3
4		OE	OEC-II	3	3	0	0	3
<b>PRACTICAL</b>								
6	U18PCME7L1	PC	Design and Analysis Lab	2	0	0	2	1
7	U18EEME7P1	EE	Project –I	8	0	0	8	4
<b>ACTIVITY BASED COURSES</b>								
8	U18MCAB713	MC	Behavioral and interpersonal skills	2	0	0	2	0
9	U18MCAB714	MC	Nature – Nature club	2	0	0	2	0
Total				26				17

SEMESTER VIII								
Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1		PE	PEC –VI	3	3	0	0	3
		OE	OEC III	3	3	0	0	3
2		OE	OEC –IV (MOOC)	2	2	0	0	2
<b>PRACTICAL</b>								
3	U18EEME8P2	EEC	Project –II	16	0	0	16	8
<b>ACTIVITY BASED COURSES</b>								
4	U18MCAB815	MC	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
Total				24				16

**Total Credit: 169**

## LIST OF PROFESSIONAL ELECTIVES

### Professional Core Elective -I

Code No.	Specialization	Course Title	L	T	P	C
U18PEME011	Thermal	Advanced Internal Combustion Engines	3	0	0	3
U18PEME012	Design	Design for Manufacturing	3	0	0	3
U18PEME013	Manufacturing	Special casing Process	3	0	0	3
U18PEME014	Manufacturing	Industrial Engineering	3	0	0	3

### Professional Core Elective -II

Code No.	Specialization	Course Title	L	T	P	C
U18PEME021	Thermal	Power Plant Engineering	3	0	0	3
U18PEME022	Design	Tribology	3	0	0	3
U18PEME023	Materials Engineering	Composite Materials and Technology	3	0	0	3
U18PEME024	Manufacturing	Industrial Robotics	3	0	0	3

### Professional Core Elective -III

Code No.	Specialization	Course Title	L	T	P	C
U18PEME031	Thermal	Gas Dynamics and Jet Propulsion	3	0	0	3
U18PEME032	Design	Design of Jigs fixtures and press Tools	3	0	0	3
U18PEME033	Manufacturing	Unconventional Machining Process	3	0	0	3
U18PEME034	Manufacturing	Process Planning and Cost Estimation	3	0	0	3

### Professional Core Elective -IV

Code No.	Specialization	Course Title	L	T	P	C
U18PEME041	Automobile	Automobile Engineering	3	0	0	3
U18PEME042	Design	Mechanical Vibrations	3	0	0	3
U18PEME043	Thermal	Advance Turbo Machines	3	0	0	3
U18PEME044	Industrial Management	Total Quality Management	3	0	0	3

### Professional Core Elective -V

Code No.	Specialization	Course Title	L	T	P	C
U18PEME051	Thermal	Refrigeration and Air conditioning	3	0	0	3
U18PEME052	Thermal	Computational Fluid Dynamics	3	0	0	3
U18PEME053	Design	Mechanics of Fracture	3	0	0	3
U18PEME054	Industrial Management	Principles of Managements	3	0	0	3

### Professional Core Elective -VI

Code No.	Specialization	Course Title	L	T	P	C
U18PEME061	Thermal	Combustion Engineering	3	0	0	3
U18PEME062	Thermal	Design of Heat Exchanger	3	0	0	3
U18PEME063	Design	Rapid prototyping	3	0	0	3
U18PEME064	Industrial Engineering	Plant layout and Material Handling	3	0	0	3

## LIST OF OPEN ELECTIVES COMMON TO ALL B.Tech PROGRAMMES

### ALL THE COURSES WITH L=3, T=0, P=0 & C=3

1. U18OEBA001 Sociology
2. U18OEBA002-Lean Six Sigma
3. U18OEBA003-Cyber Law and Ethics
4. U18OEBA004-Economic Policies in India
5. U18OEBA005-Management Information System
6. Total Engineering Quality Management
7. U18OEBA007-Industrial Psychology
8. U18OEBA008-Entrepreneurship Development and IPR
9. U18OEBA009-Intellectual Property Rights
10. U18OEBA010-Engineering Economics and Cost Analysis
11. U18OEEN001- Soft Skills and Interpersonal Communication
12. U18OEEN002-Indian Writing in English
13. U18OEEN003-Creative Writing
14. U18OEEN004- Proficiency in English and Accent Training
15. U18OEMA001-Cryptography
16. U18OEMA002-Finite Automata Theory / Formal Languages
17. U18OEMA003-Linear Programming
18. U18OECE001 - Metro Systems and Engineering
19. U18OECE002-Pollution Regulations
20. U18OECE003-Road Safety
21. U18OECE004- Infrastructure Development
22. U18OECE005- Project Safety Management
23. U18OECE006- Environment, Health and Safety in Industries
24. U18OEME001-Design for Manufacturing and Assembly
25. U18OEME002-Industrial Safety
26. U18OEME003-Refrigeration and Cryogenics
27. U18OEME004- Product Design and Development
28. U18OEAE001-Electric and Hybrid Vehicles
29. U18OEAE002-Intelligent Transportation System
30. U18OEAE003-Vibration and Noise Control
31. U18OEAE004-Automotive Sensors and Applications
32. U18OEMT001-MEMS and Nano Technology
33. U18OEMT002-Non-Destructive Testing
34. U18OEMT003-Bio Mechatronics
35. U18OEMT004-Artificial Intelligence for Robotics
36. U18OEAE001-Industrial Aerodynamics
37. U18OEAE002- Elements of Aeronautics and Astronautics
38. U18OEAE003- Unmanned Aerial Vehicle
39. U18OEAE004- Introduction to Avionics
40. U18OEAE005-Rocket Propulsion
41. U18OECE001-Green Technologies
42. U18OECE002-Electrical Safety and Quality Assurance
43. U18OECE003-Energy Conservation Techniques
44. U18OECE004-PLC and SCADA for Industrial
45. U18OECE001-Communication Systems

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| 46. U18OEEC-002-VLSI circuits  | 70. U18OEIT004-Ethical Hacking Techniques           |
| 47. U18OEEC-003-Image Processing Techniques                                      | 71. U18OECS004-Mobile Application Development       |
| 48. U18OEEC-004-Communication Networks   | 72. U18OECS005-System Modelling and Simulation      |
| 49. U18OEEC-005-An Introduction to DSP   | 73. U18OECS006-Web Programming                      |
| 50. U18OEEC-006-Basics of IoT  | 74. U18OECS007-Virtual Reality                      |
| 51. U18OEBM001-Medical Radiation Safety Engineering                              | 75. U18OECS008- E Commerce                          |
| 52. U18OEBM002-Medical Waste Management  | 76. U18OEGE001-Metagenomics and Epigenomics         |
| 53. U18OEBM003-Quality Control in Healthcare                                     | 77. U18OEGE002-Molecular Genetics and Genomics      |
| 54. U18OEBM004-Wearable Technology   | 78. U18OEGE003-Principles of Molecular cell biology |
| 55. U18OEEI001-Analytical Methods and Instrumentation                            |   |
| 56. U18OEEI002-Introduction to process Data Analytics                            | --XXXX--  |
| 57. U18OEEI003-Reliability and Safety in Process industries                      |   |
| 58. U18OEEI004-Multi sensor data fusion  |   |
| 59. U18OEBT001- Bioprocess Economics & Plant Design                              |   |
| 60. U18OEBT002-Brewing technology  |   |
| 61. U18OEBT003-Biomining   |   |
| 62. U18OEBT004-Industrial Safety Engineering                                     |   |
| 63. U18OEAC001-Geo- informatics for Precision Farming                            |   |
| 64. U18OEAC002-Livestock and poultry management                                  |   |
| 65. U18OEAC003-Extension methodologies and transfer of Agricultural Technologies |   |
| 66. U18OEAC004-Soil and Water Conservation Engineering                           |   |
| 67. U18OEIT001-Block Chain Technology  |   |
| 68. U18OEIT002-Semantic Web  |   |
| 69. U18OEIT003-Entrepreneurship Development                                      |   |

**HUMANITIES AND SOCIAL STUDIES INCLUDING MANAGEMENT COURSES (HS)**

Sl. No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18HSEN101	HS	Communicative English	4	2	0	2	3
2	U18HSEN201	HS	Technical English	3	1	1	0	3
3	U18HSBA501	HS	Organizational Behavior	3	3	0	0	3
Total Credit								9

**BASIC SCIENCE (BS)**

S.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18BSMA101	BS	Engineering Mathematics –I	4	3	1	0	4
2	U18BSPH 101	BS	Waves and Optics	3	3	0	0	3
3	U18BSCH101	BS	Engineering Chemistry	3	3	0	0	3
4	U18BSMA201	BS	Engineering Mathematics- II	4	3	1	0	4
5	U18BSPH201	BS	Introduction to Mechanics	3	3	0	0	3
6	U18BSCH201	BS	Environmental Sciences	3	3	0	0	3
7	U18BSBT101	BS	Biology for Engineers	2	2	0	0	2
8	U18BSMA302	BS	Partial Differential Equations and Probability & Statistics	4	3	1	0	4
9	U18BSMA401	BS	Numerical Methods	4	3	1	0	4
10	U18BSMA601	BS	Operations Research for Engineers	3	3	0	0	3
<b>PRACTICAL</b>								
10	*U18BSPH2L1	BS	Wave Optics and Mechanics Lab	3	0	0	3	1.5
11	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	1.5
Total Credits								36

## ENGINEERING SCIENCE COURSES (ES)

S.No	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18ESCS101	ES	Problem Solving and Python Programming	3	3	0	0	3
2	U18ESME101	ES	Engineering Graphics & Design	5	1	0	4	3
3	U18ESEE101	ES	Basic Electrical & Electronics Engineering	3	3	0	0	3
4	U18ESME 301	ES	Engineering Mechanics	4	3	1	0	4
<b>PRACTICAL</b>								
4	U18ESCS1L1	ES	Problem Solving and Python Programming Laboratory	3	0	0	3	1.5
5	U18ESME1L2	ES	Workshop/Manufacturing Practices Laboratory	5	1	0	4	3
6	U18ESEE1L3	ES	Basic Electrical & Electronics Engineering Laboratory	3	0	0	3	1.5
Total Credits								19

## PROFESSIONAL CORE COURSES

S.No	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18PCME302	PC	Materials Engineering	3	3	0	0	3
2	U18PCME303	PC	Thermodynamics	4	3	1	0	4
3	U18PCME304	PC	Manufacturing Processes	3	3	0	0	3
4	U18PCME305	PC	Fluid Mechanics and Machinery	4	3	1	0	4
5	U18PCME401	PC	Applied Thermodynamics	4	3	1	0	4
6	U18PCME402	PC	Strength of Materials	4	3	1	0	4
7	U18PCME403	PC	Manufacturing Technology	3	3	0	0	3
8	U18PCME404	PC	Instrumentation and Control	3	3	0	0	3
9	U18PCME405	PC	Theory of Machines	4	3	1	0	4
10	U18PCME501	PC	Heat Transfer	4	3	1	0	4
11	U18PCME502	PC	Computer Aided Design	3	3	0	0	3
12	U18PCME503	PC	Machine Design -I	4	3	1	0	4
13	U18PCME601	PC	Machine Design -II	4	3	1	0	4
14	U18PCME602	PC	Finite Element Analysis	4	3	1	0	4
15	U18PCME701	PC	Automation in Manufacturing	3	3	0	0	3

<b>PRACTICALS</b>								
<b>16</b>	U18PCME3L1	PC	Machine Drawing	3	0	0	3	1
<b>17</b>	U18PCME4L1	PC	Strength of Materials and Fluid Mechanics Lab	3	0	0	3	1
<b>18</b>	U18PCME4L2	PC	Metallurgy and Metrology Lab	3	0	0	3	1
<b>19</b>	U18PCME5L1	PC	Thermal and Heat Transfer Engineering Laboratory	3	0	0	3	1
<b>20</b>	U18PCME5L2	PC	Instrumentation and Dynamics Lab	3	0	0	3	1
<b>21</b>	U18PCME5L3	PC	Manufacturing Technology lab	3	0	0	3	1
<b>22</b>	U18PCME6L1	PC	CAD/CAM Lab	3	0	0	3	1
<b>23</b>	U18PCME7L1	PC	Design and Analysis Lab	3	0	0	3	1
Total Credits								62

#### **EMPLOYABILITY ENHANCEMENT COURSES (EE)**

Sl.No.	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>PRACTICAL</b>								
<b>1</b>	U18EEEA6L2	EEC	Soft Skill	2	0	0	2	1
<b>2</b>	U18EEME6L3	EEC	Summer Internship	0	0	0	0	1
<b>3</b>	U18EEME7P1	EEC	Project –I	8	0	0	8	4
<b>4</b>	U18EEME8P1	EEC	Project –II (Main Project)	16	0	0	16	8
Total Credits								14

#### **MANDATORY COURSES (MC)**

SEM	Code No.	Category	Course Title	Contact Periods	L	T	P	C
<b>THEORY</b>								
1	U18MCTH401	MC	Constitution of India	2	2	0	0	0
2	U18MCTH502	MC	Universal Human Values	2	2	0	0	0
3	U18MCTH603	MC	Essence of Indian Knowledge Tradition	2	2	0	0	0
<b>ACTIVITY BASED COURSES</b>								
1	U18MCAB101	MC	Physical health – Sports & Games	2	0	0	2	0
1	U18MCAB102	MC	Gardening & Tree Plantation -	2	0	0	2	0
2	U18MCAB203	MC	Yoga	2	0	0	2	0
2	U18MCAB204	MC	Physical health – NCC	2	0	0	2	0
3	U18MCAB305	MC	Culture- Learning an art	2	0	0	2	0

			form					
3	U18MCAB306	MC	Culture – Intangible Cultural, heritage(festivals, Food ways, Local games)	2	0	0	2	0
4	U18MCAB407	MC	Literature & Media – Literature, Cinema & Media	2	0	0	2	0
4	U18MCAB408	MC	Literature & Media – Group Reading of Classics	2	0	0	2	0
5	U18MCAB509	MC	Social Services – Social Awareness	2	0	0	2	0
5	U18MCAB510	MC	Social Services – NSS	2	0	0	2	0
6	U18MCAB611	MC	Self Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
6	U18MCAB612	MC	Self Development- religion and Inter-faith	2	0	0	2	0
7	U18MCAB713	MC	Behavioral and interpersonal skills	2	0	0	2	0
7	U18MCAB714	MC	Nature – Nature club	2	0	0	2	0
8	U18MCAB815	MC	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
Total Credits				36	6	0	30	0

**SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION**

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	3	3	-	-	3	-	-	-	9	5.33
2	Maths& Basic Sciences (BS)	10	15	4	4	-	3	-	-	36	21.30
3	Engineering Sciences (ES)	7.5	7.5	4	-	-	-	-	-	19	11.25
4	Professional Core (PC)	-	-	15	20	14	9	4		62	36.69
5	Professional Electives (PE)	-	-	-	-	6	6	3	3	18	10.65
6	Open Electives/ MOOC (OE)	-	-	-	-	-		6	5	11	6.51
7	Project Work, Seminar, Internship, Term Paper, etc. (EE)	-	-	-	-	-	2	4	8	14	8.28
8	Mandatory course(MC)	0	0	0	0	0	0	0	0	0	0
	<b>Total Credit</b>	<b>20.5</b>	<b>25.5</b>	<b>23</b>	<b>24</b>	<b>23</b>	<b>20</b>	<b>17</b>	<b>16</b>	<b>169</b>	
	<b>Total Contact Hour</b>	<b>35</b>	<b>36</b>	<b>28</b>	<b>32</b>	<b>32</b>	<b>27</b>	<b>26</b>	<b>25</b>	<b>241</b>	<b>241</b>

**TOTAL CREDITS=169**

<b>U18HSEN101</b>	<b>COMMUNICATIVE ENGLISH</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Periods – 45						2	0	2	3		
	Prerequisite – School English											
	Course Coordinator Name & Department:-											
<b>OBJECTIVES</b>	To gain fundamental knowledge of language and the uses in daily life.											
<b>COURSE OUTCOMES</b>												
CO1	The student will be able to comprehend the text with clarity											
CO2	The capacity to read and listen will improve											
CO3	Writing technical report will be learnt properly											
CO4	Speaking skills will be acquired											
CO5	Overall communication skills will make them employable											
<b>MAPPING BETWEEN COURSE OUTCOMES&amp; PROGRAMME OUTCOMES</b>												
<b>COs\POs</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>	<b>l</b>
<b>1</b>	3										3	
<b>2</b>		2							2			
<b>3</b>			3							3		
<b>4</b>				3		2						
<b>5</b>					3		3	1				
Category	Humanities and Social Studies (HS)											
Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

**UNIT I SPEAKING 6**

Speaking- Pronunciation, Intonation, Stress and Rhythm -Common Everyday Situations: Conversations and Dialogues -Communication at Workplace -Interviews -Formal Presentations -introducing oneself – exchanging personal information- narrating events, - incidents , speaking about one’s friend/pet -Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development– prefixes- suffixes- articles, prepositions.

**UNIT II READING 6**

Reading – comprehension (multiple choice questions, short questions) - short narratives and descriptions from newspapers including dialogues and conversations also used as short reading texts-- and longer passages - understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences vocabulary and structures- Vocabulary Building -The concept of Word Formation

**UNIT III LISTENING 6**

Listening – listening to longer texts and filling in the table- product description- asking about routine actions and expressing opinions. –Listening to telephonic conversations -degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs- Identifying Common Errors in Writing - Subject-verb agreement - Noun-pronoun agreement

**UNIT IV WRITING 6**

Writing- letter writing, formal and personal letters- after listening to dialogues or conversations and completing exercises based on them. Understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences -Tenses- simple present-simple past- present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs- Articles - Prepositions.

**UNIT V LANGUAGE DEVELOPMENT 6**

Writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing- listening to talks, conversations to complete the remaining, participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense.– paragraph writing- topic sentence- main ideas short narrative descriptions . Synonyms, antonyms, and standard abbreviations- Basic Writing Skills- Sentence Structures- Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence- Organizing principles of paragraphs in documents- Techniques for writing precisely

## **SOFTSKILL LABORATORY**

**15**

### **LIST OF EXPERIMENTS / EXERCISES**

1. Group discussion
2. Making effective presentations
3. Watching interviews & conversations
4. Reading different genres of texts
5. International English Language Testing System (IELTS)
6. Test of English as a Foreign Language (TOEFL)
7. Mock interviews
8. Time management & stress management
9. Role play
10. Listening to lectures, discussions from TV/ Radio.
11. Articulation of sounds - intonation.
12. Creative and critical thinking.

### **TEXT BOOKS:**

1. English A Course book for Under Graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

### **REFERENCES**

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013
4. Means, L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning, USA: 2007
5. Practical English Usage. Michael Swan. OUP. 2005.
6. Remedial English Grammar. F.T. Wood. Macmillan. 2007
7. On Writing Well. William Zinsser. Harper Resource Book. 2001

**Course Coordinator**

**HOD**

<b>U18BSMA101</b>	<b>Engineering Mathematics – I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 60	3	1	0	4
	Prerequisite – School Level Mathematics				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES</b>	The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate integration analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.				

<b>COURSE OUTCOMES (COs)</b>												
CO1	To apply both the limit definition and rules of differentiation to differentiate functions. Also they will have a basic understanding of Rolle’s Theorem that is fundamental to application of analysis to Engineering problems.											
CO2	To apply definite integrals of algebraic and trigonometric functions using formulas and substitution. Also they will have a basic understanding of Beta and Gama functions.											
CO3	To apply differential and integral calculus to notions of curvature. Also apply differentiation to find maxima and minima of functions.											
CO4	To apply multiple integrals to compute area and volume over curves, surface and domain in two dimensional and three dimensional spaces.											
CO5	Identify Eigenvalue problems from practical areas using transformations; Diagonalising the matrix would render the Eigen values.											
<b>CO/PO Mapping</b>												
<b>3 – Strong, 2 – Medium, 1 – Weak</b>												
COs	<b>Programme Outcomes (POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3				2		1			1		
CO2	3		3	1	2			2				
CO3	3				2				1			
CO4	3	2			2				1			
CO5	3		3		2				2	1		
<b>Category</b>	Basic Science (BS)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

**UNIT I DIFFERENTIAL CALCULUS - One Variable (9+3)**

Representation of functions – limit of a function – continuity – Derivatives – Differentiation rule – Maxima and minima of functions of one variable – Rolle’s Theorem – Mean Value Theorem – Taylor’s and Maclaurin’s Theorem with remainders.

**UNIT II INTEGRAL CALCULUS - One Variable (9+3)**

Definite integrals – Substitution rule – Techniques of integration – Integration by parts – Trigonometric integrals – Trigonometric substitutions – Integrations of rational functions by partial fractions – Integrations of irrational functions- Integration of improper functions - Beta, Gamma functions and their properties.

**UNIT III DIFFERENTIAL CALCULUS - Several Variables (9+3)**

Partial derivatives –Euler’s theorem on Homogeneous functions - directional derivatives – total derivative – Jacobian – Maxima and minima of two variables.

**UNIT IV MULTIPLE INTEGRALS - Several Variables (9+3)**

Double integrals in Cartesian co-ordinates – Change of order of integrations – Area as a double integral – Triple integrals in Cartesian co-ordinates –Volume as triple integrals – Double integrals in polar co-ordinates – simple problems.

**UNIT V MATRICES (9+3)**

Characteristic Equations – Eigenvalue and Eigenvectors of the real matrix– Properties– Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of Quadratic form.

**TEXT BOOKS**

1. Grewal B. S, Higher Engineering Mathematics, Khanna Publisher, Delhi – 2014.
2. Kreyszig. E, Advanced Engineering Mathematics, 10<sup>th</sup> edition, John Wiley & Sons, Singapore, 2012.

**REFERENCE BOOKS**

1. Veerarajan T, Engineering Mathematics, II edition, Tata McGraw Hill Publishers, 2008.
2. Kandasamy P &co., Engineering Mathematics, 9<sup>th</sup> edition, S. Chand & co Pub., 2010.
3. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. Narayanan S., Manicavachagam Pillai T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2<sup>nd</sup> edition), S.Viswanathan Printers and Publishers,
5. George B. Thomas ,Jr ,Maurice D.Weir, Joel Hass., Thomas’ Calculus ,Twelfth Edition Addison-Wesley, Pearson.

**Course Coordinator****HOD**

<b>U18BSPH101</b>	<b>Waves and Optics</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>Total Contact Hours - 45</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	<b>Prerequisite – Higher Secondary School Physics</b>				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES:</b> To develop Physics and Engineering strategies of Waves and Optics and to discuss their functionalities in modern optoelectronics.					

<b>Course Outcomes (COs)</b>													
CO1	Understand the basic concept of waves and lights												
CO2	Understand the importance of Ultrasonic waves and Non-Destructive Testing												
CO3	Understand the propagation of light and geometrical optics												
CO4	Understand the optical phenomenon like interference, diffraction and superposition of waves												
CO5	Understand the concept of laser and its applications												
<b>Mapping of Course Outcomes with Programme Outcomes (POs)</b> <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	3	2	3	2			2	3	3		3
	CO2	1	3	2	2	3			2		1	3	
	CO3	3	1			1			2	2		2	
	CO4	3	1			1			2	2		2	
	CO5	3	2	2	2				2		3	1	
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### **UNIT 1 NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES IN ONE DIMENSION 9**

Introduction - Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, standing waves, longitudinal waves and the wave equation for them, acoustics waves and speed of sound. Waves with dispersion, superposition of waves, wave groups and group velocity.

### **UNIT 2 ULTRASONIC WAVES 9**

Production of ultrasonic by magnetostriction and piezoelectric methods - acoustic grating – Detection - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Industrial and Medical applications – Sonogram.

### **UNIT 3 THE PROPAGATION OF LIGHT AND GEOMETRIC OPTICS 9**

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them

### **UNIT 4 WAVE OPTICS 9**

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson

interferometer. Fraunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power

## **UNIT 5 LASERS**

**9**

Einstein's theory of matter radiation interaction and A & B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO<sub>2</sub>), solid-state lasers (Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

### **TEXT BOOKS**

- 1) M.N. Avadhanulu and P.G. Kshirsagar, "A Textbook of Engineering Physics" S.Chand Publishers, 2016 (for Units 1,3,4 & 5)
- 2) G.Senthil Kumar, "Engineering Physics", VRB publishers, Chennai, 2015 (for Unit 2)

### **REFERENCE BOOKS**

- 1) Brij Lal and Subramanian, "Waves and Oscillation", Vikas Publishing House, 2011
- 2) R.Murugesan, "Optics and Spectroscopy", S.Chand Publishers, 2015
- 3) BrijLal and Subramanian, "Optics", S.Chand Publishers 2006
- 4) Ian G. Main, "Vibration and waves in physics", Cambridge University Press, 1978
- 5) H.J. Pain, "The physics of vibrations and waves", 6th edition, Wiley 2006
- 6) AjoyGhatak, "Optics", Tata McGraw-Hill publishing company, New Delhi, 2009
- 7) O. Svelto, "Principles of Lasers", Springer, 2010
- 8) Online reference Wikipedia.org

**Course Coordinator**

**HOD**

<b>U18BSCH101</b>	<b>ENGINEERING CHEMISTRY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – School Level Chemistry				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES:</b> To gain fundamental knowledge of Engineering Chemistry and its applications					

<b>COURSE OUTCOMES (COs)</b>												
CO1	To impart knowledge to the Students about the principles, water characterization, conversant with boiler feed water requirements and water treatment techniques.											
CO2	To make them understand the industrial importance of Phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys											
CO3	To make the students to be well versed with the principles of Conventional and non-conventional energy sources and energy storage devices.											
CO4	To make the students to have a deep knowledge of the Chemistry of Fuels and calorific value, manufacture of solid, liquid and gaseous fuels.											
CO5	To make them understand the Nanochemistry, Types of nanomaterials: Nanoparticles, Nanochemistry in biology and medicines.											
<b>CO/SO Mapping: 3 – Strong, 2 – Medium, 1 – Weak</b>												
<b>COs</b>	<b>Programme Outcomes (POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	3			2		3		3		1		
<b>CO2</b>		1	3		2		3		2		1	
<b>CO3</b>		2		3		1				2		3
<b>CO4</b>	3		2	1			2			3		
<b>CO5</b>		3		1		2				3		
<b>Category</b>	Basic Science (BS)											
<b>Approval</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018											

### UNIT I WATER TECHNOLOGY

9

Introduction - Characteristics: Hardness of Water – Types - Temporary and Permanent Hardness - Estimation by EDTA method. Alkalinity – Types of Alkalinity - Phenolphthalein and Methyl Orange Alkalinity - Determination – Domestic Water Treatment – Disinfection methods (Chlorination, Ozonation, and UV Treatment). Boiler feed water – Requirements – Disadvantages of using hard water in boilers (Caustic embrittlement, Boiler corrosion, Priming and foaming) – Prevention of scale formation – softening of hard water - Internal treatment (Calgon treatment method) – External treatment – Demineralization process – Desalination and Reverse osmosis.

### UNIT II PHASE RULE AND ALLOYS

9

Introduction: Statement of Phase Rule and Explanation of terms involved – One component system – Water system – Construction of phase diagram by thermal analysis - Condensed phase rule - Two Component System : Simple eutectic systems (lead-silver system) – eutectic temperature – eutectic composition – Pattinson's Process of desilverisation of Lead. Alloys: Importance, ferrous alloys – nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing –hardening – tempering - normalizing – carburizing - nitriding. Non- ferrous alloys: Brass and Bronze.

### UNIT III NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction: Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation – breeder reactor. Solar energy conversion – solar cells – wind energy. Fuel cells – hydrogen – oxygen fuel cell. Batteries: Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries: Lead–acid storage battery –working –uses. Nickel–cadmium battery -working –uses. Solid – state battery: Lithium battery.

#### **UNIT IV FUELS**

**9**

Introduction: Calorific value – types of Calorific value - gross calorific value – net calorific value. Analysis of Coal – Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke –manufacture by Otto-Hoffmann method. Petroleum processing and fractions– cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number. Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG. Flue gas analysis – importance - Orsat apparatus.

#### **UNIT V NANOCHEMISTRY**

**9**

Introduction: Nanochemistry: Definition - Classification based on dimensions - Size dependent properties. Types of nanomaterials: Nanoparticles: Synthesis by Bottom-up and top-down approaches - Nanoporous materials: Synthesis by sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes (CNTs): Single walled and Multi walled nanotubes - Mechanical and electrical properties of CNTs - Applications of CNTs - Synthesis of CNTs by Electric arc discharge method and Laser ablation method. Nanochemistry in biology and medicines – nanocatalysis. Nanocomposites – sensors and electronic devices.

#### **TEXT BOOKS:**

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara “A text book of Engineering Chemistry” S.Chand&Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).
4. S. Vairam, P. Kalyani and Suba Ramesh, —Engineering Chemistry, Wiley India PVT, LTD, New Delhi, 2013.
5. G. B. Sergeev, Nano chemistry, Elsevier Science, New York, 2006.

#### **REFERENCES:**

1. B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

**Course Coordinator**

**HOD**

<b>U18ESCS101</b>	<b>PROBLEM SOLVING AND PYTHON PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Prerequisite – NIL				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES</b>	To gain fundamental knowledge of algorithmic problem solving and python programming				

<b>COURSE OUTCOMES (COs)</b>													
CO1	Develop algorithmic solutions to simple computational problems												
CO2	Demonstrate programs using simple Python statements and expressions.												
CO3	To gain knowledge regarding control flow and functions associated with python												
CO4	Use Python data structures – lists, tuples & dictionaries for representing compound data												
CO5	To gain knowledge on files, exception, modules and packages in Python for solving problems												
<b>Mapping of Course Outcomes with Programme Outcomes (POs)</b>													
<b>CO/SO Mapping: 3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	3	3	2	3	2	1		2	1	2	3
	CO2	3	3	2	2		2		1			2	
	CO3	2	2	1	3	2		1		1		2	3
	CO4	2	2	1	2	3	2	1	2	1		2	
	CO5	2	3	1	2	2				2	2	1	
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### **MODULE 1 : ALGORITHMIC PROBLEM SOLVING**

**9**

Introduction to components of a computer system - disks, memory, processor, operating system, compilers – Problems, Solutions, Idea of Algorithm –Representation of Algorithm. Building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Problem Illustrations

### **MODULE 2: DATA, EXPRESSIONS, STATEMENTS**

**9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two Points.

### **MODULE 3: CONTROL FLOW, FUNCTIONS**

**9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

### **MODULE 4: LISTS, TUPLES, DICTIONARIES**

**9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list, Processing list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

## **MODULE 5: FILES, PACKAGES**

**9**

Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, packages: NumPy, SciPy, Matplotlib, Scikit-learn, Scilab Interface.

### **TEXT BOOKS:**

1. Allen B. Downey, ‘Think Python: How to Think Like a Computer Scientist’, 2<sup>nd</sup> edition, Updated for Python3, Shroff/O’Reilly Publishers, 2016  
(<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, – An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

### **REFERENCES**

1. John V Guttag, —Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3, Second edition, Pragmatic Programmers, LLC, 2013

**Course Coordinator**

**HOD**

<b>U18ESME101</b>	<b>Engineering Graphics &amp; Design (Theory &amp; Lab.)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 75	1	0	4	3
	Prerequisite – +12 Level Maths and Physical Science				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES</b>	To Prepare students to design a system, component, or process to meet desired needs, using the techniques, skills, and modern engineering tools necessary for engineering practice				

<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will gain Exposure to engineering communication.												
CO2	Students will learn standards of engineering graphics.												
CO3	Students will get Exposure to basics of building construction												
CO4	Students will get Exposure to computer-aided geometric design												
CO5	Student will gain basic knowledge and Exposure to the visual aspects of												
<b>Mapping of Course Outcomes with Programme Outcomes (POs)</b> (S/M/W indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3			2			3					
	CO2	3	3	1		3	2						3
	CO3			3									
	CO4											3	
	CO5	3						1					3
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### Detailed contents

#### ***Traditional Engineering Graphics:***

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

#### ***Computer Graphics:***

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

*(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)*

### **MODULE 1: INTRODUCTION TO ENGINEERING DRAWING (9+2)**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales; Draw simple annotation, dimensioning and scale. Construction of Conic sections; Cycloid, Epicycloid, Hypo cycloid and Involute of circle.

### **MODULE 2: ORTHOGRAPHIC PROJECTIONS (10+2)**

Principles of Orthographic Projections; Conventions; Projections of points and Orthographic projection of lines in first quadrant - Parallel to both the planes – Perpendicular to one plane – Parallel to one plane and inclined to other plane – Inclined to both the planes; Projections of planes inclined to either HP or VP.

**MODULE 3: PROJECTIONS OF REGULAR SOLIDS& ISOMETRIC PROJECTIONS (10+3)**

Projection of solids in first quadrant – Prism, Pyramid, Cone and Cylinder inclined to one plane; Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions - Isometric Views of Simple Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

**MODULE4: SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACE (10+3)**

Sectional view of Prism, Cylinder, Pyramid, Cone (simple position in first quadrant) with cutting planes perpendicular to one plane and parallel or inclined to another plane– True shape of sections; Development of lateral surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.

**MODULE 5: BUILDING DRAWING (9+2)**

Introduction to building drawing; Types of Projection adopted in Building Drawing; Scales for various types of Drawings, Symbols, Conventions and Abbreviations. Drawing of residential single and two storied buildings with detail of Line plan, Foundation Plan, Ground floor Plan, First floor plan, Elevation and Sections.

**MODULE 6: OVERVIEW OF COMPUTER GRAPHICS (12+3)**

Introduction to CAD; Basic commands; Coordinate systems; Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Setup a drawing with proper scale – Dimensioning commands, Editing Dimensions and Dimension text; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; Create basic drawing of objects such as polygon and general multi-line figures; Creating orthographic views of simple solids like prism, pyramid, cylinder, cone. Drawing sectional views of prism, pyramid, cylinder and cone; Preparation of fabrication drawing (Development of surfaces); Drawing front view, top view and side view of objects from the given pictorial view; Creation of 3-D models of simple objects.

**TEXT BOOKS:**

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

**Course Coordinator**

**HOD**

<b>U18BSPH2L1</b>	<b>WAVE OPTICS AND MECHANICS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(Common to B.Tech-Civil, Mech, Mechatronics, Aero, Aerospace &amp; Auto)</b>	0	0	3	1.5
	Total Contact Hours - 45				
	Prerequisite – <b>Wave Optics and Mechanics</b>				
Course Coordinator Name & Department:-					
<b>OBJECTIVES:</b> To impart Practical knowledge of Physics to the students					

<b>Course Outcome (CO's)</b>													
CO1	Understand the fundamental concept of optics												
CO2	Understand the concept of production of ultrasonic waves												
CO3	Understand the basic concept of Mechanics												
<b>Mapping of Course Outcomes with Programme Outcomes (POs)</b>													
<b>CO/SO Mapping: 3 – Strong 2 – Medium 1-Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3		3	3				3	1	2	3	
	CO2	3	3	1					3	1	2		3
	CO3	3	3	1					3	2	2		
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### Physics Lab experiments for Semester I & II

List of Experiments for Waves and Optics – Common for all branches

- 1) Ultrasonic Interferometer
- 2) Air-wedge Experiment
- 3) Particle size determination
- 4) Determination of acceptance angle
- 5) Determination of Laser Wavelength
- 6) Spectrometer – Determination of wavelength using grating

List of Experiments for Mechanics

- 1) Torsional Pendulum – without symmetrical mass
- 2) Torsional Pendulum – With symmetrical mass
- 3) Young's Modulus – Non-uniform bending
- 4) Young's Modulus – Uniform Bending
- 5) Compound Pendulum
- 6) Coefficient of viscosity of the given liquid – Poiseuille method

**Course Coordinator**

**HOD**

<b>U18BSCH2L4</b>	<b>CHEMISTRY LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – Engineering Chemistry				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES:</b> To enhance the practical knowledge on Chemistry through Volumetric and circuit experiments					

<b>COURSE OUTCOMES (COs)</b>												
CO1	Students will able to analyze - hardness, Alkalinity, Dissolved oxygen, Chlorides in Water by Argentometric Method, Determination of Water of Crystallization and as well as estimation of Copper by EDTA method using											
CO2	Students will understand basic principle of spectrophotometric method											
CO3	Students will learn Conductometric Titration of Strong Acid with Strong Base and Conductometric Precipitation titration.											
CO4	Students will be able to analyze Determination of Molecular weight of a polymer by Viscosity Average Method											
CO5	Students will understand about pH measurements for Acid - alkali Titrations and rate of corrosion by weight loss method											
<b>MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES</b>												
<b>3 – Strong, 2 – Medium, 1 – Weak</b>												
COs	Programme Outcomes (POs)											
	a	b	c	d	e	f	g	h	i	j	k	l
CO1	3		2	2		3		3		1		
CO2	1	3			2		3		2		1	
CO3		2		2						2		3
CO4	3		2				2				3	
CO5		3		1		2				3		3
Category	Basic Sciences (BS)											
Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### LIST OF EXPERIMENTS

- Determination of Total Hardness, Temporary Hardness and Permanent hardness of Water by EDTA method
- Estimation of Alkalinity - Titrimetry
- Estimation of Dissolved Oxygen
- Estimation of Chlorides in Water by Argentometric Method (MOHR'S Method)
- Estimation of Copper by EDTA method
- Estimation of Iron in Water by Spectrophotometry
- Conductometric Titration of Strong Acid with Strong Base
- Determination of Molecular weight of a polymer by Viscosity Average Method
- pH measurements for Acid - alkali Titrations
- Determination of rate of corrosion by weight loss method.
- Conductometric Precipitation titration
- Determination of Water Crystallization

### REFERENCES

- R. Jeyalakshmi, "Practical Chemistry", Devi Publications 2014.
- S.S. Dara, A text book on experiments and calculation Engg.

<b>U18ESCS1L1</b>	<b>PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – NIL				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES:</b> To enhance the practical knowledge on writing programs using Python					

<b>COURSE OUTCOMES (COs)</b>													
CO1	Write, test, and debug simple Python programs.												
CO2	Implement Python programs with conditionals and loops												
CO3	Develop Python programs step-wise by defining functions and calling them												
CO4	Use Python lists, tuples, dictionaries for representing compound data												
CO5	Read and write data from/to files in Python and to simulate using the packages Scilab, NumPy and Matplotlib												
<b>Mapping of Course Outcomes with Programme Outcomes (POs)</b> (S/M/W indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	3	3	2	3	3	2	2	2	2		2	2
	CO2	3	3	1	3	3	2	1	2	2	2	2	
	CO3	3	3	2	2	2	2		2	2	2	2	3
	CO4	3	2	3	3	3	2	2	2	2	1		
	CO5	3	3	2	3	2	2		2	2	1	2	3
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### LIST OF EXPERIMENTS FOR PROBLEM SOLVING AND PYTHON PROGRAMMING LAB

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (Power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Find the most frequent words in a text read from a file
11. Simulate elliptical orbits in Pygame
12. Simulate bouncing ball using Pygame
13. Simulate matrix operations with Scilab
14. Simulate fitting curve with NumPy and Matplotlib

### REFERENCES:

1. Kenneth A. Lambert, —Fundamentals of Python: First Programs, CENGAGE Learning, 2012
2. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux and Scilab

**Course Coordinator**

**HOD**

<b>U18HSEN201</b>	<b>TECHNICAL ENGLISH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods – 45	2	1	0	3
	Prerequisite – I semester English				
	Course Coordinator Name & Department:-				
<b>OBJECTIVES</b>	To gain fundamental knowledge of English language and its usage in day to day life.				

### COURSE OUTCOMES (COs)

On completion of the course, the students will be able to												
CO1	The student will acquire basic proficiency in English											
CO2	Reading and listening ability will improve.											
CO3	Comprehension techniques will develop.											
CO4	writing and speaking skills will be acquired											
CO5	Overall communication skills will make them employable.											
<b>COs\POs</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>	<b>l</b>
<b>1</b>	<b>2</b>										<b>3</b>	
<b>2</b>		<b>3</b>							<b>2</b>			
<b>3</b>			<b>3</b>							<b>3</b>		<b>3</b>
<b>4</b>				<b>2</b>		<b>3</b>						
<b>5</b>					<b>2</b>		<b>2</b>	<b>1</b>				
<b>Category</b>	Humanities and Social Studies (HS)											
<b>Approval</b>	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### UNIT I LISTENING

9

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- extended definitions –listening to daily issue- -Vocabulary Development- technical vocabulary - Language Development – subject verb agreement – compound words.

### UNIT II READING

9

Reading – reading longer technical texts- identifying the various transitions in a text- interpreting charts, graphs after reading the, practice in speed reading- vocabulary Development-vocabulary used in formal letters/emails and reports -Language Development personal passive voice, numerical adjectives.

### UNIT III TECHNICAL WRITING

9

Writing after listening to classroom lectures- talk should be on engineering /technology– introduction to technical presentations- longer texts both general and technical, Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words.

### UNIT IV FORMAL WRITING

9

Writing- email etiquette- job application – cover letter –Resume preparation (via email and hard copy)- analytical essays and issue based essays–Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- dependant, independent, if conditionals.

Speaking –participating in a group discussion – role play, Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- transitive, intransitive verbs, Language Development- reported speech.

**TEXT BOOKS:**

1. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

**REFERENCES**

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges Cengage Learning, USA: 2007

**Course Coordinator**

**HOD**

<b>U18BSMA201</b>	<b>Engineering Mathematics II</b> <b>(Common to B.Tech – Civil, Mech, Mechatronics, Automobile, Aero, Aerospace, EEE, ECE, BME, CSE &amp; IT)</b>											<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Periods - 60											<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
	Prerequisite – School Level Mathematics														
	Course Coordinator Name & Department:-														
<b>OBJECTIVE</b>	The objective of this course is to equip the students of Engineering and Technology with techniques in ordinary equations, vector calculus, complex variables and Laplace transform with advanced level of mathematics and applications that would be essential to formulate problems in engineering environment.														
<b>COURSE OUTCOMES (COs)</b>															
CO1	The mathematical tools for solution of differential equation that model physical process.														
CO2	To evaluate the line, surface and volume integrals using Green's, Stoke's and Gauss Theorems and their verification.														
CO3	To understand the analytic functions, conformal mapping and complex integration and their applications.														
CO4	To evaluate real and complex integrals using the Cauchy's integral formula and Residue theorem.														
CO5	To apply the concept of Laplace Transformation in analysis and solve differential equations.														
<b>CO/PO Mapping</b> <b>3 – Strong, 2 – Medium, 1 – Weak</b>															
<b>COs</b>	<b>Programme Outcomes (POs)</b>														
	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>	<b>l</b>			
<b>CO1</b>	2		1		3				2		3				
<b>CO2</b>	3	2			3			2		1		3			
<b>CO3</b>	3		1				2		3			3			
<b>CO4</b>								3	2	2	1				
<b>CO5</b>	3		1	1			2				3				
<b>Cate</b>	Basic Science (BS)														
<b>App</b>	47 <sup>th</sup> Academic Council Meeting held in Aug, 2018														

### **UNIT I ORDINARY DIFFERENTIAL EQUATIONS (9+3)**

Higher order linear differential equations with constant coefficients – linear differential equations with variable coefficients– Euler's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients- Method of variation of parameters.

### **UNIT II VECTOR CALCULUS (9+3)**

Scalar and vector point function - Gradient, Divergence and curl – Directional derivatives – Angle between two surfaces - Irrotational and Solenoidal vector fields – Line Integral - Green's theorem – Gauss divergence theorem and Stokes' theorem – Simple applications involving cubes and rectangular parallelepipeds.

### **UNIT III ANALYTIC FUNCTIONS**

**(9+3)**

Functions of complex variable - Analytic functions – Necessary and sufficient conditions (without proof), Cauchy Riemann Equations in Cartesian and polar form – Harmonic functions

– properties of analytic functions – Construction of analytic functions using Milne Thomson method – Conformal mapping : and Bilinear Transformation.

#### **UNIT IV          COMPLEX INTEGRATION**

**(9+3)**

Cauchy integral theorem – Cauchy’s integral formula – problems – Taylor’s and Laurent’s Series – classification of Singularities – Poles and Residues – method of finding residues - Cauchy’s residue theorem and its applications to evaluate real integrals – contour integration.

#### **UNIT V          LAPLACE TRANSFORMS**

**(9+3)**

Transforms of elementary functions – Basic properties – Shifting theorem- Transforms of derivatives and integrals – Initial and final value theorem – Laplace transform of Periodic Functions – Inverse Laplace transform – Convolution theorem – Periodic Functions – Applications of Laplace transform for solving linear ordinary differential equations up to second order with constant coefficient.

#### **TEXT BOOKS**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Willie & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35<sup>th</sup> Edition, 2000.

#### **REFERENCE BOOKS**

1. Venkataraman. M. K, Engineering Mathematics, National Publishing Company, 2000.
  2. Bali .N.P and Manish Goyal, A Text book of Engineering Mathematics, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
  3. Veerarajan T, Engineering Mathematics, II edition, Tata McGraw Hill Publishers, 2008.
- George B. Thomas Jr., Maurice D. Weir, Joel R. Hass., Thomas’ Calculus, 12<sup>th</sup> Edition, Addison-Wesley, Pearson.

**Course Coordinator**

**HOD**

U18BSPH201	INTRODUCTION TO MECHANICS										L	T	P	C
	Total Contact Hours - 45										3	0	0	3
	Prerequisite – Higher Secondary School Physics													
	Course Coordinator Name & Department:-													
OBJECTIVE	To impart basic knowledge of mechanics involving 1D, 2D and 3D motion of a rigid body													
<b>COURSE OUTCOMES</b>														
CO1	Understand and solve the various equation of motions in different coordinates													
CO2	Understand the conservation of energy and angular momentum													
CO3	Understand the concept of harmonic motion in different damped conditions													
CO4	Understand the rigid body motion in different criteria													
CO5	Understand the rigid body motion in 3D													
<b>Mapping of Course Outcomes with Programme Outcomes (POs)</b>														
<b>CO/PO Mapping: 3 – Strong, 2 – Medium, 1 – Weak</b>														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1		1	1					2	1	2		3	
	CO2	3	1	1	3				2	1	2	1		
	CO3	2			2				3	2			2	
	CO4	3	1	1					2	1	2	1		
	CO5	1	3	3	2				2	1	1	1		
3	Category	Basic Sciences (BS)												
4	Approval	47 <sup>th</sup> Meeting of the Academic Council held in Aug, 2018												

### UNIT 1

Forces in Nature; Newton's laws and its completeness in describing particle motion; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates

### UNIT 2

Potential energy function;  $F = -\text{Grad } V$ , equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical and parabolic orbits;

### UNIT 3

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance

### UNIT 4

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion, Kinetic energy of a rotating body

### UNIT 5

Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed

**TEXT BOOKS**

1. Dr.R.K.Bansal, “A Text Book of Engineering Mechanics”, Laxmi publication (P) Ltd. 6<sup>th</sup> edition, 2013.

**REFERENCE BOOKS**

1. R.K.Gaur and S.L.Gupta, “Engineering Physics” Dhanpat Rai Publications” 2012.
2. M.K. Harbola, “Engineering Mechanics”, 2<sup>nd</sup> edition, Cengage, 2013.
3. M.K. Verma, “Introduction to Mechanics”, 1<sup>st</sup> edition, CRC press, 2009.
4. D.Kleppner&R.Kolenkow, “An Introduction to Mechanics”, McGraw Hill Education, 2017
5. JL Meriam and L.G.Kraige, “Engineering Mechanics – DynamicsVol 2”, 7th ed. Wiley, 2012
6. JP Den Hartog, “Mechanical Vibrations”, Dover Publications, Inc., 1985
7. WT Thomson, “Theory of Vibrations with Applications”, Pearson, 5<sup>th</sup> edition, 1997.
8. Online References: Wikipedia org

**Course Coordinator****HOD**

		<b>ENVIRONMENTAL SCIENCE</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
<b>U18BSCH201</b>	Total Contact Periods – 45	3	0	0	3							
	Prerequisite – NIL											
	Course Coordinator Name & Department:-											
<b>OBJECTIVES</b>	<ul style="list-style-type: none"> <li>• To study the interrelationship between living organism and environment.</li> <li>• To study of the nature and concepts of ecosystem.</li> <li>• To learn about the integrated themes and biodiversity of an environment.</li> <li>• To study of pollution control and waste management.</li> <li>• To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.</li> </ul>											
<b>COURSE OUTCOMES</b>												
CO1	Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving											
CO2	Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.											
CO3	Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems											
CO4	Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales											
CO5	Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes											
<b>CO/SO Mapping: 3 – Strong, 2 – Medium, 1 – Weak</b>												
<b>COs</b>	<b>Programme Outcomes (POs)</b>											
	a	b	c	d	e	f	g	h	i	j	k	l
<b>CO1</b>	3			2		3		3		1		3
<b>CO2</b>	1	3	3		2		3		2		1	
<b>CO3</b>		2				1			3	2		
<b>CO4</b>	3		2	1			2				2	3
<b>CO5</b>		3		1		2				3		

### UNIT I -NATURAL RESOURCES

9

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people –Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems - Food resources: World food problems, changes caused by agriculture and overgrazing, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Equitable use of resources for sustainable lifestyles.

### UNIT II -ECOSYSTEMS

9

Introduction: concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert

ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)- Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and Possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

### **UNIT III -BIODIVERSITY AND ITS CONSERVATION**

**9**

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega diversity nation, Hot-spots of biodiversity - Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

### **UNIT IV-ENVIRONMENTAL POLLUTION**

**9**

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - pollution case studies - Disaster Management: floods earthquake, cyclone and landslides.

### **UNIT V- SOCIAL ISSUES AND HUMAN POPULATION**

**9**

Social issues: Environmental Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wildlife protection Act, Forest Conservation Act, Public awareness – Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder-Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes. Human population: population growth, variation among nations, Population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

### **TEXT BOOKS:**

1. Gilbert M. Masters, Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education 2004.
2. Benny Joseph, Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
3. R.K. Trivedi, Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
4. Rajagopalan, R, Environmental Studies-From Crisis to Cure', Oxford University Press 2005.
5. K.V.B. Raju and R.T. Ravichandran, "Basics of Civil Engineering".

### **REFERENCES:**

1. Cunningham, W.P. Cooper, T.H. Gorhani, Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
2. Dharmendra S. Sengar, Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.

**Course Coordinator**

**HOD**

<b>U18BSBT101</b>	<b>BIOLOGY FOR ENGINEERS</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30					2	0	0	2
	Prerequisite – Higher Secondary level biology, basic concepts in cell signaling								
	Course Coordinator Name & Department:-								
<b>OBJECTIVES:</b> To provide a basic understanding of the biological systems and its applications in the industrial sector									

<b>COURSE OUTCOMES (COs)</b>													
CO1	To understand the basic concepts of the cell and its structure												
CO2	To understand about biodiversity and its conservation												
CO3	To know the fundamentals of genetics and the immune system												
CO4	To create an awareness about human diseases												
CO5	To give a basic knowledge of the applications of transgenics												
CO6	To know the applications of bio systems in environment, medical and agricultural sectors												
Mapping of Course Outcomes with Programme Outcomes (S/M/W indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POS	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3					2	2			3	2	2
	CO2	3			2		3		2	2			
	CO3	2		2			2						3
	CO4							3			2	2	
	CO5	3	3					3	2	2			
	CO6	3						3					3
3	Category	Basic Sciences (BS)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

**UNIT I INTRODUCTION TO LIFE 6**

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell- Introduction to biomolecules - general classification and important functions of carbohydrates-lipids-proteins-nucleic acids – vitamins

**UNIT II BIODIVERSITY 6**

Plant System: basic concepts of plant growth-nutrition-photosynthesis-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions. Microbial System -types of microbes-economic importance and control of microbes.

**UNIT III GENETICS AND IMMUNE SYSTEM 6**

Evolution: theories of evolution- evidence of laws of inheritance-variation and speciation-nucleic acids as a genetic material-central dogma - immunity- antigens - antibody-immune response.

**UNIT IV HUMAN DISEASES 6**

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, AIDS and Hepatitis

**UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6**

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines -cloning- bioremediation-biofertilizer-biocontrol- biosensors-biopolymers-bioenergy-biomaterials-biochips

**TEXT BOOKS:**

1. A Text book of Biotechnology, R. C. Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

**REFERENCE BOOKS**

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

**Course Coordinator****HOD**

<b>U18ESEE101</b>	<b>BASIC ELECTRICAL &amp; ELECTRONICS ENGINEERING</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Periods – 45					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>				
	Prerequisite – School Level Physics												
	Course Coordinator Name & Department:-												
<b>OBJECTIVES</b>	To gain fundamental knowledge of Electrical and Electronics Engineering and its applications												
<b>COURSE OUTCOMES (COs)</b>													
CO1	To gain knowledge regarding the various laws and principles associated with DC Circuits.												
CO2	To gain knowledge regarding fundamentals of AC circuits.												
CO3	To gain knowledge regarding electrical machines and transformers.												
CO4	To gain knowledge regarding various types of semiconductor devices and small signal amplifiers.												
CO5	To gain knowledge on principles of digital electronics systems.												
<b>Mapping of Course Outcomes with Programme Outcomes</b> <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POS	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	1			2				3		1	
	CO2	3	1			2				3		1	3
	CO3	3	2			2				3		1	3
	CO4	3	1			2				3		1	
	CO5	3	1			2				3		1	3
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### MODULE 1 : DC CIRCUITS

12

Electrical circuit elements, voltage and current sources, Fundamental Relationship of VI for RLC circuit, Ohms Law, Source Transformation, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Basics of Superposition, Thevenin and Norton Theorems, Maximum Power Transfer Theorem.

### MODULE 2: AC CIRCUITS

9

Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Time-domain analysis of first-order RL and RC circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections.

### MODULE 3: ELECTRICAL MACHINES & TRANSFORMERS

9

Principles of operation and characteristics of; DC machines, Synchronous machines, three phase and single phase induction motors. Transformers (single and three phase) regulation and efficiency, all day efficiency and auto-transformer.

### MODULE 4: SEMICONDUCTOR DEVICES AND APPLICATIONS

9

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier and its applications, Introduction to OP-AMP.

## **MODULE 5: DIGITAL ELECTRONICS**

**6**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – Fundamentals of A/D and D/A Conversion.

### **TEXT BOOKS:**

1. John Bird, Electrical Circuit Theory & Technology, Taylor & Francis Ltd, 6<sup>th</sup>, edition. 2017.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, Second Edition, PHI Learning, 2007.
3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 10th Edition, 2011.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Pearson, 2nd Edition, 2015.
6. Millman and Halkias, “Integrated Electronics”, McGraw Higher Ed, 2nd Edition, 2011.
7. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 2nd Edition, 2015.
8. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', New Age International Pvt Ltd Publishers, 2011.

### **REFERENCES:**

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, Third Reprint, 2016.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Higher Ed, 1st Edition, 2011.
3. Jacob Millman and Christos C-Halkias, “Electronic Devices and Circuits”, McGraw Higher Ed, 4th Edition, 2015.

**Course Coordinator**

**HOD**

<b>U18ESME1L2</b>	<b>Workshop/Manufacturing Practices Laboratory</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Periods – 75						1	0	4	3			
	Prerequisite – NIL												
	Course Coordinator Name & Department:-												
<b>OBJECTIVES</b>	To educate the students on common manufacturing processes employed in Industries.												
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will gain knowledge of the different manufacturing processes.												
CO2	Students will be able to fabricate components with their own hands.												
CO3	Students will gain practical knowledge of the dimensional accuracies and dimensional tolerances.												
CO4	Students will be able to produce small devices of their interest.												
<b>Mapping of Course Outcomes with Programme Outcomes</b> (S/M/W indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POS	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1											3	
	CO2			3	2							3	
	CO3		2										3
	CO4	3			1							3	2
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

**Lectures & videos:**

**(15 hours)**

**Detailed contents**

- Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lecture)**
- CNC machining, Additive manufacturing **(2 lecture)**
- Fitting operations & power tools **(2 lecture)**
- Carpentry **(2 lecture)**
- Plastic moulding, glass cutting **(2 lecture)**
- Metal casting **(2 lecture)**
- Welding (arc welding & gas welding), brazing **(2 lecture)**

**WORKSHOP PRACTICE:**

1. Machine shop **(6 hours)**
  - a) Facing
  - b) Turning
  - c) Drilling Practice
  
2. Fitting shop **(6 hours)**
  - a) Fitting Exercises–Preparation of square fitting
  - b) Vee–fitting models.
  
3. Carpentry **(9 hours)**
  - a) Preparation of Lap joints.

- b) Mortise and Tenon joints.
- c) Cross Half joints.
- d) Dove Tail joints.

**4. Welding shop (Arc welding 6 hrs + gas welding 3 hrs) (9 hours)**  
Preparation of butt joints, lap joints and Tee joints

**5. Sheet Metal working (9 hours)**  
a) Forming & Bending:  
b) Model making—Trays, funnels, etc.  
c) Different type of joints

**6. Demonstration (6 Hours)**  
Smithy operations, upsetting, swaging, setting down and bending. Example—Exercise—  
Production of hexagonal headed bolt.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

**SUGGESTED TEXT/REFERENCE BOOKS:**

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers Private Limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4<sup>th</sup> edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4<sup>th</sup> edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

H

**Course Coordinator**

**HOD**

<b>U18ESEE1L3</b>	<b>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours – 45						0	0	3	1.5			
	Prerequisite – School Level Physics & Basic Electrical and Electronics Engineering												
	Course Coordinator Name & Department:-												
<b>OBJECTIVES:</b> To enhance the practical knowledge on basics of electrical and electronics Components and circuits.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To handle basic electrical equipment and verify current and voltage law												
CO2	To understand the steady-state and transient time-response of R-L, R-C, and R-L-C circuits												
CO3	To understand domestic wiring procedures practically.												
CO4	To analyze ac signal parameters using cathode ray oscilloscope and function generator												
CO5	To understand all the fundamental concepts semiconductor Diode and Transistor												
CO6	To understand all the fundamental concepts of logic Gates and Flip-Flaps												
<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs)</b> (S/M/W indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	Cos/POS	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	3			3				3		2	
	CO2	3	3			3				3		2	3
	CO3	3	3			3				3		2	
	CO4	3	3			3				3		2	
	CO5	3	3			3				3		2	3
	CO6	3	3			3				3		2	
3	Category	Engg Sciences (ES)											
4	Approval	47 <sup>th</sup> Meeting of Academic Council held in Aug, 2018											

### LIST OF EXPERIMENTS FOR BASIC ELECTRICAL ENGINEERING LAB

1. Verification of Ohms and Kirchoff's Voltage and Current Laws
2. Measurement of the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Fluorescent lamp wiring
4. Staircase wiring
5. Measurement of energy using single phase energy meter
6. Observation of the no-load current waveform on an oscilloscope and Measurement of Primary and secondary voltages and currents of a Transformer
7. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding – slip ring arrangement) and single-phase induction machine.
8. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

### LIST OF EXPERIMENTS FOR BASIC ELECTRONICS ENGINEERING LAB

1. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.

2. Characteristics – Half wave and Full wave Rectifiers
3. Characteristics – Common Base transistor configuration
4. Verification of truth tables of OR, AND, NOT, NAND, NOR gates and Flip-flops – JK and RS
5. Applications of Operational Amplifier

**REFERENCE BOOKS:**

1. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson Education India, 2011

**Course Coordinator**

**HOD**

<b>U18BSMA302</b>	<b>Partial Differential Equations , Probability and Statistics</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours – 60							3	1	0	4			
	Prerequisite – Engineering Mathematics I & II													
	Course Coordinator Name & Department:-Ms S.Priyanka& Dept.of Mathematics													
<b>OBJECTIVES</b>														
<ul style="list-style-type: none"> <li>Grasp the Fourier series expansion for given periodic function in specific intervals and their different forms.</li> <li>Learn techniques of solving the standard types of first order and second order partial differential equations.</li> <li>Learn solving wave and heat equation using Fourier series. Learn basics of probability, Baye’s Theorem.</li> <li>Understand the concept of random variable, moment generating functions and their properties; learn standard distributions in discrete and continuous cases.</li> <li>Learn measures of central tendency and correlation and regressions, rank correlation, statistical intervals for single sample and test of hypothesis for a small and large sample.</li> </ul>														
<b>COURSE OUTCOMES (Cos)</b>														
CO1	Expand given function using the knowledge of Fourier Series and frequently needed practical harmonic analysis that an engineer may have to make from discrete data.													
CO2	Solve PDE and higher order with constant coefficients and physically interpret the results.													
CO3	Boundary Value Problems and Differential Equations will be knowledgeable about and will be able to analyze solutions to two-point boundary value problems, boundary value problems for partial differential equations.													
CO4	Evaluate the probability using addition and multiplication theorem. Apply Baye’s Theorem for practical problems to find the probability. Apply the discrete and continuous distribution for solving practical problems. Evaluates the moments of distributions using moment generating functions.													
CO5	Learn the basic idea of statistics including measures of central tendency .													
CO6	Identify the appropriate hypothesis testing procedure based on type of outcome variable and number of samples.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1	2				3	2	3	1	2			2	
	CO2	2	3	1		3	2	1			2	2	2	
	CO3	3	3	3	1				1		1		3	
	CO4	3	3	2	1			1		2			3	3
	CO5	3	3		1		2	1	1				3	3
	CO6	3	3				2		1				3	
	Category	Basic Sciences												
4	Approval	47th Academic Council, July 2018												

### UNIT I      **FOURIER SERIES**

**12Hrs**

Dirichlet’s conditions – General Fourier Series – Half range Sine and Cosine series – Parseval’s Identity – Harmonic Analysis.

**UNIT II PARTIAL DIFFERENTIAL EQUATIONS****12Hrs**

Formation – Solutions of standard types of first order equations – Lagrange’s linear equations – Linear partial differential equation of second and higher order with constant coefficients.

**UNIT III BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS****12Hrs**

Classifications second order linear partial differential equations – Solution of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation – Fourier Series solutions in Cartesian coordinates.

**UNIT IV PROBABILITY DISTRIBUTION****12Hrs**

Probability – Axioms of probability – Conditional probability – Baye’s theorem – Random variables – Binomial – Poisson – Geometric – Uniform – Exponential and normal distribution and their properties.

**UNIT V STATISTICS AND TESTING OF HYPOTHESIS****12Hrs**

Measures of central tendency – Moments – Skewness and kurtosis – Correlation and Regression – Rank correlation – Test of significance: Large sample test for single proportion, difference of proportions – Chi Square test for goodness fit and independence of attributes.

**TEXT BOOKS**

1. S. J. Farlow, Partial Differential Equations for Scientist and Engineers, Dover Publications 1993.
2. S.C.Gupta&V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, New Delhi , 2003. [ Units I to III].

**REFERENCE BOOKS**

1. R. Haberman, Elementary Applied partial differential equations with Fourier Series and Boundary Value Problems, 4<sup>th</sup> Ed., Prentice Hall, 1998.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36<sup>th</sup> Edition, 2001.
3. Manish Goya and .N.P Bali I, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
4. Douglas C. Montgomery and George C. Runger. “Applied Statistics and Probability for Engineers” , 6<sup>th</sup>Edn. Wiley India Pvt Ltd., New Delhi-2. 2010.
5. TirupathiR.Chandrauptta. “Quality and Reliability in Engineering”. Book Vistas, New Delhi.for Engineers” , 6<sup>th</sup>Edn. Wiley India Pvt Ltd., New Delhi-2. 2010.
6. TirupathiR.Chandrauptta. “Quality and Reliability in Engineering”. Book Vistas, New Delhi.

**Course Coordinator**  
**Ms S.Priyanka.**

**Dr. K. Balasubramanian**

**HOD**

<b>U18ESME301</b>	<b>ENGINEERING MECHANICS</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 60							3	1	0	4		
	Prerequisite – Engineering Mathematics I , II, Engg. Physics												
	Course Coordinator Name & Department:— Mr. V. Jose Ananth Vino ,Department of Mechanical Engineering												
<b>OBJECTIVES:</b> To understand the concept of basic engineering mechanism													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will understand the concepts and behaviour of engineering mechanics												
CO2	Students will demonstrate and draw the vectorial representation of forces and moments												
CO3	Students will be able to differentiate between machines and mechanisms..												
CO4	Students will gain knowledge regard be able to examine various types of forces and reactions and draw the free body diagram for complicated structures..												
CO5	Student will gain knowledge in solving problems involving work and energy												
CO6	Student will gain knowledge on friction on equilibrium and its application.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	3	1	3		3		1		3	3	3
	CO2						3	3	1				
	CO3						3	3	1		2		
	CO4						3	3	1		2		2
	CO5						3	3	1		2		
	CO6						3	3	1		2		1
	Category	Engineering Sciences											
4	Approval	47th Academic Council, July 2018											

## UNIT I

12

Introduction - Units and Dimensions - Laws of Mechanics – **Lame’s theorem, Parallelogram and triangular Law** of forces – Vectors –Vectorial representation of forces and moments – Vector operations on forces - Coplanar Forces – Resolution and Composition of forces – Resultant of several concurrent forces - Equilibrium of a forces – Forces in space - Equilibrium of particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

## UNIT II

12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples– Scalar components of a moment – **Varignon’s theorem** - Equilibrium of Rigid bodies in two dimensions -Equilibrium of Rigid bodies in three dimensions.

## UNIT III

12

Determination of areas – First moment of area and the Centroid of standard sections – T section, I section, Composite figures, Hollow section – second moments of plane area – Rectangle, triangle, circle - T section, I section, Hollow section – Parallel axis theorem and

perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Basic concept of Mass moment of inertia.

#### **UNIT IV**

**12**

Frictional force – Laws of Coloumb friction – Cone of friction – Angle of repose – Simple contact friction – Sliding of blocks – Wedge friction - Ladder friction – Screw Jack – Belt friction - Rolling resistance.

#### **UNIT V**

**12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Relative acceleration – Curvilinear motion of particles – **Newton’s law** – work energy equation – impulse and Momentum – Impact of elastic bodies.

#### **TEXT BOOK:**

1. Beer, F.P and Johnson Jr. E.R, “Vector Mechanics for Engineers: Vol. 1 Statics and vol. 2 Dynamics”, McGraw-Hill International Edition, 2013.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.

#### **REFERENCES :**

1. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt., Ltd., 2006.
2. Kumar, K. L Kumar, V., Engineering Mechanics, Tata McGraw – Hill, New Delhi, 2010
3. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw - Hill, 2013.
4. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.

**Course Coordinator**

**Mr. Jose Ananth Vino**

**HOD**

**Dr. K. Balasubramanian**

<b>U18PCME302</b>	<b>MATERIALS ENGINEERING</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours – 45					3	0	0	3				
	Prerequisite – Basic Physics and Chemistry												
	Course Coordinator Name & Department:-Dr. C. M. Meenakshi Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.</li> <li>To provide a detailed interpretation of equilibrium phase diagrams</li> <li>Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Student will be able to identify crystal structures for various materials and understand the defects in such structures												
CO2	Student gain knowledge in selecting materials												
CO3	Student will be able predict the mechanical properties of materials												
CO4	Student will be able to derive the material properties of ferrous and non-ferrous alloys												
CO5	Student will be able to interpret surface engineering techniques												
CO6	Student will be able build mechanical integrity and deduct failure in materials												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3		3									
	CO2	3		3									
	CO3	3		2						2			
	CO4	2	3		1								
	CO5					2							
	CO6											3	2
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

Structure of metals, alloys and ceramics – Molecules and bonding – Crystal structure: Inter atomic distance and Ionic radii, polymorphism, Miller indices of atomic planes, Bragg's law, crystal defects – point, line and plane defects – Effect of crystal imperfection on mechanical properties- strengthening mechanism for improvement of mechanical properties – Allotropy, grain and grain boundaries, Slip system, critically resolved shear stress, Schmid's law.

### UNIT II

8

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.

### UNIT III

9

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Creep, Introduction to non-destructive testing (NDT)

#### **UNIT IV**

**10**

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium

#### **UNIT V**

**9**

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

#### **TEXT BOOKS:**

1. Callister W.D, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Dieter G.E, Mechanical Metallurgy, McGraw Hill ISE, 1999.
3. Jindal U.C, “Engineering Materials and Metallurgy”, Pearson, 2011
4. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4<sup>th</sup> Indian Reprint, 2002.
5. Raghavan V, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.

#### **REFERENCES:**

1. Arumugam, M. Material Science, Anuradha Publishers, 1997.
2. Flinn R.A& Trojan P.K, Engineering Materials and their Applications
3. Rajan, T.V. Sharma and Ashok Sharma, Heat Treatment – Principles and their techniques, Prentice Hall of India Pvt. Ltd., 2004.
4. [www.studynama.com/.../315-Engineering-materials-metallurgy-lecture-n...](http://www.studynama.com/.../315-Engineering-materials-metallurgy-lecture-n...)

**Course Coordinator**

**HOD**

**Dr.C. M. Meenakshi**

**Dr. K. Balasubramanian**

<b>U18PCME303</b>	<b>THERMODYNAMICS</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 60							3	1	0	4		
	Prerequisite – MATHEMATICS –I &II												
	Course Coordinator Name & Department:-Mr. V. Srinivasan, Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To learn about work and heat interactions, and balance of energy between system and its surroundings</li> <li>To learn about application of I law to various energy conversion devices To evaluate the changes in properties of substances in various processes</li> <li>To understand the difference between high grade and low grade energies and II law limitations on energy conversion</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To calculate energy balance to the systems and control volumes, in situations involving heat and work interactions												
CO2	Derive second law of thermodynamics and estimate carnot cycle problems.												
CO3	Compare the various types of steam and gas power cycles.												
CO4	Evaluate changes in thermodynamic properties of substances												
CO5	Estimate the performance of energy conversion devices												
CO6	Differentiate between high grade and low grade energies.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	3	3			3		1	3		2	3
	CO2						3		1			2	
	CO3						3		1			2	3
	CO4						3		1			2	3
	CO5						3		1			2	
	CO6						3		1			2	
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT-I

(12)

Fundamentals - System & Control volume; Property, State & Process; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; Temperature, Definition of thermal equilibrium and Zeroth law; Definition of heat; First Law for Cyclic & Non-cyclic processes; Concept of Internal energy and Enthalpy. Application to closed and open systems, steady and unsteady flow processes.

### UNIT-II

(12)

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale. Clausius inequality; Definition of entropy S; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases

**UNIT-III****(12)**

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

**UNIT-IV****(8)**

Thermodynamic cycles - Basic Rankine, Brayton cycle, effect of reheat, regeneration and intercooling and comparison with Carnot cycle.

**UNIT-V (12)**

Ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.

**TEXT BOOKS:**

1. Nag P.K-Basic and Applied Thermodynamics-Tata McGraw Hill Publishing Company, 2002
2. Rajput R.K-Engineering Thermodynamics-Laxmi Publications

**REFERENCES:**

1. Somasundaram S.C-Thermal Engineering-New Age International (P) Ltd,1996
2. Rao Y.V.C-An Introduction to Thermodynamics-New Age International (P) Ltd, 2004
3. YunusA.Cengel-Thermodynamics-International Edition, 2006
4. [bookboon.com/en/engineering-thermodynamics-ebook](http://bookboon.com/en/engineering-thermodynamics-ebook)

**Course Coordinator****Mr. V. Srinivasan****HOD****Dr. K. Balasubramanian**

<b>U18PCME304</b>	<b>MANUFACTURING PROCESSES</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45					3	0	0	3
	Prerequisite- Manufacturing Practices								
	Course Coordinator Name & Department:-Dr. R. J. Golden Renjith Nimal& Department of Mechanical Engineering								
<b>OBJECTIVES</b>									
<ul style="list-style-type: none"> <li>To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods</li> </ul>									
<b>COURSE OUTCOMES (COs)</b>									
CO1	Recall the concepts of basic manufacturing process.								
CO2	Explore the importance of various manufacturing process.								
CO3	Evaluate the cutting forces and prevent the failures of machine tool.								
CO4	Analyze the principles of metal cutting in Lathe.								
CO5	Discuss the working principle of various Metal cutting machines.								
CO6	Improve surface finish in the given components using grinding machines.								

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	F	g	h	i	j	k	l
2	CO1	2	2	3		1	1	2	1	1	1	2	2
	CO2	1	2	3				1	1	2			
	CO3	2	2	2			1	2					
	CO4	3	2	3			1	1	1	1			1
	CO5	3	2	3									
	CO6	3	2	3			1	1	1	1			
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

Mechanical working of metals-Forming, hot and cold working-rolling, extrusion, spinning, wire- drawing, press working. Welding - different types of gas and arc welding process, soldering and brazing. Foundry: Pattern, pattern materials, types, moulding, Cupola Furnace. Casting: Sand casting using Green sand mould, Die casting, centrifugal casting, casting defects and inspection.

### UNIT II

8

Introduction, mechanics of metal cutting- chip formation, Merchant's circle theory, cutting force calculations, tool materials, Influence of tool angles, tool life, cutting fluids, machining time calculations, Metal cutting economics, problem in merchant circle, machining time and economics.

**UNIT III****10**

Lathe- Introduction, types, construction, mechanisms, operations and attachments, nomenclature of single point cutting tool. Capstan and turret lathes: various mechanisms, tool and loading arrangement. Automatic lathes- single spindle and multi spindle mechanisms.

**UNIT IV****10**

Shaper, planer and slotter: types, specification, mechanisms, operations, holding devices, difference between shaper and planer. Milling machine - types and specification, mechanisms, holding devices, milling operations. Milling tool nomenclature, indexing types-simple, compound and differential.

**UNIT V****8**

Drilling, Boring- Specification. Nomenclature of drilling and reaming tool and its specification. Broaching: Specification, types, mechanisms, nomenclature of broaching tool. Surface Finishing: Grinding, Honing, Polishing, Buffing, Metal Spraying, Galvanizing, Anodizing, Electroplating and Super finishing.

**TEXT BOOKS:**

1. Degarmo, Black & Kohser, Materials and Processes in Manufacturing
2. Hajra Chowdary S.K. The Fundamentals of Work Shop Technology. Vol. I & II, Media Publishers, 1997
3. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014
4. Sharma P.C, A Text Book of Production Technology, S.Chand & Company Ltd, New Delhi, 2007

**REFERENCES:**

1. Chapman W.A.J. - Work shop technology, vol I, II & III, 1975, ELBS.
2. Rao P.N.. Manufacturing Technology - Foundry Forging & Welding, TMH., New Delhi -2009.
3. Roy.A.Lindberg, Processes and Material Manufacture, PHI, 1995
4. [www.studynama.com/.../301-Manufacturing-Technology-1-lecture-notes..](http://www.studynama.com/.../301-Manufacturing-Technology-1-lecture-notes..)

**Course Coordinator****HOD****Dr. R. J. Golden Renjith Nimal****Dr. K. Balasubramanian**

U18PCME 305	<b>FLUID MECHANICS AND MACHINERY</b>						L	T	P	C			
	Total Contact Hours – 60						3	1	0	4			
	Prerequisite – MATHEMATICS I & II												
	Course Coordinator Name & Department:- <b>Mr. Arun V Rejus Kumar</b> &Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To learn about the application of mass and momentum conservation laws for fluid flows To understand the importance of dimensional analysis</li> <li>To obtain the velocity and pressure variations in various types of simple flows To analyze the flow in water pumps and turbines.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Apply mathematical knowledge to predict the properties and characteristics of a fluid												
CO2	Can understand different types of flow.												
CO3	Understand dimensional analysis												
CO4	Learn Fluid Dynamics and kinematics												
CO5	Understand working principle of pumps												
CO6	Understand working principle of turbines												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	E	f	g	h	i	j	k	l
2	CO1	3	3	1					2	2		3	3
	CO2	3	3	1					2	2		3	2
	CO3	3	3	1					2	2		3	3
	CO4	3	3	1					2	2		3	
	CO5	3	3	1					2	2		3	3
	CO6	3	3	1					2	2		3	2
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### Unit-I

9

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.

### Unit-II

9

Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram.

### Unit-III

9

Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis. Centrifugal pumps, Pump outlet and efficiencies-Cavitations, pump characteristics, multistage pumps, axial flowpumps-characteristics, construction details,Non-dimesnsionalparameters-Efficiencies-reciprocating pumps, Indicator diagram-Rotary pumps – Classifications, Working.

**Unit-IV****8**

Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump – working principle.

**Unit-V****8**

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines.

**Text Book:**

1. Dr.R.K.Bansal. Fluid Mechanics-Laxmi Publication.
2. Modi and Seth-Fluid Mechanics and Hydraulic Machines, 2005.

**References:**

1. Agarwal.S.K.Fluid Mechanics and Machinery-McGraw Hill,1999.
2. Jain.A.K.Fluid Mechanics-Khanna Publishers,2009.
3. Kumar D.S-Fluid Mechanics and Fluid Power Engineering, S.K.Kataria&Sons,1998.
4. Mohanty, Fluid Mechanics, PHI,2000.
5. [https://books.google.co.in/.../Fluid\\_Mechanics\\_and\\_Machinery.html?id](https://books.google.co.in/.../Fluid_Mechanics_and_Machinery.html?id)

**Course Coordinator****Mr. Arun V Rejus Kumar****HOD****Dr. K. Balasubramanian**

U18PCME3L1	<b>MACHINE DRAWING</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30						0	0	2	1
	Prerequisite – ENGINEERING GRAPHICS									
	Course Coordinator Name & Department: Mr.Hariharan, Department of Mechanical Engineering									
<b>OBJECTIVES</b>										
<ul style="list-style-type: none"> <li>To make the students understand and interpret drawings of machine Components so as to prepare assembly drawings.</li> <li>To familiarize the students with Indian Standards on drawing practices and standard components.</li> </ul>										
<b>COURSE OUTCOMES (COs)</b>										
CO1	To discover good interpretation of machine components									
CO2	To demonstrate standardization of drawings.									
CO3	Student will demonstrate Indian and International standard components.									
CO4	To make use of industrial standard.									
CO5	Decide what tolerance and fits and assembly									
CO6	Imagine to Learn the difference between free sketching and machine drawing									

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	Cos/POs	a	b	c	d	E	f	g	h	i	j	k	l
2	CO1	3	2	3			1	1	1	1	1	1	
	CO2	3	2	3			1	1	1	1			
	CO3	3	2	3			1	1	1	1			
	CO4	3	2	3			1	1	1	1			
	CO5	3	2	3			1	1		1			
	CO6	3	2	3			1	1		1			
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

Indian standard code (BIS) of practice for engineering drawing-General principle of presentation, Conventional representation of threaded parts, Springs, Gear and common features, Abbreviations and symbols use in technical drawings.

Tolerance- Types-Symbols used and representation on the drawing - Fit types, Selection for different application- Allowance, Interchangeability. Surface finish- Relation to the manufacturing processes- Types of representation on the drawing- Welding symbols.

**Preparation of working drawing for given machine components:**

Bolts, Screws, Studs, Nuts, Keys and Key-ways.

**Preparation of simple assembly drawings:**

Different types of cotter and knuckle joints.

**Preparation of simple assembly drawing for following machine with part drawings given:**

Screw jack, Plummer block, Connecting rod, Machine vice, Tail stock of lathe, Tool head of shaper, fuel injection pump for single cylinder engine, Stop valve.

**TEXT BOOKS:**

1. Bhatt, N.D. Machine Drawing- Charotar publishing House, 2000.

2. Gopala Krishnan, Machine Drawing- Subash publishers, 2001.

**REFERENCES:**

1. Narayana.K.L. Machine Drawing- New age publisher, 2006.

**Course Coordinator**

**R.Hariharan**

**HOD**

**Dr. K. Balasubramanian**

<b>18MCAB305</b>	<b>CULTURAL- LEARNING AN ART FORM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 30	0	0	2	0
	Prerequisite – Nil				
	Course Coordinator Name & Department:-AICTE				

### **Learning an Art Form**

Cultivation of arts is an integral part of the development of human beings since the arts are what make us most human, most complete as people. They offer us the experience of wholeness because they touch us at the deepest levels of mind and personality. They come into being not when we move beyond necessity but when we move to a deeper necessity, to the deeper human need to create order, beauty and meaning out of chaos. They are the expressions of deepest human urges, imperatives and aspirations.

While enriching the process of learning through enhanced perceptual and cognitive skills, learning of arts promotes self-esteem, motivation, aesthetic awareness, cultural exposure, creativity, improved emotional expression, as well as social harmony and appreciation of diversity. They promote an understanding and sharing of culture, and equip the learners with social skills that enhance the awareness and respect of others. Each institution will offer a range of introductory courses in different art forms: music, dance, theatre, painting, and other art forms. Care should be taken to give adequate representation to local and regional art forms in which our culture abounds. For example, Banaras has local traditions in vocal music like *Chaiti, Hori, Kajri* and *Birha*.

An institution in Banaras area can offer courses on these art forms apart from regular classical and semi-classical vocal music forms. Similar local art tradition can be utilized in different cities and regions. This will, in turn, also ensure wider community involvement/interaction with the institution. Students will be given an option to choose a particular art form, and learn and practice it under an artist -instructor. At the end of the course, a student should be able to demonstrate basic proficiency in that particular art form. Contact hours per week should be 3-4 hours.

Towards the end of the course, the institution can organize a function/program in which all the students publicly demonstrate their skills.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

<b>18MCAB306</b>	<b>CULTURAL- INTANGIBLE CULTURAL HERITAGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 30	0	0	2	0
	Prerequisite – NIL				
	Course Coordinator Name & Department:-AICTE				

### **Intangible Cultural Heritage (Festivals, Food ways, Local Games)**

As part of our rich intangible cultural heritage, foodways, fares and festivals, local games and sports are important sources for discovering the social and cultural values of our people and understanding the inner dynamics of our society, as these are sites where we witness the most significant and intimate representations of our society’s self-perception—how our society perceives itself. These traditions have shaped and strengthened our social and cultural identities, and also the notion of community at the local, regional, and national levels. They have played a significant role in the making of our social life, and through them we have constructed for ourselves, individually and collectively, a sense of shared lived past and group identity. They facilitate the transmission of a culture’s most deeply held values, from one generation to another and their continuity or discontinuity helps us to understand the changing social structure and culture of a society. For example, each community has its own foodways, and their overall health, well-being and cultural continuity are directly related to their ability to eat traditional foods and continue their traditional food practices. These traditional foods and food practices are deeply intertwined with their cultures and value systems, and play an important role in religious ceremonies and spirituality. Similar is the case with fares and festivals, and local games and sports. These traditions are bound up with rituals, customs, beliefs, and often also with trade, craft and professions. They are not mere superstitious rituals often condemned and denounced as being regressive, stagnant and backward, but repositories of our indigenous knowledge and wisdom which have evolved over centuries, and they still continue to serve social and cultural functions. This knowledge has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that sustain societies in many parts of the world.

Most of these traditions are either on the verge of extinction or undergoing drastic changes due to globalization, acculturation, migration, questions of identity related to social mobility to conform to a higher social order or simply because the context in which these traditions originated or were conceived no longer exist and their effectiveness or need seems no longer relevant. For example, while the agro-ecological and food systems offer some signs of resilience and adaptation, a range of factors are increasingly threatening these systems and peoples’ well-being. The knowledge and skills of elders concerning traditional food preparation, and the use of traditional herbs and plants for healing purposes have not been passed on to the next generation and is at risk of being lost and disappearing altogether from reservation life and culture.

The course aims at exposing students to these traditions, and making them aware of the veritable treasure house of indigenous knowledge which can be utilized as resource for realizing a vision of sustainable future.

Each locality/region our Indian sub-continent abounds in a rich variety of food-ways, fares and festivals, games and sports. Students should be asked to identify one of these traditions and study them in detail. For example, the following guidelines can be adopted in the study of food-ways:

- To study and document the indigenous knowledge and wisdom of everyday food habits and food items consumed;
- To study and document the prevalent social practices and beliefs regarding traditional foods;
- To study and document the feasts on religious and social occasions of different communities;
- To identify and document the food items consumed by different communities and determine their nutritional values;
- To conduct chemical analysis of food ingredients;
- To identify and document the kitchen generated health ingredients used by different communities;
- To find out the uses of leftover food stuff of different communities;
- To develop hygienic food chart for people ailing and suffering from different metabolic disorders; and to develop suitable communication strategies to effectively disseminate traditional knowledge regarding food habits.

Similarly, in the case of fares and festivals, and games and sports one could study how these traditions create a sense of community bonding and lead to the rules of commensality and social interaction and behavior. Suitable guidelines along the lines of foodways can be developed and adopted for such a study.

At the end of the course, students will be required to submit a detailed project report. Options should be given to the students to make short documentaries and films on these traditions.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

<b>U18PCME401</b>	<b>APPLIED THERMODYNAMICS</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 60							3	1	0	4		
	Prerequisite – Thermodynamics												
	Course Coordinator Name & Department:-Dr. D. Ravi, Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To learn about of I law for reacting systems and heating value of fuels</li> <li>To learn about gas and vapor cycles and their first law and second law efficiencies</li> <li>To understand about the properties of dry and wet air and the principles of psychrometry</li> <li>To learn about gas dynamics of air flow and steam through nozzles</li> <li>To learn the about reciprocating compressors with and without intercooling</li> <li>To analyze the performance of steam turbines</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To explain the law of reacting systems and heating value of fuels												
CO2	To illustrate energy conversion in various thermal devices												
CO3	Analyze about reciprocating compressors with and without intercooling												
CO4	Elaborate Gas dynamics of air flow and steam through nozzles												
CO5	Understand phenomena occurring in high speed compressible flows												
CO6	Estimate the performance of steam turbines using principle of psychrometry												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3											1
	CO2		2										
	CO3						1				3		
	CO4										3	2	1
	CO5												
	CO6								3			3	
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### Unit-I

12

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

### Unit-II

12

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles.

### Unit-III

12

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. Working principles, Simple impulse(De laval) turbine, Reaction turbine, Analysis of steam turbines, velocity and pressure compounding of steam turbines.

**Unit-IV****12**

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables, Flow of steam and refrigerant through nozzle, supersaturation- compressible flow in diffusers, efficiency of nozzle and diffuser.

**Unit-V****12**

Introduction to Psychrometry-Psychrometric chart- Properties of dry and wet air, use of psychrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point. Simple calculations used in psychrometry,

**TEXT BOOKS:**

1. Domkundwar S-Thermal Engineering-Dhanpat Rai publishers,2000
2. Rajput R.K, Thermal Engineering, Dhanpat Rai publishers, 2008

**REFERENCES:**

1. Nag P.K, Basic & Applied Thermodynamics-Tata McGraw Hill, 2002
2. YunusA.Cengel-Thermodynamics-International Edition, 2006.
3. [engg-ebook.blogspot.in](http://engg-ebook.blogspot.in) > ... > r k rajput > sem 4 > thermal engineering

**Course Coordinator**  
**Dr. D. Ravi**

**HOD**  
**Dr. K. Balasubramanian**

U18BSMA401	<b>Numerical Methods</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours - 60					3	1	0	4				
	Prerequisite – Engineering Mathematics I & II												
	Course Coordinator Name & Department:- <b>Mr. P. Bathmanaban,</b> <b>Mrs. K. L. Rajashree</b> & Dept of Mathematics												
<b>OBJECTIVES</b>													
The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate integration analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will gain knowledge for solving equations by Newton-Raphson and Regula-Falsi methods and system of linear equations by various methods.												
CO2	Students will be able to interpolate the value of a dependent variable in the given data by Newton's forward and backward difference formulae and also unequal intervals.												
CO3	Understanding the concept of numerical differentiation and integration using Trapezoidal and Simpson's rules.												
CO4	Be exposed Taylor's series and Runge-Kutta methods to solve initial value problems of ODE												
CO5	Student will be able to solve two dimensional Laplace, Poisson equations.												
CO6	Apply one dimensional heat and wave equations of PDE in Engineering problems.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	2			3		1	2	1	1	2	3
	CO2	3	1		2	3	1		2			1	2
	CO3	3		2		3		1		1		1	2
	CO4	3	2			2				1			
	CO5	3	2	3	2	2	1				2	1	2
	CO6	3		3		2					2	1	
3	Category	Basic Science											
4	Approval	47th Academic Council, July 2018											

### UNIT 1 SOLUTION OF POLYNOMIAL AND TRANSCENDENTAL EQUATIONS

**9+3 Hrs**

Fixed Point Iteration methods - Newton-Raphson method and Regula-Falsi method for single variable-solutions of linear system of equations by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods.

### UNIT 2 INTERPOLATION

**9+3 Hrs**

Finite differences -Relation between finite difference operators- Interpolation using Newton's forward and backward difference formulae, Interpolation with unequal intervals-Newton's Divided difference formula, Lagrange's Interpolation formula.

### UNIT 3 NUMERICAL DIFFERENTIATION AND INTEGRATION

**9+3 Hrs**

Numerical Differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's Both  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rules. Double integration using Trapezoidal rule and Simpson rule.

#### **UNIT 4 INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATION 9+3 Hrs**

Single step methods- Taylor series, Euler and modified Euler methods, RungeKutta method of fourth order for solving first and second order differential equations, Multiple step methods- Milne and Adam's -Bash forth predictor and corrector methods.

#### **UNIT 5 BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATION 9+3 Hrs**

Finite difference - solution of  $2^{\text{nd}}$  order ODE - Finite difference solutions for two dimensional Laplace and Poisson equations, Finite difference solutions for one dimensional heat equation both implicit and explicit (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for one dimensional wave equation.

#### **TEXT BOOKS**

1. Sastry.SS "Introductory Numerical Methods" 5<sup>th</sup> edition, PHI, 2012.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42<sup>nd</sup> Edition, 2016.
3. Jain K.K. Iyengar, S.R.K and Jain, R.K. "Numerical Methods for Scientific and Engineering Computation" 4<sup>rd</sup> edition, 2005 .

#### **REFERENCE BOOKS**

1. Curtis F.Gerald. "Applied Numerical Analysis" 7<sup>th</sup> Edn. Pearson Education,
2. Dennis G.Zill and Warren S.Wright. "Advanced Engineering Mathematics", 3<sup>rd</sup> Edn. Jones & Bartlett Publishers, UK. 1992.
3. P.Kandasamy, K.Thilagavathy, K.Gunavathi- Numerical methods, S.Chand & Company, 2<sup>nd</sup> Edition 2010.

**Course Coordinator**  
**Mr. P. Bathmanaban**  
**Mrs. K. L. Rajashree**

**HOD**  
**Dr. K. Balasubramanian**

U18PCME402	<b>STRENGTH OF MATERIALS</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours - 60					3	1	0	4				
	Prerequisite – Engineering Mechanics												
	Course Coordinator Name & Department:- Mr. R. Hariharan, Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads</li> <li>To calculate the elastic deformation occurring in various simple geometries for different types of loading</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To recognize the deformation behavior of simple structures.												
CO2	Determine the types of beams and shear force and bending moment diagrams.												
CO3	Illustrate about moment of inertia and deflection of beam												
CO4	Analyze stress behavior												
CO5	To evaluate the stresses and deformation of the various types of shafts												
CO6	Design about thick and thin cylinders												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	E	f	G	h	i	j	k	l
2	CO1	3	3			3							3
	CO2					2					1		
	CO3			3		2					1		3
	CO4		2			2	2				1		
	CO5					2					1		
	CO6					2					1		1
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT-I

**9+3**

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

### UNIT-II

Beams and type's transverse loading on beams- shear force and bending moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

### UNIT - III

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

#### **UNIT - IV**

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.

#### **UNIT - V**

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure, column and struts, Euler's formula, limitations of Euler's formula.

#### **Text Books:**

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. Ferdinand P. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, TataMcGrawHill Publishing Co. Ltd., New Delhi 2005
3. Prabhu T. J. – Mechanics of Solids, 2009
4. Subramanian R, Strength of Materials, Oxford University Press, 2007.

**Course Coordinator**  
**Mr. R. Hariharan**

**HOD**  
**Dr. K. Balasubramanian**

U18PCME403	<b>MANUFACTURING TECHNOLOGY</b>					L	T	P	C				
	Total Contact Hours – 45					3	0	0	3				
	Prerequisite- MANUFACTURING PROCESSES												
	Course Coordinator Name & Department:- Dr. R. J. Golden Renjith Nimal , Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To provide knowledge on machines and related tools for manufacturing various components.</li> <li>To understand the relationship between process and system in manufacturing domain.</li> <li>To identify the techniques for the quality assurance of the products and the optimality of the process in terms of resources and time management.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To get the knowledge of Jigs and Fixtures so as to describe the machine capability for variety of operations.												
CO2	Students will be able to discuss and improve the gear manufacturing and finishing processes.												
CO3	Classify and explain the working principle of different NTM processes and interpret their suitability for machining different materials.												
CO4	Students will be able to memorize the basic concepts of high energy rate forming.												
CO5	Students will be able to evaluate different molding and forming operations for plastic materials.												
CO6	Students will be able to analyze the different manufacturing processes of metals as well as polymer products.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	E	f	g	h	i	j	k	l
2	CO1	3	3	3	3	3	2	2	1	2	2	3	3
	CO2	3		3	2	2		2	1		2		
	CO3	3		2		3		2		1	2		
	CO4	3				3		2		2			3
	CO5	3		3				3	1		2		
	CO6	3	2	3	2	2		3			3	2	
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT I

10

Tooling for conventional and non-conventional machining processes: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; press tools – configuration, design of die and punch; principles of forging die design.

### UNIT II

10

Gear manufacturing process: Gear milling, gear shaping, gear planning, gear hobbing, Gear broaching. stamping process, cold drawing process, rolling process, sintering process, gear finishing process - gear shaving, gear grinding, gear lapping, gear honing.

### UNIT III

10

Non-traditional machining techniques, classification. Abrasive jet machining, Electrical Discharge machining, E.D wire cutting, Electro chemical machining, Electron Beam

Machining, Laser Beam Machining, Ultrasonic Machining – process parameters, process capabilities, application.

**UNIT IV** **6**

High Energy Rate forming - Explosive forming, Electro hydraulic, Electro magnetic forming, Dynapack machine – process parameters, process capabilities, application.

**UNIT V** **9**

Plastics – Introduction, Types, Plastic Moulding - compression Moulding, transfer Moulding, injection Moulding, blow Moulding, film and sheet forming, thermo forming, reinforced plastic, laminated plastics.

**TEXT BOOKS:**

1. Degarmo, Black & Kohser, Materials and Processes in Manufacturing
2. Hajra Chowdary S.K. The Fundamentals of Work Shop Technology. Vol. I & II, Media Publishers, 1997
3. Kalpakjian and Schmid, Manufacturing processes for Engineering materials (5th Edition)-Pearson India, 2014
4. Sharma P.C, A Text Book of Production Technology, S.Chand & Company Ltd, New Delhi, 2007

**REFERENCES:**

1. Chapman W.A.J - Work shop technology, vol I,II & III, 1975, ELBS.
2. Rao P.N. Manufacturing Technology - Foundry Forging & Welding, TMH., New Delhi – 2009.
3. Roy. A.Lindberg, Processes and Material Manufacture, PHI, 1995
4. [www.studynama.com/.../301-Manufacturing-Technology-1-lecture-notes](http://www.studynama.com/.../301-Manufacturing-Technology-1-lecture-notes).

**Course Coordinator**  
**Dr. R. J. Golden Renjith Nimal**

**HOD**  
**Dr. K. Balasubramanian**

U18PCME404	<b>INSTRUMENTATION AND CONTROL</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours - 45						3	0	0	3		
	Prerequisite – Basic Physics											
	Course Coordinator Name & Department:- <b>Mr. V. P. Durairaj</b> , Department of Mechanical Engineering											
<b>OBJECTIVE:</b>												
<ul style="list-style-type: none"> <li>To provide a basic knowledge about measurement systems and their components</li> <li>To learn about various sensors used for measurement of mechanical quantities</li> <li>To learn about system stability and control</li> <li>To integrate the measurement systems with the process for process monitoring and control</li> </ul>												
<b>COURSE OUTCOMES (COs)</b>												
CO1	Develop the knowledge of basics of Measurements, Metrology and Measuring instruments.											
CO2	Improve the competence in sensors, transducers and terminating devices with associated parameters.											
CO3	Discuss the various devices for measuring torque, force, strain, stress and temperature.											
CO4	Describe the various advanced measuring devices and laser metrology.											
CO5	Determine the advancements in the control system.											
CO6	Demonstrate the ability to analyze the results of various measuring systems and instruments to give better conclusions.											
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k
2	CO1	3		2							2	
	CO2				2	3				1		
	CO3	1	3			3			2			
	CO4	2			2							3
	CO5			2	2	1				3		
	CO6	1			3							2
	Category	Professional Core										
4	Approval	47th Academic Council, July 2018										

### UNIT – I

10

Generalized measuring system - Limits, fits and tolerances; Limit Gauges and Slip Gauges, linear and angular measurements; comparators; Interferometry; Metrology in tool wear and part quality including surface integrity, alignment and testing methods; tolerance analysis in manufacturing and assembly, Auto collimator – Angle Dekkor.

### UNIT – II

9

Measurement systems and performance – accuracy, range, resolution, error sources; Instrumentation system elements – sensors and transducers for common engineering measurements; Signal processing and conditioning; correction elements

### UNIT – III

9

Form measurement – Measurement of tooth thickness – gear tooth Vernier – Surface finish measurement – radius measurement – flatness and roundness measurement – Screw thread and gear Measurement. Laser Metrology: Precision instrument based on laser – Principle – Application of laser – Laser interferometer – Applications in linear measurement and angular measurement.

#### **UNIT – IV**

**8**

Coordinate Measuring Machine – constructional features – types – Applications of CMM – CNC. CMM applications – Inspection by computer aided – machine vision – Applications in Metrology.

Force measurement – Torque measurement – Pressure measurement – Temperature measurement – Vibration Measurement.

#### **UNIT – V**

**9**

Actuators: pneumatic, hydraulic, electric; Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers; System models, transfer function and system response, frequency response; Nyquist diagrams and their use.

#### **TEXT BOOKS:**

1. Instrumentation and control systems by W. Bolton, 2<sup>nd</sup> Edition, Newnes, 200
2. Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007
3. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York, 1999.
4. R.K.Jain Engineering Metrology , Khanna Publishers, 2005

#### **REFERENCES:**

1. Kumar D.S Mechanical Measurement and Control – Metropolitan Book company Pvt. Ltd. – 1989.
2. T.G.Beckwith and N.Lewis Buck, Mechanical Measurements, Addison Wesley, 2001
3. Sirohi, R.S. and Radhakrishnan, H.C.Mechanical Measurements, New Age, 1994.

**Course Coordinator**  
**Mr. V. P. Durairaj**

**HOD**  
**Dr. K. Balasubramanian**

U18PCME405	THEORY OF MACHINES					L	T	P	C
	Total Contact Hours - 60					3	1	0	4
	Prerequisite –Engineering Mechanics								
	Course Coordinator Name & Department:- <b>Dr. R. J. Golden Renjith Nimal</b> , Department of Mechanical Engineering								
<b>OBJECTIVES</b>									
<ul style="list-style-type: none"> <li>To understand the kinematics and rigid- body dynamics of kinematically driven machine components</li> <li>To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link</li> <li>To be able to design some linkage mechanisms and cam systems to generate specified output motion</li> <li>To understand the kinematics of gear trains</li> </ul>									
<b>COURSE OUTCOMES (COs)</b>									
CO1	Discuss the basic concepts of various mechanisms.								
CO2	Examine the velocity and acceleration diagram for a given mechanism.								
CO3	Discover the effects of friction in mechanical element.								
CO4	Design cams and followers for specified motion profiles.								
CO5	Determine the static and dynamic balancing calculations for rotating and reciprocating masses.								
CO6	Evaluate the important types of vibrations and acquire knowledge in the calculation of natural frequency.								

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	2	1	3		3			2	1		2	3
	CO2	1		3	2	1		2	1			2	2
	CO3	3	2	3	2		1	2	3	1		3	
	CO4		3	2		2		1	3			2	
	CO5	3	2	3	1	3		2	2			3	1
	CO6	3	3	2	1	2			3			1	
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT I

12

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

### UNIT II

12

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

### UNIT III

12

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque - Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

#### **UNIT IV**

**12**

Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method

#### **UNIT V**

**12**

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

#### **TEXT BOOKS**

1. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, New Delhi, 2002.
2. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co, New Delhi,2004.

#### **REFERENCES**

1. Burton Paul, “Kinematics and Dynamic of Planer Machinery”, Prentice Hall, 1979.
2. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 1989.
3. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 1989.
4. Rao, J.S and Dukkanpati, R.V, “Mechanism and Machine Theory”, Second Edition, WileyEastern Ltd., 1992.
5. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 1980.

**Course Coordinator**

**Dr. R. J. Golden Renjith Nimal**

**HOD**

**Dr. K. Balasubramanian**

U18MCTH 401	<b>CONSTITUTION OF INDIA</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours - 45							2	0	0	0		
	Prerequisite – Professional Courses												
	Course Coordinator Name & Department:- Department of Management studies												
<b>OBJECTIVES</b>													
To know about Indian constitution. To know about central and state government functionalities in India. To know about Indian society.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To understand the historical background and fundamental rights												
CO2	To understand the structure and functions of governments												
CO3	To understand the Indian social structure												
CO4	To gain knowledge in Indian federal system												
CO5	To gain knowledge Indian social structure												
CO6	To gain knowledge the right of women, children and SC&ST												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	1		3									
	CO2					3			2	1			
	CO3	1					3			1			
	CO4							2		1			
	CO5	1					2		2				
	CO6												
	Category	Mandatory Course											
4	Approval	47th Academic Council, July 2018											

**UNIT I** 9  
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

**UNIT II** 9  
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

**UNIT III** 9  
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

**UNIT IV** 9  
Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

**UNIT V** 9

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

**TEXT BOOKS:**

1. Agarwal R.C., “ (1997) Indian Political System “, S.Chand and Company, New Delhi.
2. Durga Das Basu, “ Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.

**REFERENCES:**

1. Gahai U.R, “(1998) Indian Political System “, New Academic Publishing House, Jalaendhar.
2. Maciver and Page, “Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.
3. Sharma K.L, “ (1997) Social Stratification in India: Issues and Themes “, Jawaharlal Nehru University, New Delhi.
4. Sharma R.N., “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.
5. Sharma, Brij Kishore, “Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
6. Yogendra Singh, “(1997) Social Stratification and Change in India “, Manohar, New Delhi
7. [www.cgsird.gov.in/constitution.pdf](http://www.cgsird.gov.in/constitution.pdf)

**Course Coordinator**

**HOD**  
**Dr. K. Balasubramanian**

U18PCME4L1	<b>STRENGTH OF MATERIALS AND FLUID MECHANICS LAB</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	<b>Total Contact Hours –30</b>							<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>		
	Prerequisite – Engineering Mechanics												
	Course Coordinator Name & Department:- Mr. Arun V.Rejus Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will understand flow through pipes												
CO2	Students will practically understand different flow measuring equipment.												
CO3	Student will understand the strength of components and testing methods.												
CO4	Student will understand the characteristics of pumps.												
CO5	Students study the importance of flow analysis												
CO6	Students learn deflection and stresses												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	2	3	2	1						1	2	
	CO2	2	3	2	1						1	2	
	CO3	2	3	2	1						1	2	
	CO4	2	3	2	1						1	2	
	CO5	2	3	2	1						1	2	
	CO6	2	3	2	1						1	2	
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### LIST OF EXPERIMENTS

#### **FLUID MECHANICS LAB**

1. Determination of flow through pipes, losses in pipes.
2. Calibration of orificemeter and venture meter
3. Flow through notches and weir
4. Flow through open orifice
5. Buoyancy experiment-Metacentric height.
6. Impact of jet on vanes-inclined and curved vanes
7. Verification of Bernoulli's equation

#### **FLUID MACHINERY LAB**

1. Performance characteristics of Jet pump
2. Performance characteristics of Vane pump
3. Performance characteristics of Centrifugal pump
4. Performance characteristics of Reciprocating pump
5. Performance characteristics of Gear pump
6. Characteristics of Impulse turbine

7. Characteristics of Reaction turbine

**STRENGTH OF MATERIALS LAB**

1. Tension test of a mild steel rod
2. Double shear test on mild steel and Aluminum rods
3. Torsion test on mild steel rod
4. Hardness test on metals- Brinell and Rockwell hardness
5. Deflection test on helical springs
6. Deflection test on beams
7. Compression test – bricks
8. Double shear test in U.T.M

**Course Coordinator**

Mr. Arun V.Rejus

**HOD**

**Dr. K. Balasubramanian**

U18PCME4L2	<b>METROLOGY &amp; METALLURGY LAB</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours –30							0	0	2	1		
	Prerequisite – Metrology												
	Course Coordinator Name & Department:- Mrs.G.Sucharitha, Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To get an idea of the dimensional &amp; form accuracy of products.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will understand the difference between accuracy and precision												
CO2	Students will be able to identify the different measuring equipments .												
CO3	Student will have the knowledge to make a use of metallurgical microscope.												
CO4	Student will learn to analyze metallographic structures of different materials.												
CO5	Student will be able to explain the crystallographic structures of different materials.												
CO6	Students will be able to discuss about the profile of a gear.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	F	g	h	i	j	K	L
2	CO1	3											
	CO2		3										1
	CO3									3			
	CO4										1		
	CO5				2							1	
	CO6							2					
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### LIST OF EXPERIMENTS:

#### METROLOGY LABORATORY

1. Calibration of dial gauge, micrometer and vernier.
2. Measurement using Precision Measuring Instrument like vernier caliper, Micrometer, dial gauge, Vernier height Gauge
3. Measurement of angles using sine bar, bevel protractors, sine centre
4. Use of Tool Maker's Microscope
5. Volume and Area Measurement for the given block using slip gauge.
6. Bore diameter measurement using micrometer and telescopic gauge

#### METALLURGY LABORATORY

1. Study of metallurgical microscope
2. Preparation of specimen for metallographic observation of white Cast Iron, Grey Cast Iron, Malleable Iron.
3. Preparation of specimen for metallographic observation of Mild Steel, Low Carbon Steel, Medium Carbon Steel, Tool Steel, High speed Steel, and Stainless steel.
4. Preparation of specimen for metallographic observation of Copper-bronze, Copper brass.
5. Microscopic examination of heat-treated and untreated metallic samples

**Course Coordinator**

Mrs.G.Sucharitha

**HOD**

**Dr. K. Balasubramanian**

U18MCAB407	<b>LITERATURE &amp; MEDIA – LITERATURE ,CINEMA&amp; MEDIA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Coordinator Name & Department:-AICTE				

The objective is to inculcate the habit of active (or interactive) consumption of the best content available in literature, films and media, rather than passive consumption. Description Literature is perhaps as old as history or may be older and it is difficult to think of a fully educated person without any exposure to the best of the world literature (not just the literature of their own country or in their own language). Cinema is more recent and mass media is even more recent, but all these have a vital role in today's society. The problem is that the content available easily to most people (partly due to extensive promotion) caters to the lowest common denominator. Engineering students should be encouraged to read the best of the world literature and watch the best of the world cinema (regardless of their viewpoints). They should also be made aware that news is best collected from different sources, which don't necessarily agree, so that they can understand the true meaning of democracy and also learn to form educated opinions about various topics based on the information from diverse sources. They should learn that being opinionated without being properly informed (say, by relying only on one source of news on TV based on TRPs) is not the right way to be a good citizen. They should get the experience of their opinion being contradicted by the most reliable evidence, so that they realize that there is no shame in changing a wrong opinion in the light of overwhelming evidence. For that, they will also have to learn how to find out the degree of reliability of different sources. One way to achieve this is to conduct workshops where students, aided by invited experts, read news from different sources, watch the best cinema and read or watch different media sources. They can then discuss these with their peers and with the invited experts and learn to talk peacefully with people of different viewpoints, as well as learn to form their own opinions. They should then be encouraged to write about their takeaways from these discussions or their opinions and their reasons for forming those opinions. Such activities can counter the current culture of being 'trolls' on the social media, for example. Instead, we should have citizens who give due respect to their fellow citizens and learn to analyze, discuss and reach conclusions in an agreeable manner, without unnecessary feelings of bitterness and enmity.

Another related exercise could be to read or watch advertisements and then analyze them in terms of the biases they promote (such as the desirability of fair skin) or the deception they indulge in to psychologically compel consumers to buy things they don't really need. Some advertisements even promote the habit of treating fellow human beings with contempt for being different from them (even in terms of possessing the products they are promoting). A well-educated citizen should be less susceptible to such practices in advertisements. Advertisements are just one example. Something similar could be done with all kinds of propaganda material

**Course Coordinator**

**HOD**  
**Dr. K.**  
**Balasubramanian**

U18MCAB408	<b>LITERATURE &amp; MEDIA – GROUP READING OF CLASSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Coordinator Name & Department:-AICTE				

This will make group to read one or two books during a semester.

**Process:** An hour may be fixed for a small group for a particular classic. Group sits and each person reads aloud (if possible with proper modulation) taking turns. This if done properly for an hour one may complete 30-40 pages in an hour. A normal classic can be finished in 15 to 20 days. If serious books on philosophy etc. are taken up a discussion can be held after every idea is complete.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

U18PCME501	<b>HEAT TRANSFER</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 60							3	1	0	4		
	Prerequisite – Thermal Engineering-II												
	Course coordinator Name & Department – Mr.J. Manikandan, Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>• The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.</li> <li>• Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.</li> <li>• The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the students can able to understand different heat and mass transfer principles												
CO2	Students exhibit memory of the principles of conduction												
CO3	Students are able to present the principles of convection												
CO4	Students solve problems in new situations by applying acquired knowledge for the welfare of the people												
CO5	Students will have the knowledge of examining the radiation concepts in heat and mass transfer												
CO6	Students are able to present and defend opinions by making judgments about steady state and unsteady state of systems												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3	2					2			2		3
	CO2	3							1		2		
	CO3	3							1		2		3
	CO4											1	2
	CO5							2					
	CO6						2						
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### Unit –I

14

Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer- approximate solution to unsteady conduction heat transfer by the use of Heissler charts.

### Unit-II

14

Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer- Correlations for forced and free convection- Approximate solutions to

laminar boundary layer equations (momentum and energy) for both internal and external flow. Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

**Unit-III**

**10**

Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and  $\epsilon$ -NTU methods. Boiling and Condensation heat transfer, Pool boiling curve

**Unit-IV**

**12**

Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.

**Unit-V**

**10**

Introduction mass transfer, Fick's law of diffusion, Stefan's law, Mass transfer co-efficient, Non-dimensional number used in mass transfer, evaporation process in the atmosphere. Similarity between heat and mass transfer.

**Total number of hours (40 lectures + 12 tutorials)**

**TEXT BOOKS:**

1. Nag P.K, Heat transfer, McGraw Hill Book Company,2002.
2. Sachdeva.R.C-Fundamentals of Heat&Mass Transfer-NewAgeInternational(P)Ltd, 2003
3. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002

**REFERENCES:**

1. Dr.D.S.Kumar,Heat and Mass Transfer,S.K.Kataria& sons,2003
2. Holman.J.P-heat transfer –McGraw hill Book Company, 2002
3. OzisikN.M-heat transfer-McGraw hill Book Company, 1985
4. [bookboon.com/en/momentum-heat-and-mass-transfer-ebook](http://bookboon.com/en/momentum-heat-and-mass-transfer-ebook)

**Course Coordinator**

Mr.J. Manikandan

**HOD**

**Dr. K. Balasubramanian**

U18PCME502	<b>COMPUTER AIDED DESIGN</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 45							3	0	0	3		
	Prerequisite – Manufacturing Technology												
	Course coordinator Name & Department – Dr.S.Thirumavalavan Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
This course will enable the student To gain knowledge about the basic fundamentals of CAD.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To Remember how computers are integrated at various levels of planning, manufacturing and computer aided planning and monitoring.												
CO2	Understand the concepts of CAD Algorithm												
CO3	To apply the knowledge of various curves in CAD												
CO4	To analyze the basics of CAM												
CO5	To create Part Programming in CAM												
CO6	To understand the 2D , 3D and Part Programming												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	G	h	i	j	k	l
2	CO1	3	3							2			
	CO2												
	CO3			3			3	2	2				3
	CO4				3						2	2	
	CO5												
	CO6												3
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

Principles of Computer hardware, Software and Operating System, Data Handling and File Structures, Computer aid in Phases of design- CAD standards- Graphical Kernel System (GKS), standards for exchange images, Open Graphics Library (OpenGL), Data exchange standards- IGES, STEP, CALS etc., Communication standards

Elements of CAD Systems, Introduction to Graphic Hardware, Software, Details of 2D Software Packages-Layering, Drawing Primitives, Display Techniques, Editing, utilities, Scaling, Dimensioning, 3D Visualization, Geometric Modeling-Wireframe and Solid models.

### UNIT II

9

Hidden Line – Surface - Solid removal algorithms – shading – colouring – computer animation.Assembly of parts- assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, mechanism simulation and interference checking

### UNIT III

9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves- Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep.

**UNIT IV****9**

Numerical Control- Modes- NC Elements- NC Machine Tools- CNC Machines- CNC Hardware Basics- CNC Tooling- CNC Machine Tools and Control System- Part Programming- Manual part programming & Types- G-Codes and M-Codes.

**UNIT V****9**

Advanced Part Programming- Direct Numerical Control- Adaptive Control Computer Aided Part Programming, APT, Canned Cycle, Offset, Simple CNC programs

**TEXT BOOKS:**

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

**REFERENCES:**

1. Chris McMahon and Jimmy Browne, CAD/CAM, Pearson Education, 2001.
2. Mikell P.Groover, Automation, Production Systems and CIM, II Edition, Prentice Hall of India, 2001.
3. Radhakrishnan P. CAD/CAM/CIM, I Edition, New central Book Agency, 2006.
4. Rao P.N. CAD/CAM, Principles and Application, Tata McGraw Hill, 2005.

**Course Coordinator**  
Dr.S.Thirumavalavan

**HOD**  
Dr. K. Balasubramanian

		<b>MACHINE DESIGN - I</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
U18PCME503	Total Contact Hours - 60	3	1	0	4								
	Prerequisite – ENGINEERING MECHANICS												
	Course coordinator Name & Department – Dr.V.Balambica Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
This course seeks to provide an introduction to the design of machine elements commonly encountered in mechanical engineering practice.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will be able to learn the concepts and behavior of machine components failure criteria based on suitable material selection.												
CO2	Student will have an understanding of the origins, nature and applicability of empirical design principles, based on safety considerations												
CO3	Students will have an overview of codes, standards and design guidelines for different elements												
CO4	Students will have the knowledge of parametric optimization and design iteration												
CO5	Students will recognize the relationships between component level design and overall machine -system design performance												
CO6	Upon completion of this course, students will be able to improve design methodologies and provide alternative solutions.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3	3	1					2	2		3	3
	CO2	3	3	1									
	CO3											3	
	CO4			1									1
	CO5			2						2		2	
	CO6		3	3					2	2		3	
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### **UNIT I FUNDAMENTALS**

**12**

Design process – Engineering Materials and Mechanical properties – Design Considerations: Limits, Fits and Tolerances – Principal stresses — Calculation of permissible stress – Failure theories(Static and Dynamic) including fatigue failure – Stress Concentration .

### **UNIT II DESIGN OF SHAFTS**

**12**

Design of Shafts under Static and Fatigue loading – Shafts carrying Pulleys, Gears – Simply Supported Shafts - Hollow shafts.

### **UNIT III DESIGN OF HELICAL & LEAF SPRINGS**

**12**

Design of Tension, Torsional and Compression Helical springs and Leaf springs – Springs for Buffers – Springs for Impact loads.

### **UNIT IV DESIGN OF BEARINGS**

**12**

Design of sliding contact bearings using Somerfield number - Selection of Rolling contact bearings for Radial and Axial load combination .

**UNIT V DESIGN OF JOINTS & COUPLINGS**

**12**

Design of Joints --Bolted and Welded joints -Screw fasteners --Analysis and Application of Power Screws-- Design of Couplings: Muff coupling -Flange Coupling & Clamp coupling.

**TEXT BOOKS :**

1. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, 1992.
2. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International;1989.

**REFERENCES :**

1. Bhandari V.B – Design of Machine Elements – TataMcGraw Hill, 2007.
2. Design Data, PSG College of Technology, 2007.
3. Dobrovolsky, Machine Elements – Mir Publications, 1978.
4. Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, 1994.
5. Norton R. L, Mechanical Design – An Integrated Approach, Prentice Hall, 1998
6. Pandya & Shah – Elements of Machine Design, 2000.
7. Prabhu T.J. – Fundamentals of Machine Design, 2009.
8. Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.
9. [www.allexamresults.net/.../download-pdf-textbook-of-thermal-engineering](http://www.allexamresults.net/.../download-pdf-textbook-of-thermal-engineering)

**Course Coordinator**

Dr.V.Balambica

**HOD**

**Dr. K. Balasubramanian**

U18HSBA401	<b>ORGANIZATIONAL BEHAVIOR</b>						L	T	P	C			
	Total No. of contact hours: 45						3	0	0	3			
	Pre-requisite:												
	Course coordinator Name & Department –Dept of Management Studies												
<b>Course Objectives</b>													
<ol style="list-style-type: none"> <li>1. Understanding the basic approaches in organization</li> <li>2. Knowledge on theories of Personality</li> <li>3. Clear sight on the Decision Making in Groups</li> <li>4. Analyse the behaviour of individuals and groups in organizations in terms of the key factors that influence organizational behaviour. Assess the potential effects of organizational - level factors (such as structure, culture and change) on organizational behaviour.</li> </ol>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Familiarity with the knowledge of Frame work of Organizational Behaviour												
CO2	Knowledge of the Interpersonal perception												
CO3	Awareness of the Merits and Demerits of Group decision making.												
CO4	Understanding of the Sources of power												
CO5	Familiarity with the knowledge of types of Conflicts												
CO6													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	C	d	e	f	g	h	i	j	k	L
2	CO1				3								
	CO2				3			3		3			
	CO3				3								
	CO4										3		
	CO5										3		
	CO6												
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### Unit I

9

Organizational Behavior – Definition, Need for studying Organizational Behavior, Disciplines involved in the study of Organizational Behavior, -Contributing disciplines and area - Application of Organizational Behavior in Business.

### Unit II

9

Individual behaviour – personality, perception, learning, attitudes inter-personal behavior – Group and inter-group behaviour.

### Unit III

9

Group Dynamics – Formal and Informal Group, Group Norms, Group Cohesiveness, Group Behaviour and Group Decision – Motivation – Need and Importance – Theories of Motivation

**Unit IV**

**9**

leadership-nature, styles and approaches, development of leadership including laboratory training. Power and Authority – Definition of Power – Types of Power.

**Unit V**

**9**

Management of change-conflict Management- Management of culture, Cross Cultural Management.

**REFERENCES**

1. Uma Sekaran, Organizational Behavior: Text and Cases TMH Publications
2. Ashwathappa K, Organizational Behavior: Text, cases and games, Himalaya Publishers
3. Chandhan JS, Organizational Behavior, Vikas Publishers
4. Stephen Robbins, Organizational Behavior, Pearson Education
5. RS Diwedi, Human Relations and Organizational Behavior, Mac Millan

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

U18PCME5L1	<b>THERMAL AND HEAT TRANSFER ENGINEERING LABORATORY</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours - 30							0	0	2	1		
	Prerequisite – Thermal Engineering, Thermodynamics												
	Course coordinator Name & Department – Mr.J.Manikandan, Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To practically understand the concepts and working of various thermal application like IC engines, Compressors and Refrigeration and Air conditioning systems</li> <li>To practically understand the concepts and working of various Heat transfer application like Conduction, convection and radiation systems</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the students can able to understand the fundamentals in every area of thermal engineering.												
CO2	Will improve the knowledge regarding the concepts in thermal and heat transfer lab												
CO3	Students are able to present the working principle of Thermal Equipments												
CO4	Students can examine the working principle of IC Engines												
CO5	Students are able to present the concept and working of compressors												
CO6	Students are able to compile the working principle of Heat transfer equipments												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3											
	CO2		3										
	CO3									3			
	CO4										1		
	CO5				2							1	
	CO6							2					
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### Contents:

#### Thermal Lab

- Determination of viscosity using Saybolt and Redwood viscometer
- Valve timing diagram of a four stroke engine, Port timing diagram of a two stroke engine
- Determination of mechanical efficiency of four stroke diesel engine
- Heat balance test on a four stroke diesel engine
- Performance test on a multi cylinder petrol engine- Morse test
- Test on Air compressor
- Performance test on a Refrigeration plant
- Performance test on A/C plant

## **Heat Transfer Lab**

Thermal conductivity of insulating materials

Thermal conductivity of guarded hot plate method

Heat transfer through composite wall

Heat transfer by free and forced convection

Test on heat exchangers- parallel and counter flow

Emissivity measurement apparatus

Stefan-Boltzman apparatus

Test on Pin fin apparatus

**Course Coordinator**

**Mr.J.Manikandan**

**HOD**

**Dr. K. Balasubramanian**

U18PCME5L2	<b>INSTRUMENTATION AND DYNAMICS LAB</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours –30					0	0	2	1				
	Prerequisite – Instrumentation and Control												
	Course coordinator Name & Department – Dr. R. J Golden Renjith Nimal Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To understand the measurement of mechanical properties of materials</li> <li>To understand the deformation behaviour of materials</li> <li>To understand the kinematic and dynamic characteristics of mechanical devices</li> <li>To understand how certain measuring devices are used for dynamic testing.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Recall the concepts in kinematics and Dynamics of Machinery												
CO2	Describe the various measuring devices are used for dynamic testing.												
CO3	Improve knowledge regarding various types of forces and reactions.												
CO4	Determine the natural frequency of various types of vibrations.												
CO5	Demonstrate the balancing of rotors and develop the knowledge to use tachometer.												
CO6	Analyze the forces acting on machines and mechanisms for specific applications such as, cams, gears and balancing.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	F	g	h	i	j	k	L
2	CO1	3								2			
	CO2											3	
	CO3									2			
	CO4								1				
	CO5			2									
	CO6						3				2		
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### LIST OF EXPERIMENTS:

#### INSTRUMENTATION

1. Pressure measuring device calibrations
2. Force measurement load cell, providing ring
3. Temperature measuring devices: Thermocouple, Platinum resistance thermometer.
4. Speed measurement: Tachometer & Stroboscope
5. Torque measurement
6. Flow measurement: Orifice meter, Rotometer.

7. Vibration measurement.

### **DYNAMICS LAB**

1. Kinematics of four bar, slider crank, crank rocker, double crank, double rocker and oscillating cylinder mechanisms
2. Cam & follower and motion studies
3. Kinematics of gear trains – Simple, Compound, Epicyclic
4. Determination of M.O.I by using connecting rod and flywheel
5. Governors – Watt, Porter
6. Motorized gyroscope and verification of losses
7. Single degree of freedom Spring-mass-damper system, determination of natural frequency and damping coefficient
8. Determination of M.O.I using compound pendulum.
9. Determination of stiffness and natural frequency of single rotor and two rotor shafts.
10. Determination of critical speed of shaft with concentrated loads- Whirling of shafts.
11. Balancing of rotors.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

		<b>MANUFACTURING TECHNOLOGY LAB</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
U18PCME5L3		Total Contact Hours- 30				0	0	2	1				
		Prerequisite – Manufacturing Technology											
		Course coordinator Name & Department – R.Hariharan , Department of Mechanical Engineering											
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To provide an understanding of advanced manufacturing methods.</li> <li>To get an idea of the dimensional &amp; form accuracy of products</li> <li>To expose students in understanding various metal cutting operations and commonly used machine tools.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	recognize lathe and its working												
CO2	To aware about different tools used in manufacturing.												
CO3	Understand the concept of tool wear.												
CO4	Distinguish the functions and applications of different metal cutting tools												
CO5	To formulate different methods of manufacturing												
CO6	To create how to learn force calculations												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3								2		3	
	CO2											3	
	CO3									2			
	CO4												
	CO5												3
	CO6			2		3					2		
3	Category	Professional core											
4	Approval	47th Academic Council, July 2018											

### LIST OF EXPERIMENTS:

- Exercise on Plain turning and thread cutting
- Taper turning and knurling using lathe
- Contour milling using vertical milling machine
- Spur gear cutting in milling machine
- Helical Gear cutting using Hobbing machine
- Determination of cutting forces in Milling and drilling using dynamometers
- Slotting and key way cutting in vertical slotting machine
- Shaper Exercise : Making a square from a round rod
- Exercise on drilling and boring
- Surface Grinding

Course Coordinator

HOD

**R.Hariharan**

**Dr. K. Balasubramanian**

U18MCAB611	<b>SELF DEVELOPMENT –SPRITUAL, MINDFULNESS &amp; MEDITATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Designed by – AICTE				

### **Spiritual, Mindfulness and Meditation**

The human mind especially among the youth needs to transcend its preoccupation with negative experiences such as fear, anxiety, anger and obsession and to become more comfortable with the experience of compassion, acceptance and forgiveness.

The student's attitude of acceptance towards negativity, aggression and turbulent emotions should be diffused with the practice of mindfulness. Rather than suppressing emotions or by indulging in them, the student be taught to handle such vibes with acceptance and generosity and with the observation of the self.

A mindful state has to be achieved when negative thoughts and experiences are becoming more personalized and do not serve as dictators of subsequent feelings and activities (e.g. suicide attempts, violence etc.). Both concentrative and insight meditation techniques may be practiced for 10-day sessions during every two months. Behavioral techniques of self monitoring should also be practiced to observe the stream of consciousness from the perspective of a vigilant but detached observer.

The students should be trained to practice different models of mindfulness and meditation so as to elicit a state of deep physical and behavioral relaxation. They may work on selectively influencing or changing the symmetry in hemispheric brain activity. Positive addiction, meta - cognitive practices etc. are exercised to make the students experience the universal human capacity through spiritual experiences.

The students may learn to turn-off or bypass the cognitive processing of usual daily pre-occupations and concerns, allowing access to mindful, spiritual and meditative state of self realization.

#### **Activities:**

Reading (10 books/ narrations)

Exercises (Mindfulness based Stress Reduction (MBSR) and 10 more)  
Sessions: multiple 10-day sessions may be organized over a semester.

U18MCAB612	<b>SELF DEVELOPMENT – RELIGION AND INTER -FAITH</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Designed by – AICTE				

The objective is to gain knowledge about the beliefs and philosophies of different religions on issues like environment, gender equality, unity, financial equality etc.

The scholars of different religious and philosophical sects should be invited to talk about the issues mentioned above. Efforts should be made to ensure that such talks and discourses should stay clear-off making a critical study on these areas.

Following activities must be included.

Reading of books on religious texts of different faiths by famous authors. (Reading methods may be as suggested under ‘book reading’.)

Organizing lecture on interfaith issues covering philosophies and chronology and contemporary situations world over at a given time.

U18PCME601	<b>MACHINE DESIGN II</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours – 60						3	1	0	4			
	Prerequisite – Machine design I												
	Course coordinator Name & Department – Mr. V.Jose Ananth Vino Department of Mechanical Engineering												
<b>OBJECTIVES</b> To learn about the design procedures for mechanical power transmission components.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the students will understand the basic design aspects associated with different types of clutches and brakes.												
CO2	Students will be able to do analysis of flexible power transmission drives and can design and recommend best flexible power transmission drives for any types of machines												
CO3	Students will understand Design principles associated with different types of gears												
CO4	Students will apply the design knowledge for recommending the required types, size and shape of gears required in any machines.												
CO5	Students can evaluate gear box for automobiles and machine tools.												
CO6	Students can create single plate clutch ,multi plate clutch and gears .												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3	3	1						3		3	3
	CO2	3	3	1					2			3	
	CO3	3	3							2		3	
	CO4	3	2	2					2			3	2
	CO5	2	2	2								2	
	CO6	2	3	3					2			3	
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT I

12

Design of Plate Clutches, Axial Clutches, Cone Clutches, Internal Expanding Rim Clutches; Electromagnetic Clutches; Band and Block brakes, External Shoe Brakes, Internal Expanding Shoe Brake.

### UNIT II

12

Design of Flexible Transmission drives using manufacturer's data. Design of Flat Belts & Pulleys, Selection of V-belts and pulleys, Selection of Hoisting Wire ropes and pulleys, Design of Chains and Sprockets

### UNIT III

12

Gear Materials- Force Analysis-Design of Spur and Helical gears – Cross Helical Gears, Terminology, Helix angles, Sizing of a pair of Helical gears.

### UNIT IV

12

Straight Bevel gear- Tooth Terminology, Tooth Forces and Stresses, Equivalent Number of teeth. Estimating the Dimensions of a pair of Straight Bevel gears; Worm gear, Merits & Demerits, Terminology, Materials, Forces & Stresses, Efficiency, Estimating the size of Worm Gear Pair.

#### **UNIT V**

**12**

Gear box- Geometric progression, Standard step ratio; Ray diagram, Kinematics layout; Design of Sliding Mesh, Constant mesh, Synchromesh Gear Box- Design of Multi-Speed Gear Box for Machine Tool Applications. Calculation of Number of teeth in Gears- Speed Reducer Unit; Variable Speed Gear Box.

#### **TEXT BOOKS :**

1. Prabhu T.J. Design of Transmission Elements, 2008.
2. Shigley, Mechanical Engineering Design – Tata McGrawHill, 2004.

#### **REFERENCES :**

1. Dobrovolsky, Machine Elements – Mir Publications, 1978.
2. Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.
3. Maitra G. and Prasad L., Handbook of Mechanical Design, 2<sup>nd</sup> ed., Tata McGraw Hill, 2001.
4. Pandya & Shah – Elements of Machine Design, 2000
5. [www.faadooengineers.com/.../26687-Machine-design-by-shigley-ebook](http://www.faadooengineers.com/.../26687-Machine-design-by-shigley-ebook)
6. **Design data book compiled by PSG college of Technology.**

**Course Coordinator**

**V. Jose Ananth Vino**

**HOD**

**Dr. K. Balasubramanian**

U18PCME602	<b>FINITE ELEMENT ANALYSIS</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 60							3	0	0	4		
	Prerequisite – Numerical Methods												
	Course coordinator Name & Department – Dr.C.M.Meenakshi Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
This course will enable the student To gain knowledge about the basic fundamentals of CAD.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the students will able to recognize different mathematical Techniques used in FEM analysis												
CO2	Understand the concepts of Nodes and elements												
CO3	Students will able to apply FEA in Structural and thermal problem												
CO4	Students will able analyze heat transfer problem using FEA technique												
CO5	Students will able to classify the types of analysis and its application												
CO6	Students will able to build a FEA Model												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3	2					2			2		3
	CO2	3							1		2		
	CO3	3							1		2		
	CO4											1	
	CO5							2					3
	CO6					2							
3	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### UNIT -1

**9**

Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.

### UNIT –II

**9 HRS**

One dimensional second order equation, Bar element – Mechanical and Thermal loads discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, longitudinal vibration and mode shapes

### UNIT -III

**9 HRS**

Two dimensional equations, variational formulation, finite element formulation, triangular elements- shape functions, elemental matrices application to thermal problems, torsion of non-circular shafts. Plane stresses and plane strain problems. Trusses and Frames.

### UNIT -IV

**9 HRS**

Natural coordinate systems, isoparametric elements and shape functions, numerical integration and application to plane stress problems, Choice of quadrature rule – Gauss Point -matrix solution techniques, solution of dynamic problems

**UNIT – V**

**9 HRS**

Introduction to FE software.Computerized FEA – Preprocessing –Element types - Mesh generation – Solution – Post processing – Procedures of Case studies.

**TEXT BOOKS:**

1. Rao S.S., The Finite Element Method in Engineering, 3<sup>rd</sup> ed., Butterworth Heinemann, 2004.
2. Reddy J.N., An Introduction to Finite Element Method, 3<sup>rd</sup> ed., Tata McGraw Hill, 2005.
3. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi, 2007.

**REFERENCES:**

1. Bathe K.J – Finite Element Procedure – Prentice Hall of India, 1996.
2. Bhavikati S.S – Finite Element Analysis, New Age International Publishers.
3. ChandraputlaT.R ,A.D.Belegundu – Introduction to Finite Elements in Engineering – Prentice Hall of India, 2002
4. Chandraputla&Belegundu, Introduction to Finite Elements in Engineering, 3<sup>rd</sup> ed., Prentice Hall,1990
5. <https://www.amazon.in/...FINITE-ELEMENT-ANALYSIS...ebook/.../B0>
6. Zienkiewicz O.C–The Finite Element Method in Engineering Science, McGrawHill, 2000.

**Course Coordinator**  
**Dr.C.M.Meenakshi**

**HOD**  
**Dr. K. Balasubramanian**

U18BSMA601	<b>OPERATIONAL RESEARCH</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours - 60							3	0	0	3		
	Course coordinator Name & Department – Department of Mechanical Engineering												
<b>OBJECTIVES</b> To provide the student with the concept and an understanding of basic concepts in Linear Programming techniques, Duality Principles, Transportation and Assignment problems, Inventory models, PERT/CPM, Queuing and Replacement Models.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Explain the basic concepts of optimization and to formulate and solve linear programming problems, Apply duality principle in day to day life style												
CO2	Apply the concepts of Transportation Problem and Assignment Problem, Participate in the class room discussion on Transportation algorithm.												
CO3	Explain and Demonstrate the basic concepts of PERT- CPM and their application reproduce the network model.												
CO4	Explain the basic concepts of optimization and to formulate and solve inventory problems.												
CO5	Explain and apply the concepts of Queueing theory and their application												
CO6	Explain and apply the concepts of sequencing problem and its applications												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3	3	2		3		1				3	
	CO2	3	3						2	3		3	1
	CO3		3		2	2				3	2	3	
	CO4	2		3		2	1		3			3	
	CO5		2	3	3	1					3		
	CO6		2		3	1					3		
	Category	Humanity science											
4	Approval	47th Academic Council, July 2018											

### UNIT I LINEAR PROGRAMMING

12Hrs

Introduction to phases of an Operations Research study– Linear programming – Formulation of the Programming – Graphical method – Simplex method – Dual simplex method-Two phase method.

### UNIT II TRANSPORTATION & ASSIGNMENT PROBLEMS

12Hrs

Transportation models – Vogel’s approximation method Modi method – Unbalanced transportation problem – Degeneracy in transportation models - Assignment problems – Hungarian method

### UNIT III NETWORKS & REPLACEMENT MODELS

12Hrs

Networks – PERT and CPM – Network diagrams – Shortest route – Minimum spanning tree, Replacement models– Individual and Group replacement policy

**UNIT IV INVENTORY MODELS 12Hrs**

Inventory models– Deterministic models– Production models – Economic Ordering Quantity Models – Quantity Discount Model –Multi Product Models – Inventory Control Models in practice.

**UNIT V QUEUING MODELS&RESOURCE SCHEDULING 12Hrs**

Queuing theory – Queuing system and structure – Kendal’s notation– Poisson arrival and Exponential service time – Characteristic of queuing models – Single channel and Multiple models.Resource scheduling – Sequencing n jobs through 2 machines and 3 machines.

**Text Books /References:**

1. Gupta and Hira D.S “ Operations Research”, S. Chand & Co, New Delhi, 2006
2. Kanti Swarup, Gupta, P.K and Manmohan, “Operations Research”, Sultan Chand & Sons 1997
3. Paneerselvam, R, Operations research, Prentice-Hall of India, New Delhi, 2001.
4. Taha H.A, “Operations Research”, Prentice Hall of India, 2002, Seventh Edition 2007.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

		<b>CAD/CAM LABORATORY</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
U18PCME6L1	Total Contact Hours –30						0	0	2	1			
	Prerequisite – CAD /CAM/CIM												
	Course coordinator Name & Department – Mr.Srinivasan												
	Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
This course will enable the student To gain knowledge about the basic fundamental of CAD and CAM													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Understand the benefits of computer aided design												
CO2	Students remember and learn the Knowledge of CNC.												
CO3	Understand the computer aided manufacturing of machine elements.												
CO4	<b>Students analyze 2D modeling</b>												
CO5	Students apply and solve 3d Drawings												
CO6	Remember to learn writing commands												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3							2			1	3
	CO2	3							2			1	
	CO3			3	3	3						1	3
	CO4					2						1	3
	CO5					2							
	CO6							2	2	2			
3	Category	Professional core											
4	Approval	47th Academic Council, July 2018											

### **CAD** Introduction to Computer Aided Drawing

**2-D DRAWING** Orthographic Views, Isometric Views, 2D Sectional Views, Part Drawing, Assembly Drawing, Detailed Drawing. Dimensioning, Annotations, Symbols, Welding, Surface finish, Threads, Text, Bill of Materials. Exercise- Knuckle Joint, Gib and Jotter Joint, Screw Jack, Foot Step Bearing.

**3-D DRAWING** Part Modeling- Protrusion, Cut, Sweep, Draft and Loft- Modify/Edit- Pattern- Transformation, Boolean operation. Assembly- Creating Assembly from Parts, Modify/Edit- Pattern Conversion of 3D Solid Model to 2D Model. Surface Modeling- Tabulated, Revolve, Ruled and Edge Surfaces. Exercise- Piston, Connecting Rod, Knuckle Joint, Universal Joint, Couplings.

### **CAM LAB**

1. Manual Part programming for CNC machines Using standard G – Codes and M- codes. Simulation of Tool path – Machining Practices on Trainer type CNC Machines – Straight cut, Taper turning, Profile, Parting, Thread cutting.
2. CNC Milling Machine: Production of Various Contour shapes
3. Computer assisted part programming – APT programming Language – Part programming

- using APT and other NC programming Languages.
4. Introduction to Component Modeling
  5. NC code generation using CAD / CAM software – Post processing for standard CNC controls like FANUC, SINUMERIC etc.,

**Course Coordinator**  
Mr.Srinivasan

**HOD**  
**Dr. K. Balasubramanian**

		<b>SOFT SKILL LAB</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
U18EEEA6L2	Total Contact Hours –30	0	0	2	1								
	Prerequisite – CAD /CAM/CIM												
	Course Designed by – Department of English												
<b>OBJECTIVES</b>													
Develop their communicative competence in English with specific reference to speaking and listening													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Develop their communicative competence in English with specific reference to speaking and listening												
CO2	Enhance their ability to communicate effectively and efficiently in interviews.												
CO3	Strengthen their prospects of success in competitive examinations.												
CO4	Work with peer group in a smooth manner.												
CO5	Develop inter personal and intra personal skills												
CO6	Develop their communicative competence in English with specific reference to speaking and listening												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1												
	CO2						3						
	CO3												
	CO4				3								
	CO5				2								
	CO6												
3	Category	Humanity Science											
4	Approval	47th Academic Council, July 2018											

### **UNIT I LISTENING AND SPEAKING SKILLS**

**6 hours**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio.

### **UNIT II READING AND WRITING SKILLS**

**6 hours**

Reading different genres of texts ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

### **UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS**

**6 hours**

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

### **UNIT IV INTERVIEW SKILLS**

**6 hours**

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

#### **UNIT V SOFT SKILLS**

**6 hours**

Motivation- emotional intelligence-Multiple intelligences-managing changes-time management-stress management-leadership traits-team work- career planning -intercultural communication- creative and critical thinking

To be totally learner-centric with minimum teacher intervention as the course revolves around practice.

1. Suitable audio/video samples from YouTube to be used for illustrative purposes.
2. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
3. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

#### **REFERENCES:**

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth , Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2013.
4. Evans, D, **Decision maker**, Cambridge University Press, 2010.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

U18EEME6L3	<b>SUMMER INERNSHIP</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours - 30							0	0	0	1		
	Prerequisite –												
	Course Designed by – Dr. K. Balasubramanian Department of Mechanical Engineering												
<b>OBJECTIVES</b> Develop their communicative competence in English with specific reference to speaking and listening													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Recognize the importance and opportunities for the development of skills.												
CO2	Select the appropriate training and experiential learning methodologies.												
CO3	Strengthen their potential in diversified but essential activities like counselling, assessment, outreach, and provision of supervision and enhance the prospects of success in technological world.												
CO4	Outline the importance of work with peer group and to enhance their amicability.												
CO5	Recommend an open and supportive environment conducive to the development of multicultural competence.												
CO6	Make use of the prescribed regulations to built the continuous assessment report												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) <b>3 – Strong, 2 – Medium, 1 – Weak</b>													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1												
	CO2							3					
	CO3												
	CO4				3				2				
	CO5				2						2		
	CO6												
3	Category	Humanity Science											
4	Approval	47th Academic Council, July 2018											

### **Industrial / Practical Training / Internship / Mini Project**

The Industrial / Practical Training shall carry 100 marks and shall be evaluated through continuous assessment only. At the end of Industrial / Practical training / internship / Summer Project, the student shall submit a brief report on the training undergone and a certificate from the organization concerned. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department. Certificates (issued by the Organization) submitted by the student shall be attached to the mark list and sent to the Controller of Examinations by the Head of the Department.

**Course Coordinator**

**Dr. K. Balasubramanian**

**HOD**

**Dr. K. Balasubramanian**

18MCAB509	<b>SOCIAL SERVICES – SOCIAL AWARENESS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Designed by – AICTE				

**Social awareness** (Artisans-relates to engg., visit to hospitals, orphanages, police station, courts, trauma centers, consumer forums)

Human beings live in relationship with their family members and with others in the society. As a society, mankind strives to achieve ordered and organized life through which an environment of cooperation and coexistence is expected. A healthy society creating an environment of fearlessness is a key for the mankind to achieve higher goals because it is society which makes us most human, most complete as people.

Although as a society, our expectation is fearlessness, but due to lack of understanding of our role in a society, we fail to fulfill the expectation. The social awareness activity shall promote an understanding and sharing of issues of societal problem through exposure to variety of artisans and different kind of organizations. It is expected that this exposure will enable the learners to appreciate social issues, problems and challenges.

Each institution will offer a range of introductory activity based courses focusing on local artisans related to engineering so that students are sensitized to appreciate their problems and can take up some of the problems to solve while they do their regular studies. This course shall also include visits to visit to hospitals, orphanages, police station, courts, trauma centers, consumer forums so that they get exposed to different facets of societal problems. Care should be taken to give adequate representation to local and regional organizations and artisans. For example, Banaras has local traditions in *BanarasiSaari*, Toy making, etc and has almost all types of organizations. An institution in Banaras area can offer courses on these artisans. This will, in turn, also ensure wider community involvement/interaction with the institution. At the end of the course/semester, a student should be able to identify a social issue, prepare project report and give presentation on the selected issues. Contact hours per week should be 3 -4 hours. Towards the end of the course, the institution can organize an exhibition in which all the students publicly demonstrate findings of their reports and their future plan of actions.

18MCAB510	<b>SOCIAL SERVICES – NSS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Designed by – AICTE				

**Social Service** (teach in neighborhood, adopt an underprivileged school, village stay / visit (NSS), cleanliness drive, and skill transfer)

U18PCME701	<b>AUTOMATION IN MANUFACTURING</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours – 45						3	0	0	3			
	Prerequisite – Manufacturing Technology, CAD/CAM												
	Course coordinator Name & Department – Mr.Lenin Rakesh Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To understand the importance of automation in the of field machine tool based manufacturing</li> <li>To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC</li> <li>To understand the basics of product design and the role of manufacturing automation</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the Students can able to remember the computer based automation of manufacturing operations												
CO2	Students are able to learn and understand the fundamentals of CAD												
CO3	Learn and analyze about the New Product Development and Optimization												
CO4	Students remember the fundamentals of CNC and CNC Programming												
CO5	Understand the Electronics in Mechanical systems and Flexible automation												
CO6	Students are able to create a new level of manufacturing												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	B	C	D	e	f	G	h	i	j	K	l
2	CO1	3				3					2		3
	CO2					1					2		
	CO3		3	3							2	3	
	CO4	2			3						2	3	
	CO5			2	3						2	3	1
	CO6			2							2	3	
3	Category	Professional core											
4	Approval	47th Academic Council, July 2018											

## UNIT I

10

Introduction to automation, Current trends, CAD, CAM, CIM; Rigid automation: Part handling, Machine tools. Flexible automation: Computer control of Machine Tools and Machining Centers, NC and NC part programming, Flexible fixturing.

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**UNIT II****9**

Computer Aided Design: Fundamentals of CAD - Hardware in CAD-Computer Graphics Software and Data Base, Geometric modeling for downstream applications and analysis methods

**UNIT III****8**

Introduction to Modeling and Simulation: Product design, process route modeling, Optimization techniques, Computer aided process planning, Case studies & industrial applications.

**UNIT IV 9**

Computer Aided Manufacturing: CNC technology, PLC, Micro-controllers, CNC-Adaptive Control-Flexible Manufacturing System- Shop floor control systems- Concurrent Engineering

**UNIT V****9**

Low cost automation-Mechanical & Electro mechanical Systems, Assembly Automated Material handling- Robotics- Pneumatics and Hydraulics- Illustrative Examples and case studies.

**TEXT BOOKS:**

1. Ibrahim Zeid , CAD/CAM : Theory & Practice, 2nd edition.
2. Mikell P. Groover, Automation, Production Systems, and Computer-integrated Manufacturing,prentice Hall
3. SeropeKalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology, 7th edition,Pearson
4. YoramKoren, Computer control of manufacturing system, 1st edition

**Course Coordinator**

Mr.Lenin Rakesh

**HOD**

**Dr. K. Balasubramanian**

U18PCME7L1	<b>DESIGN AND ANALYSIS LAB</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours – 30					0	0	2	1				
	Prerequisite – CAD /CAM Laboratory												
	Course coordinator Name & Department – Dr.C.M.Meenakshi Department of Mechanical Engineering												
<b>OBJECTIVES</b> This course will enable the student To gain knowledge about the basic fundamentals of Analysis in Design of Simple Machine Elements.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will understand the benefits of Computer Aided Design												
CO2	Students will recognize different analyzing software tools.												
CO3	Students will be able use the computer aided manufacturing for creating various machine elements.												
CO4	Students will be able to apply the concepts of 2D Design and Modeling												
CO5	Students Will be able to design 3D models												
CO6	Students Will able to justify the machine elements after analysis												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	3	3	3					2			3	
	CO2	3	3	3					2			3	
	CO3			3	3	3			1			3	
	CO4					2			1			3	
	CO5					2			1			2	
	CO6						2	2	2			2	
	Category	Professional Core											
4	Approval	47th Academic Council, July 2018											

### LIST OF EXPERIMENTS:

#### A. PROGRAMMING IN MATLAB

1. Simple Applications in Arithmetic, Linear Algebra, Matrix operations.
2. Basic 2-D plots like i) Creating the circle ii) Creating the sine curve

## **B. MESHING AND ANALYSIS**

1. Simple Meshes using a Meshing Software
2. Stress analysis of a plate with circular hole
3. Stress analysis of beams (Cantilever, Simply supported and fixed beams)
4. Thermal analysis of hot fluids in a pipe line
5. Mass flow of flue gases in an exhaust pipe
6. Harmonic analysis of a thin plate under axial loading
7. Mode frequency of a 2D component

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

The item chosen may be small machine elements (Example- screw jack, coupling, machine vice, cam and follower, governor etc) attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic/pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts related to fabrication.

**Course Coordinator**

Dr.C.M.Meenakshi

**HOD**

**Dr. K. Balasubramanian**

U18EEME7P1	<b>PROJECT -I</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours –16 periods per week					0	0	8	4				
	Prerequisite – Professional Courses												
	Course coordinator Name & Department – Dr.K.Balasubramanian Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
Every project work shall have a guide who is the member of the faculty of the institution. The aim of the project work is to deepen comprehension of principles by applying them to a new creative problem which may be the design and manufacture of a system, a research investigation, project management or a design problem.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Tabulate a comprehensive report covering core related information, literature survey and describe the problem statement, project work details and conclusion.												
CO2	Summarize the final report in typewritten form as outlined in the guidelines.												
CO3	Make use of the prescribed regulations to built the continuous assessment report												
CO4	Motivate the studentto design and analyse the mechanical components												
CO5	Understand the different fabrication processes.												
CO6	Formulate assertiveness to face industrial environment.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3							2			1	
	CO2	3						3	2	3		1	
	CO3			3	3	3		3				1	
	CO4					2		3		2		1	
	CO5					2							
	CO6						2	3	2				
3	Category	Employment Enhancement											
4	Approval	47th Academic Council, July 2018											

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to undergo learning in research oriented areas, collecting survey and documents on the growing fields in technology

The students as an individual will choose one topic which will be the topic of his project work in the final semester. Every project work shall have a guide who will be the faculty of the institution.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

**Dr. K. Balasubramanian**

18MCAB713	<b>BEHAVIORAL AND INTERPERSONAL SKILLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 30	0	0	2	0
	Prerequisite – Nil				
	Course coordinator Name & Department –Department of Mechanical Engineering				

**Behavioral and Interpersonal skills** (non-verbal skills / behaviours, non-aggression)

Each individual has behavior patterns that are shaped by the context of his or her past. Most often, adapting the behaviour to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression. The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn the goal setting process and thus become more effective in achieving their goals.

The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team. The specific objectives, however, are as following.

To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.

To train the students for communicating effectively in both formal as well as in informal settings.

To help the students to understand the importance of non-verbal aspects of effective communication.

To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work

To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.

To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting. The activities involved are designed to facilitate their career goal decision making.

The activities to achieve the above objectives can be suggested as follows.

- Motivational lectures
- Group Discussions/activities
- Case Study
- Games/Stimulation Exercises
- Role-Playing
- Mindfulness training.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

18MCAB714	<b>NATURE CLUB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 30	0	0	2	0
	Prerequisite – Nil				
	Course Designed by – AICTE				

**Nature club** (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity)

Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.

Identify a tree fruit flower peculiar to a place or having origin from the place.

Making high resolution big photographs of small creatures (bees, spiders, ants, mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).

Videography/ photography/ information collections on specialties/unique features of different types of common creatures. Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

U18EEME8P2	<b>PROJECT WORK-II</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours –16 periods per week					0	0	16	8				
	Prerequisite – Professional Courses												
	Course coordinator Name & Department – Dr.K.Balasubramanian Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
Every project work shall have a guide who is the member of the faculty of the institution. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Identify core related information, literatures and describe the problem statement, project methodology and conclusion.												
CO2	Summarize the final report in typewritten form as outlined in the guidelines.												
CO3	Apply the prescribed regulations to built the continuous assessment report												
CO4	Motivate the students to design innovatively and evaluate the functioning of mechanical components												
CO5	Assess different fabrication processes.												
CO6	Formulate assertiveness to face industrial environment.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3							2			1	
	CO2	3						3	2	3		1	
	CO3			3	3	3		3				1	
	CO4					2		3		2		1	
	CO5					2							
	CO6						2	3	2				
3	Category	Employment Enhancement											
4	Approval	47th Academic Council, July 2018											

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to undergo learning in research oriented areas, collecting survey and documents on the growing fields in technology

The students as an individual will choose one topic which will be the topic of his project work in the final semester. Every project work shall have a guide who will be the faculty of the institution.

The topic chosen may be related to small machine elements (Example- screw jack, coupling, machine vice, cam and follower, governor etc) attachment to machine tools, tooling (jigs,

fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic/pneumatic devices etc.

The student is required to collect literature survey regarding the selected topic to be extended in the next semester. He has to demonstrate its working apart from submitting the project report. The report should contain study material, literature and whatever further deemed important related to his work.

**Course Coordinator**

**Dr. K. Balasubramanian**

**HOD**

**Dr. K. Balasubramanian**

18MCAB815	<b>INNOVATION - PROJECT BASED – SC., TECH, SOCIAL, DESIGN &amp; INNOVATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours - 30	0	0	2	0
	Prerequisite – Nil				
	Course Designed by – AICTE				

### **Project based – Sc., Tech, Social, Design & Innovation**

Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student which may result in development of a working system, a prototype, or a device or material, etc. They are not required or even expected to produce research or an innovation.

Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non - conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this

- Exposure to social problems (which are amenable to technological solutions)
- Design & Innovation (to address above problems)

After this students be encouraged to undertake technology projects of social relevance.

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

## PROFESSIONAL ELECTIVE COURSES

U18PEME011	<b>ADVANCED INTERNAL COMBUSTION ENGINES</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours –45					3	0	0	3				
	Prerequisite – Applied Thermodynamics.												
	Course Coordinator Name & Department – Mr.J.Manikandan Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>• To familiarize with the terminology associated with IC engines.</li> <li>• To understand the basics of IC engines.</li> <li>• To understand combustion, and various parameters and variables affecting it in various types of IC engines.</li> <li>• To learn about various systems used in IC engines and the type of IC engine required for various applications</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To explain engine exhaust emission control and basics of fuel injection systems												
CO2	To summarize the concept of alternate fuels.												
CO3	Illustrate the recent developments in Diesel Fuel Injection Systems.												
CO4	Discuss the formation of various pollutants and methods of controlling emissions												
CO5	Evaluate the performance of Air assisted Combustion												
CO6	Understand the basics of Hybrid Electric Vehicles												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1								2			1	
	CO2			3				2	3	3		1	
	CO3			3	3	2		2			1	1	
	CO4					2		2		2		1	
	CO5					2							
	CO6						2	3	2				
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I :

[9]

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection – Stages of combustion – Normal and Abnormal combustion – Knock – Factors affecting knock – Combustion chambers.

### UNIT II :

[9]

Diesel Fuel Injection Systems – Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion – Introduction to Turbocharging.

**UNIT III :** [9]

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

**UNIT IV :** [9]

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel – Properties, Suitability, Merits and Demerits – Engine Modifications.

**UNIT V :** [9]

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems – Hybrid Electric Vehicles – NO<sub>x</sub> Adsorbers – Onboard Diagnostics.

**TEXT BOOKS:**

1. Ramalingam. K.K., “Internal Combustion Engine Fundamentals”, Scitech Publications, 2002.
2. Ganesan, “Internal Combustion Engines”, II Edition, TMH, 2002.
3. Mathur. R.B. and R.P. Sharma, “Internal Combustion Engines”., Dhanpat Rai & Sons 2007.

**REFERENCES**

1. Obert E. F, "Internal Combustion Engines and Air Pollution", Harper and Row Publication Inc. NY, 1973.
2. Heisler H, "Advanced Engine Technology", Edward Arnold, 1995.
3. Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

U18PEME12	<b>DESIGN FOR MANUFACTURING</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 45							3	0	0	3		
	Prerequisite – MACHINE DESIGN, MANUFACTURING TECHNOLOGY												
	Course Coordinator Name & Department – Mr. Jeevabharathi/ Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>At the end of this course the student should be able to understand the design principles of casting, welding, forming, machining and assembly, by considering various manufacturing constraints.</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Students will learn the principles of manufacturing												
CO2	Students will Understand the Design for manufacturing												
CO3	Students will able to relate welding and its applications												
CO4	Students will able to select fasteners for their design												
CO5	Students will able to summarize about design principles of casting and machining												
CO6	Students will able to adopt the principles of machining and assembly in design												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	E	f	g	h	i	j	k	l
2	CO1												1
	CO2	3	3							2			
	CO3		3				2				2		
	CO4	3											
	CO5		3				2						
	CO6												
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

General design principle for manufacturing - Process capability- Surface finish – tolerances – features of tolerance – cumulative effect of tolerance – Geometric tolerances.

### UNIT II

9

Fits- Selective assembly- Deciding the number of groups, control of axial play- Grouped datum systems- Types- Automated assemblies- laminated shims assemblies.

### UNIT III

9

True position theory- Virtual size concept- True position tolerancing- fixed fasteners- Floating fasteners- zero true position tolerances- Functional gauging- paper layout gauging.

### UNIT IV

9

Form design of castings- Redesigning- Parting line consideration- Minimizing core requirements- economic design of castings- Form design of weldments- Welding symbols- redesigning cast members using weldments- Economic weldments.

#### **UNIT V**

**9**

Design for assembly- Design for inspection- Design for machining- Redimensioning based on manufacturing datums- Design of reduce value addition – Parts cut to length – Machined round holes- Blind & Through holes – Design consideration for various machining operations.

#### **TEXTBOOK:**

1. Spotts M.F – “Dimensioning & Tolerancing for Quantity Production” – Prentice Hall

#### **REFERENCES:**

1. Harry Peck – “Designing for Manufacture” – Pitman Publications, 1973.
2. James G.Bnalla- “Hand book of Product Design for Manufacturing”.
3. [www.bookchums.com](http://www.bookchums.com) › Books › Free ebooks

**Course Coordinator**

Mr. Jeevabharathi

**HOD**

**Dr. K. Balasubramanian**

U18PEME13	<b>SPECIAL CASTING PROCESS</b>											<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45											3	0	0	3
	Prerequisite – Manufacturing Processes ,Manufacturing Technology														
	Course Coordinator Name & Department – Dr.Golden Renjith Nimal, Department of Mechanical Engineering														
<b>OBJECTIVES</b> Understand the concepts of molding and casting															
<b>COURSE OUTCOMES (COs)</b>															
CO1	Recall and perform the basic concepts of casting processes.														
CO2	Make use of modern casting industry tools (real and virtual).														
CO3	Student will able to analyze a casting design in terms of casting parameters and cost estimates using technical methodology.														
CO4	Improve the knowledge on designing parameters of casting.														
CO5	Discuss the different fabrication processes.														
CO6	Determine the advancements in casting processes to face industrial environment.														
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low															
1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l		
2	CO1								2			1			
	CO2			3				2	3	3		1			
	CO3			3	3	2		2			1	1			
	CO4					2		2		2		1			
	CO5					2									
	CO6						2	3	2						
3	Category	Professional Elective													
4	Approval	47th Academic Council, July 2018													

### UNIT I

10

Introduction to Casting: Scope of Foundry, Features of casting, Solidification, Riser, Gating, Patterns, Moulding and core making, Defects, Sand casting -Need for special casting process-Applications.

### UNIT II

7

Shell Moulding: Process-Machines-Pattern-Sand, resin and other materials – Process parameters – Characteristics of shell mould casting-‘D’ Process – Applications

### UNIT III

8

Investment casting: Process- Pattern and mold materials – Black mold and ceramic shell mold - Mere Cast and Shaw process – Applications.

### UNIT IV

8

Centrifugal casting: Types – True centrifugal casting – semi centrifugal casting - Centrifuging– Equipment - Applications.  
Die casting: Equipment – Types – Hot chamber – Cold Chamber – Applications.

**UNIT V****12**

Reciprocating continuous mould process – Direct chill process – Use of steel, Aluminum, brass material in continuous casting. CO<sub>2</sub> Mould / Core hardening process – Full Mould process: Principle – Applications, Special processes like Squeeze casting and Electroslag casting processes.

**TEXT BOOKS:**

1. Flinn and Richard Aloysius, *Fundamentals of Metal Casting*, Addison Wesley Pub. Co.
2. Groover M.P, *Introduction to manufacturing processes*, John Wiley & Sons, 2012
3. Prashant P Date, *Introduction to manufacturing technologies Principles and technologies*, Jaico publications, 2010 (new book)
4. Rao P.N, *Manufacturing Technology: Foundry, Forming And Welding*, Tata McGraw Hill, 2008.

**REFERENCES :**

1. Hajra Chowdary S.K. The Fundamentals of Work Shop Technology. Vol. I & II, Media Publishers, 1997.
2. Higgins R.A, Engineering Metallurgy – Vol. II, 1998.
3. Jain P.L, Foundry Technology, 1992.
4. Sharma OP.C A Text Book of Production Technology, S.Chand& Company Ltd, New Delhi, 2007

**Course Coordinator**

Dr.Golden Renjith Nimal

**HOD****Dr. K. Balasubramanian**

U18PEME014	<b>INDUSTRIAL ENGINEERING</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours –45						3	0	0	3			
	Prerequisite – Manufacturing Processes ,Manufacturing Technology												
	Course Coordinator Name & Department – Mrs. G. Sucharitha/ Department of Mechanical Engineering												
<b>OBJECTIVES:</b> To impart knowledge in undertaking market research, demand forecasting and costing for designing plant, operation, production, maintaining standards of professional ethics.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	After completing the course students will be able to understand the industrial engineering concept and apply in the industrial engineering Environment.												
CO2	Describe different aspects of production planning and control in manufacturing industries.												
CO3	Demonstrate the knowledge of designing plants and controlling Production												
CO4	Students will able to analyzeand implement different concepts involved in methods study and understanding of work content in different situations.												
CO5	Students will be able to build leadership qualities and develop communication skills.												
CO6	Students will be able to create control charts for different attributes and understand the acceptable quality levels in the in the production.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			3	3								
	CO2				3					3			1
	CO3	1						3					
	CO4		1					3		2			
	CO5												
	CO6									2			
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

## UNIT I

9

Definitions-Productivity, Effectiveness, and Types-Factors Influencing Productivity-Techniques To Improve Productivity, Technology Based Techniques and material Based Productivity Improvement-Inventory Control-M.R.P-Quality Circles-Brainstorming-Pareto Analysis-Cause And Effect Analysis-TQM-Zero Defects-Flextime-Just In Time-Ergonomics-Reliability Improvement-Modular Design-Maintainability.

## UNIT II

9

Types of Layout, Its Advantages and Disadvantages-Preference of Different Types of Layout, Plant Location and Decision-Definitions: Group Technology-Principles of Material Handling. Loading- Master Scheduling- Perpetual Loading-Order Scheduling-Loading By Scheduled Method-Index Method Of Scheduling-Factors Influencing Scheduling-Production Planning And Control-Routing And Dispatching-Job Card-Job Order-Order Control And Machine Load Chart.

**UNIT III****9**

Techniques of Work Study-Procedure-Method Study, Types of Process Charts and Diagrams-Multiple Activity Chart-Utility-Time Study-Micro Motion Time Study-PMTS-Work Sampling-Job Analysis-Job Evaluation and Merit Rating-Wage and Wage Incentive.

**UNIT IV****9**

Introduction-Nature And Scope-Objectives-Hawthorne Studies And Its Conclusion-Individual Behaviour-Group Behaviour,Types Of Groups-Formal And Informal Organizations-Fatigue – Accident,MajorFactors,Prevention-Importance And Methods Of Training To The Employees, Methods And Aids-Leadership And Leadership Styles-Communication And Its Importance.

**UNIT V****9**

Introduction to Quality Control-Statistical Measures-Control Chart-Types –Control Chart for Attributes-Control Chart for Number of Defects per Unit-Acceptance Sampling-Basic Probability-Normal Distribution-Acceptable Quality Level-Lot Tolerance Percent Defective-Average Outgoing Quality

**TEXT BOOKS:**

1. Khanna.O.P. Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
2. Kumar B, Industrial Engineering, Hanna Publishers,2004
3. Ramachandran S and K.Pandian Principles Of Management And Industrial Psychology, Air Walk Publishers, 2007.

**REFERENCES:**

1. Gupta And Petal, Work Study- Khanna Publishers, 1998.
2. [onlinevideolecture.com/ebooks/?subject=Industrial%20Engineering...](https://onlinevideolecture.com/ebooks/?subject=Industrial%20Engineering...)

**Course Coordinator**

Mrs.G.Sucharitha

**HOD**

Dr. K. Balasubramanian

U18PEME2 1	<b>POWER PLANT ENGINEERING</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours – 45					3	0	0	3				
	Prerequisite – Applied Thermodynamics												
	Course Coordinator Name & Department – Dr.S.Thirumavalavan / Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
To understand the various components, operations and applications of different types of power plants													
To provide an overview of power plants and the associated energy conversion issues													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Remembers the types of turbines, boilers and condensers.												
CO2	Understands the types of boilers and working of generators												
CO3	Analyze the different types of reactors and learn the key knowledge.												
CO4	Students understand the facts and ideas of hydro power plants												
CO5	Students are able to learn and evaluate the tariffs.												
CO6	Student understands the installation of nuclear power plants and their advantages and disadvantages												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	K	l
2	CO1	3											2
	CO2			3		1				3		1	
	CO3	3					2						
	CO4			3		1		2					
	CO5									3			
	CO6	3					1						
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

**OBJECTIVES:**

To provide an overview of power plants and the associated energy conversion issues

**CONTENTS:**

**UNIT-I**

(9)

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

**UNIT-II**

(9)

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

**UNIT-III**

(9)

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

**UNIT-IV****(9)**

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

**UNIT-V****(9)**

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

**TEXT BOOKS:**

1. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
2. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2<sup>nd</sup> ed., McGraw Hill, 1998.
3. Nag P.K., Power Plant Engineering, 3<sup>rd</sup> ed., Tata McGraw Hill, 2008.

**REFERENCES:**

1. Nagpal G.R- Power plant Engineering-Khanna publishers, Delhi, 1998
2. Rai G.D-Power plant engineering,khanna publishers, 2000

**Course Coordinator**

Dr.S.Thirumavalavan

**HOD****Dr. K. Balasubramanian**

U18PEME2 2	<b>TRIBOLOGY</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours – 45						3	0	0	3			
	Prerequisite – Materials science, Machine design.												
	Course Coordinator Name & Department – Mr. Jose Ananth Vino/Department of Mechanical Engineering												
<b>OBJECTIVES:</b> To understand the theories of friction and wear and to design best bearings .													
<b>COURSE OUTCOMES (COs)</b>													
CO1	The students will be able to apply theories of friction to various practical situations by analyzing the physics of the process.												
CO2	The students will be able to understand the various types of wears and wear mechanism.												
CO3	They will understand the various surface measurement techniques and effect of surface texture on Tribological behavior of a surface.												
CO4	They will be able to select materials and lubricants to suggest a tribological solution and will be able to design journal bearings												
CO5	The students will be able to design a rolling contact bearing.												
CO6	The students will be able to understand the recent developments in the field and can offer tribological solutions												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	L
2	CO1	3											2
	CO2			3		1				3		1	
	CO3	3					2						
	CO4			3		1		2					
	CO5									3			
	CO6	3					1						
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

**Unit 1:** Friction, theories of friction, Friction control, Surface texture and measurement, genesis of friction, instabilities and stick-slip motion.

**Unit 2:** Wear, types of wear, theories of wear, wear prevention.

**Unit 3:** Tribological properties of bearing materials and lubricants.

Lubrication, Reynolds's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed shoe sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), Finite Bearings, Design of hydrodynamic journal bearings

**Unit 4:** Hydrostatic, squeeze film Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings and design of Journal bearings.

**Unit 5:** Elasto-hydrodynamic lubrication – pressure viscosity term in Reynolds's equation, Hertz' theory, Ertel-Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Air lubricated bearings, Tilting pad bearings, design of rolling contact bearings.

**References:**

Cameron, "Basic Lubrication Theory", Ellis Horwood Ltd, 1981.

Principles in Tribology, Edited by J. Halling, 1975

Fundamentals of Fluid Film Lubrication – B. J. Hamrock, McGraw Hill International, 1994

Design data book compiled by PSG college of technology.

**Course Coordinator**

Mr. Jose Ananth Vino

**HOD**

**Dr. K. Balasubramanian**

U18PEME2 3	<b>COMPOSITE MATERIALS AND TECHNOLOGY</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours –45							3	0	0	3		
	Prerequisite – Materials Engineering												
	Course Coordinator Name & Department – Dr. C.M.Meenakshi ,Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
To understand the mechanical behaviour of composite materials To get an overview of the methods of manufacturing composite materials													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the students will able to discover the mechanical behaviour and application of composite materials												
CO2	students will be able to understand the fundamentals of composite material strength and its mechanical behavior												
CO3	Students will be able to analyze fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.												
CO4	Students will be able to demonstrate the thermo-mechanical behavior and study of residual stresses in Laminates during processing applying Laminate Theories (CLT)												
CO5	Students will be able appraise the residual stresses in an isotropic layered structure such as electronic chips.												
CO6	Students will be able design composite material with respect to application's mechanical strength requirement.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	G	h	I	J	K	L
2	CO1	3			1				2			1	
	CO2	3						3	2			1	1
	CO3			3	2	3		1				1	
	CO4					2		3				1	
	CO5				2	2							
	CO6		1	3					3	2			
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

## UNIT I

12

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction

of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

## **UNIT II**

**8**

Manufacturing of composite materials-Fiber Reinforced Composites- Fundamentals- bag moulding, compression moulding, pultrusion, filament winding, other manufacturing processes- Metal Matrix composites- Powder Metallurgy- Diffusion Bonding-Melt Stirring-Rheocasting- squeeze casting, , other manufacturing processes

## **UNIT III**

**9**

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai-Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

## **UNIT IV**

**8**

Performance of laminates – Static Mechanical Properties- Test Method and Analysis, Unidirectional Laminate, Cross Ply Laminates and Multidirectional Laminates- Compressive Properties-Flexural Properties-Inter laminar shear strength—Fatigue properties-Impact Properties- Environmental Effect

## **UNIT V**

**8**

Failure predictions-design considerations-joint design-codes-design examples.Optimization of laminated composites-Application of FEM for design and analysis of laminated composites-static bending analysis, buckling analysis, free vibrations, natural frequencies.

## **TEXTBOOKS:**

1. Daniel gay, Composite Materials, CRC Press, 3<sup>rd</sup> edition.
2. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.
3. Krishnan Chawla ,Composite Materials Science and Engineering, Springer publications,2012.
4. Mallick P.K , Fiber Reinforced Composites –Materials ,Manufacturing and Design-CRC Press- 3<sup>rd</sup> edition

## **REFERENCES:**

1. Michael Hyer, Stress Analysis of Fiber- reinforced composite Materials, Tata McGraw Hill, 1998.
2. Ronald Gibson, Principles of Composite Material Mechanics, Tata McGraw Hill, 1994.
3. <http://www.springer.com/in/book/9780387743646>
4. [https://books.google.co.in/books/about/Composite\\_Materials.html?id=5Q6oUTFO0RgC](https://books.google.co.in/books/about/Composite_Materials.html?id=5Q6oUTFO0RgC)

**Course Coordinator**  
**Dr.C.M.Meenakshi**

**HOD**  
**Dr. K. Balasubramanian**

U18PEME24	<b>INDUSTRIAL ROBOTICS</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 45							3	0	0	3		
	Prerequisite –BacisElectrical and Electronics Engineering												
	Course Coordinator Name & Department –R.Hariharan ,Department of Mechanical Engineering												
<b>OBJECTIVE:</b>													
<ul style="list-style-type: none"> <li>To understand the basic concepts associated with the design and Functioning and applications of Robots To study about the drives and sensors used in Robots</li> <li>To learn about analyzing robot kinematics and robot programming</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	recognize the basic engineering												
CO2	demonstrate the design of robotics												
CO3	experiment with robot kinematics and robot programming												
CO4	To survey recent application of Robots												
CO5	Explain about force and torque sensing												
CO6	Topredict learnn about material handling												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	2											
	CO2					3			2				2
	CO3	2											
	CO4					3					1		
	CO5	2		3		3							
	CO6	2											
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

## UNIT I

9

Definition of Robot – Laws of Robotics – Basic concepts – Robot Configuration – Types of Robot drives – Basic Robot motions – Point to Point control – Continuous path control – Accuracy and repeatability.

**UNIT II** **9**  
 Control system components–Control system analysis–Actuation and feed back– manipulators – Direct kinematic model and inverse kinematic model – Coordinate transformation – Robot dynamic modeling – Types of Robot and end effectors - Tools as end effectors

**UNIT III** **9**  
 Range sensing – Proximity sensing – touch sensing – force and torque sensing.Introduction to machine vision – Sensing and digitalizing – Image processing and analysis.

**UNIT IV** **9**  
 Methods online/ offline – Show and teach – Teach pendant – lead and teach – Languages Explicit – task level – capabilities and limitation – Artificial intelligence – Knowledge representation – Search techniques.

**UNIT V** **9**  
 Applications of robots in machining – Welding – Assembly – Material handling – processing – Loading and un loading – CIM inspection – Hostile and remote environments – Non industrial applications.

**TEXTBOOK:**

1. Michael P.Groover, Mitchell Weiss, Industrial Robotics Technology Programming and applications, - McGraw Hill International Editions, 1989.

**References:**

1. Fu K.S, R.C. Gonzalez , C.S.G. Lee, Robotics, Control sensing, Vision and Intelligence, - McGraw Hill International Editions, 1987.
2. Michael – B.Histland, David. G. Aliatoce., Introduction to Mechatronics and Measurement Systems, McGraw Hill International. Edition, 1999.
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com) > Engineering

**Course Coordinator**  
**R.Hariharan**

**HOD**  
**Dr. K. Balasubramanian**

U18PEME31	<b>GAS DYNAMICS AND JET PROPULSION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45				
	Prerequisite – HEAT TRANSFER	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Course Coordinator Name & Department – Mr. V. Srinivasan,Department of Mechanical Engineering				

**OBJECTIVE:**

- To impart knowledge to the students on compressible flow through ducts, jet propulsion and space propulsion.
- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
- To understand the features of compressible isentropic flows and irreversibilities like shocks.
- To provide a basic knowledge of jet and rocket propulsion technologies.

**Course Outcomes**

CO1	Will be able to recognize compressible flow through ducts, jet propulsion and space propulsion.
CO2	Will understand the basic difference between incompressible and compressible flow.
CO3	Will be able to predict the phenomenon of shock waves and its effect on flow.
CO4	Will derive the jet propulsion concepts
CO5	To solve the rocket propulsion problems
CO6	To compare the types of rocket engine

Mapping of Course Outcomes with Program outcomes (POs)  
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	K	l
2	CO1	3											
	CO2		2										
	CO3			3	2		3			3			
	CO4					1			2				
	CO5							1			1	1	
	CO6												
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

**Objectives:**

- To understand the features of compressible isentropic flows and irreversibilities like shocks.
- To provide a basic knowledge of jet and rocket propulsion technologies.

**Contents:****UNIT I****9**

Compressible fluid flow-energy and momentum equations, stagnation stages, various regions of flow, reference velocities, effect of Mach number on compressibility. Types of waves, Mach cone, Mach angle.

**UNIT II****9**

Flow through variable area ducts-nozzles and diffusers, Mach number variation, stagnation and critical states, area ratio as a function of Mach number. Flow through constant area ducts-

with friction (Fanno flow), with heat transfer (Reyleigh flow), Variation of flow properties. Use of Gas Tables and Charts.

### **UNIT III**

**9**

Governing equations, variation of flow parameters across the normal and oblique shocks. Prandtl-Meyer relations. Flow in variable area ducts with normal shocks. Use of Tables and Charts.

### **UNIT IV**

**9**

Types of jet engines-turboprop, turbojet, ramjet, pulsejet. Aircraft propulsion theory, performance analysis of jet engines, parameters affecting flight performance, thrust augmentation.

### **UNIT V**

**9**

Types of rocket engines, propellants, combustion instabilities, rocket propulsion theory, performance of rocket engine, multistage rockets, orbital and escape velocities.

### **TEXTBOOKS:**

1. Ahmed F. El-Sayed, Aircraft Propulsion and Gas Turbine Engines, CRC Press, 2008.
2. Ganesan V, Gas Turbines, Tata McGraw-Hill Publishing Company Ltd., 2003.
3. H.S. Mukunda, "Understanding Aerospace Chemical Propulsion", Interline Publishing, 2004.
4. Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992.
5. Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986.
6. Yahya S.M. Fundamentals of Compressible Flow, New Age International (P) Ltd., New Delhi, 2003.
7. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975.

### **REFERENCES:**

1. Cohen H. Rogers GFC, Saravanamuttoo H.H., Gas Turbines Theory, Addison-Wesley Longman Ltd., 2001.
2. Khajuria P.R and Dubey S.P., Gas turbines and Propulsive Systems, Dhanpat Rai Publications (P) Ltd, New Delhi 2003.
3. Philip G Hill and Carl R. Peterton, Mechanics and Thermodynamics of Propulsion, Addison-Wesley Publishing Company, 1999.
4. [freecomputerbooks.com/Total-Quality-Management-and-Six-Sigma.htm](http://freecomputerbooks.com/Total-Quality-Management-and-Six-Sigma.htm).

**Course Coordinator**

Mr. V. Srinivasan

**HOD**

Dr. K. Balasubramanian

U18PEME32	<b>DESIGN OF JIGS FIXTURES AND PRESS TOOLS</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours - 45					3	0	0	3				
	Prerequisite – MANUFACTURING TECHNOLOGY												
	Course Coordinator Name & Department – R.Hariharan, Department of Mechanical Engineers												
<b>OBJECTIVES</b>													
To understand the functions and design principles of Jigs, fixtures and press tools To gain proficiency in the development of required views of the final design.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To discover the knowledge on standard components												
CO2	Will summarize and the principle and use of standards												
CO3	Determine the use and design of fixtures												
CO4	Classify the design of press tools												
CO5	Develop the new components using CNC programming												
CO6	Invent the concept of technical design												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3											
	CO2	3		3	2					3			
	CO3			3			2						
	CO4	3		3					2			1	
	CO5	3											
	CO6	3		3									
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

Introduction to jigs & Fixtures - Design principles of jigs & fixtures - Locating principles and elements – Standard parts – Clamping devices, Mechanical ,Pneumatic and hydraulic actuation, Clamping force analysis.

**UNIT II**

**12**

Drill bushes - Different types of jigs- plate, latch, channel, box, post, angle plate, angular post, turnover, pot jigs - Automatic drill jigs – Rack & pinion operated and Air operated jig components - Design and development of jigs for the given components.

**UNIT III**

**12**

Types of fixtures - Boring, Lathe, Milling, Broaching fixtures – Grinding, Planning and Shaping fixtures – Assembly, Inspection and Welding fixtures – Modular fixtures – Design and development of fixtures for the given components.

**UNIT IV**

**12**

Press working terminology - Types of Presses and Press Accessories – Computation of capacities and tonnage requirements – Strip layout

**UNIT V**

**12**

Design and development of various types of Cutting, Forming and Drawing dies – Blank development for cylindrical and non cylindrical shells – Compound , Progressive and Combination dies.

**TEXTBOOK:**

1.Design of Jigs, Fixtures and Press tools, C.Elanchezhian,T.Sunderselvan, Vijayaramnath B, Eswar Press, 2005.

**REFERENCES :**

1. Akgoroshkin, Jigs and Fixture Handbook, Mix Publishers, Moscow, 1983 .
2. ASTME Handbook of Fixture design,1960.
3. Design Data, PSG Tech, Coimbatore, 2003.
4. Fundamentals of tool Design ASTME, 1984.
5. <https://www.overdrive.com/media/.../design-of-jigs-fixtures-and-press-to...>

**Course Coordinator**  
**R.Hariharan**

**HOD**  
**Dr. K. Balasubramanian**

U18PEME3 3	<b>UNCONVENTIONAL MACHINING PROCESS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Manufacturing Processes				
	Course Coordinator Name & Department – Dr. R. J. Golden Renjith Nimal ,Department of Mechanical Engineering				
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>• To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications</li> </ul>					
<b>COURSE OUTCOMES (COs)</b>					

CO1	Upon completion of this course, the students can able to demonstrate different unconventional machining processes and know the influence of difference process parameters on the performance and their applications.												
CO2	To understand the need and importance of non traditional machining methods.												
CO3	To learn the basic principle, equipment, process variables and mechanics of metal removal in abrasive jet machining and water jet machining.												
CO4	To study the fundamentals of tool design, surface finishing and metal removal rate of electro chemical grinding , electro chemical machining and electro chemical honing.												
CO5	To understand principles of operation, types of electrodes and process parameters and machine tool selection in EDM and Electric discharge grinding and wire cut process.												
CO6	To learn the basics of Electron Beam Machining and comparison of thermal and non thermal processes.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	J	K	l
2	CO1	3	1	3			1	1	1	1			
	CO2	1	2	3			1	1	2	3	3	1	
	CO3	1	1	2								3	
	CO4	2	2	3			1	1	1	3		1	
	CO5	1	2	3								2	
	CO6	1	2	3			1	1	2	1	3		
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I

7

Introduction: Need for non-traditional machining methods-Classification of modern machining processes — considerations in process selection. Materials, Conventional vs Unconventional Machining Processes, Applications parameters, Economic considerations, applications and limitations, recent development

### UNIT II

9

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

### UNIT III

9

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

### UNIT IV

10

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR- Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.

### UNIT V

10

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

**TEXT BOOKS:**

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi.

**REFERENCE BOOKS:**

1. Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York,1987.
2. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

**Course Coordinator**

**HOD**

Dr. R. J. Golden Renjith Nimal

Dr. K. Balasubramanian

U18PEME034	<b>PROCESS PLANNING AND COST ESTIMATION</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours – 45						3	1	0	3			
	Prerequisite – MANUFACTURING PROCESSES												
	Course Coordinator Name & Department – Mr.N.Lenin Rakesh ,Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
To introduce process planning concepts to make cost estimation for various products													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Upon completion of this course, the students will be able to make use of the concepts of process planning and cost estimation for various products												
CO2	Students will be able to do material evaluation and selection for various products.												
CO3	Students will be able to analyze the jigs, fixtures and quality assurance methods												
CO4	Describe the estimating procedure and evaluate different costs in the industry												
CO5	Students will be able to understand the machine time and calculate for different operations												
CO6	Students will be able to estimate forging, welding and foundry costs.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	K	l
2	CO1	3						2				1	2
	CO2		3			2				1			
	CO3		2			3	2			3			
	CO4			1		3					2		
	CO5		2				2			3			2
	CO6	1							3				3

3	Category	Professional Elective
4	Approval	47th Academic Council, July 2018

**UNIT I** **9**  
Introduction of Process Planning- methods of process planning, drawing interpretation, material evaluation, steps in process selection, production equipment and tooling selection

**UNIT II** **10**  
Process planning activities- process parameter calculation for various production processes, selection of jigs and fixtures, selection of quality assurance methods, documents for process planning, economics of process planning, case studies

**UNIT III** **10**  
Introduction to cost estimation- importance of costing and estimation, methods of costing, elements of cost estimation, types of estimates, estimating procedure, estimation of labor cost, material cost, allocation of overhead charges, calculation of depreciation cost

**UNIT IV** **8**  
Machining time estimation- importance of machine time calculation, machining time for different lathe operations, drilling and boring time calculations, Machining time calculation for Milling, Shaping, Planing and Grinding

**UNIT V** **8**  
Production costs- different production processes for different jobs, estimation of forging cost, estimation of welding cost, estimation of foundry cost, estimation of machining cost

**TEXTBOOKS:**

1. Adithian M and B.S. Pabla, Estimation and Costing, Konark publishers Pvt. Ltd., 1989.
2. Chitale A.K and R.C.Gupta, Product Design and Manufacturing, Prentice Hall Pvt. Ltd., 2005
3. Chitale A.V. and Gupta R.C., Product Design and Manufacturing, 2<sup>nd</sup> ed., Prentice Hall 2002.
4. Ostwaal P.F. and Munez J., Manufacturing Processes and Systems, 9<sup>th</sup> ed., John Wiley 1998.
5. Peter Scalon, Process Planning, Design/ Manufacture Interface, Elsevier Sci.&Tech. 2002.

**REFERENCES :**

1. Banga T.R and S.C.Sharma, Estimations and Costing, Khanna Publishers, 1988.
2. <https://books.google.com/books?id=A9-ZXblNrPoC>
3. Joseph G Monks, Operation Management, Theory & Problems, McGraw Hill Book Company, 1987.
4. Namua Singh, System Approach to computer integrated Design and Manufacturing, John Wiley & Sons, Inc., 1996.
5. Narang G.B.S and V.Kumar, Production and Costing, Khanna Publishers, 1995.

**Course Coordinator**

**Mr.N.Lenin Rakesh**

**HOD**

**Dr. K. Balasubramanian**

		<b>AUTOMOBILE ENGINEERING</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
U18PEME41	Total Contact Hours –45	3	0	0	3								
	Prerequisite – Applied Thermodynamics												
	Course Coordinator Name & Department – Mr. S.Sabarish , Department of Mechanical												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To understand the construction and working principle of various parts of an automobile.</li> <li>To have the practice for assembling and dismantling of engine parts and transmission system</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Will be able to recognize vehicle structures												
CO2	Will be able to explain the different types of engines												
CO3	Transmission systems will be identified												
CO4	Will be able to distinguish the engine auxiliary systems												
CO5	Students will learn to derive and measure forces on vehicle structure												
CO6	Students elaborate about suspension systems and steering wheels												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	3	3	1					2	2		3	3
	CO2	3	3	1					2	2		3	
	CO3								2			3	
	CO4	3	2	1						2			
	CO5	2	3						2	2		2	1
	CO6	2	3	1					2	2		2	
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT-I

9

Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicle aerodynamics, IC engines- components, function and materials, variable valve timing (VVT).

### UNIT-II

9

Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition, capacitive discharge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

### UNIT-III

9

Transmission systems, clutch types & construction, gear boxes- manual and automatic gear shift mechanisms, Over drive, transfer box, flywheel, torque converter, propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

**UNIT-IV****9**

Steering geometry and types of steering gear box, power steering, types of front axle, types of suspension systems, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control.

**UNIT-V****9**

Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells.

**TEXT BOOKS:**

1. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
2. Kirpal Singh, Automobile Engineering, 7<sup>th</sup> ed., Standard Publishers, New Delhi, 1997.

**REFERENCES**

1. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.
2. Heitner J., Automotive Mechanics, 2<sup>nd</sup> ed., East-West Press, 1999.

**Course Coordinator**

Mr. S.Sabarish

**HOD**

Dr. K. Balasubramanian

U18PEME42	<b>MECHANICAL VIBRATIONS</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45										3	0	0	3
	Prerequisite – Theory of Machines													
	Course Coordinator Name & Department – Mr. Jose Ananth Vino ,Department of Mechanical Engineering													
<b>OBJECTIVES</b>														
The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components														
<b>COURSE OUTCOMES (COs)</b>														
CO1	Understand the sources of vibration and noise in various appliances.													
CO2	Will be able to develop schematic modes for physical systems and formulate governing equations of motion.													
CO3	Recognize damping stiffness and inertia in mechanical systems.													
CO4	Students will be able to examine rotating and reciprocating systems and evaluate critical speeds													
CO5	Analyze and design machine supporting structures, vibration isolators and absorbers													
CO6	Student will be able to apply all that has been learnt to improve upon newer techniques of reducing vibrations in machines and structures.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1	3							2			1		
	CO2	3		3				2	3	3		1		
	CO3	3		3	3	2		2			1	1		
	CO4	3				2		2		2		1		
	CO5	3				2								
	CO6	3						2	3	2				

3	Category	Professional Elective
4	Approval	47th Academic Council, July 2018

**UNIT I** **9**

Vibration principle- Equilibrium & Energy methods- Free vibrations-Viscous & coulomb damping- Forced vibration EXCITATION- Transmissibility –Resonance -Characteristics.

**UNIT II** **9**

Two degrees of freedom –Matrix form – Undamped free vibration – Principal modes – Coordinate coupling – Principal co-ordinates – Torsional vibrations – Holzer method – Work & Energy approach.

**UNIT III** **9**

Transient vibration – Time dependency – Laplace transforms – Step inputs – Pulse inputs – Duhamel’s integral – Phase plane method – Shock spectrum.

**UNIT IV** **9**

Multi degrees of freedom – Equations of motion – Solution –Orthogonality of normal modes – Continuous system – Free & forced vibrations – Vibration analysis by FEM.

**UNIT V** **9**

Vibration instruments – Vibration absorber –Elastically supported dampers – Seismic instruments –Vibrometers – Pickups – Accelerometers – Mounting instruments – Amplitude & phase distortions.

**TEXTBOOKS**

1. Grover G.K – Mechanical Vibrations – Namchand& Bros. 2001.
2. Singh V.P- Mechanical Vibrations –Dhanpat Rai & Co, 2005.

**REFERENCES:**

1. [booksformech.blogspot.com/.../mechanical-vibrations-by-vpsingh-pdf.ht](http://booksformech.blogspot.com/.../mechanical-vibrations-by-vpsingh-pdf.ht).
2. Francis S.Tse, Iran E. Morse, Rolland T. Hinkle- Mechanical vibrations - CBS Publishers, 1983.
3. Thomson W.T – Theory of vibrations,Uniwin Hyman Ltd/CBS Publishers,1998.
4. Timoshenko S.P – Vibration Problems in Engineering – CBS Publishers, 1985.

**Course Coordinator**

Mr. Jose Ananth Vino

**HOD**

**Dr. K. Balasubramanian**

U18PEME43	<b>ADVANCED TURBO MACHINES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45	3	0	0	3
	Prerequisite – HEAT TRANSFER				
	Course Coordinator Name & Department – Mr.S. Nakkeeran, Department of Mechanical Engineering				
<b>OBJECTIVES</b>					
To develop skilled manpower in the field of turbo machines with the knowledge of					

transport processes through the turbo machine passage, analytical, numerical and experimental tools for design, operation, performance evaluation and innovative research in the area of turbo machines”													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Understand the performance evaluation, operation and maintenance of rotodynamic machines.												
CO2	Will be able to recognize and reproduce conceptual design of different components of thermal and hydro turbo machines.												
CO3	Design turbo machineries												
CO4	Apply the principle of machineries												
CO5	Develop axial and radial flow turbines												
CO6	Learn the principles and categorize the application of turbines												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1												2
	CO2	3	3							2			
	CO3		3				2				2	3	
	CO4	3											2
	CO5		3				2						
	CO6												
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

### UNIT II

9

Types, stage and design parameters, flow analysis in impeller blades, Volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

### UNIT III

9

Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

### UNIT IV

9

Stage velocity triangles, enthalpy-Entropy diagrams, stage losses and efficiency, work down factor, simple stage, design problems and performance characteristics.

### UNIT V

9

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

### TEXTBOOKS:

1. Ganesan V – Gas Turbines - Tata McGraw Hill Publishing Company, New Delhi- 2003.
1. Yahya S.M – Turbines, Compressors and Fans – Tata McGraw Hill Publishing Company,

2005.

**REFERENCES:**

1. Earl Logan Jr, RamendraRoy., Handbook of Turbo Machinery., CRC Press.
2. [https://books.google.co.in/books/about/Advanced\\_topics\\_in\\_turbomachinery\\_techno.html?id=qs9QAAAAYAAJ&redir\\_esc=y](https://books.google.co.in/books/about/Advanced_topics_in_turbomachinery_techno.html?id=qs9QAAAAYAAJ&redir_esc=y)

**Course Coordinator**  
Mr.S. Nakkeeran

**HOD**  
Dr. K. Balasubramanian

		<b>TOTAL QUALITY MANAGEMENT</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
U18PEME44	Total Contact Hours – 45	3	0	0	3								
	Prerequisite – Professional Courses												
	Course Coordinator Name & Department – Dr. V. Balambica/Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
1. To introduce the student about the basic terms related to quality. 2. To familiarize the student about the basic principles of TQM. 3. To acquaint the student about the basic statistical tools used in process control. 5. To introduce the student to use various tools used in implementing and checking total quality management. To familiarize the student about the different quality system used in auditing the quality of a company/industry /organization													
<b>COURSE OUTCOMES (COs)</b>													
CO1	To introduce to the student about the basic terms related to quality and concepts of quality management												
CO2	To illustrate the basic principles of total quality management												
CO3	Demonstrate tool utilization for quality improvement.												
CO4	Explain the various techniques used to measure quality												
CO5	Students will be able to validate a set of ideas on quality improvement.												
CO6	Apply various quality systems and auditing on implementation of TQM.												
<b>Mapping of Course Outcomes with Program outcomes (POs)</b> (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			2		3		2	3	2	1	1	

	CO2			2		3		2	3	2	1	1	
	CO3			2		3		2	3	2	1	1	
	CO4			3		3		2	3	2	1	1	
	CO5			3		3		2	3	2	1	1	
	CO6			3		3		2	3	2	1	1	
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

### UNIT II

9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

### UNIT III

9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

### UNIT IV

9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

### UNIT V

9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

### TEXT BOOKS:

1. Dale H. Besterfield, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

### REFERENCE BOOKS:

1. Evans. J. R. & Lindsay. W.M “The Management and Control of Quality”, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum. A.V. “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland. J.S. “Total Quality Management”, Butterworth Heinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996.
5. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

**Course Coordinator**

**HOD**

Dr. V. Balambica.

**K. Balasubramanian**

U18PEME51	<b>REFRIGERATION AND AIR CONDITIONING</b>					<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>				
	Total Contact Hours - 45					3	0	0	3				
	Prerequisite –Applied Thermodynamics ,BME												
	Course Coordinator Name & Department – Mr.J.Manikandan,Department of Mechanical Engineering.												
<b>OBJECTIVES</b>													
<ul style="list-style-type: none"> <li>To familiarize with the terminology associated with refrigeration systems and air conditioning</li> <li>To understand basic refrigeration processes</li> <li>To understand the basics of psychrometry and practice of applied psychometrics</li> <li>To acquire the skills required to model, analyse and design different refrigeration as well as air conditioning processes and components</li> </ul>													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Will recall the basic concepts associated with refrigeration systems and air conditioning												
CO2	To understand basic refrigeration processes												
CO3	Students are able to examinethe basics of psychrometry												
CO4	To acquire the skills required to model, analyse air-conditioning												
CO5	Student Evaluate the Estimation of cooling load calculations												
CO6	Students can able to create own ideason air conditioning equipments and applications												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			1		2	1				3		2
	CO2							2					
	CO3	2		2			1		2				
	CO4	3	3								2		
	CO5			2									2
	CO6		3										
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

**Use of Psychrometric and Refrigerant tables in the Examination is permitted.**

**UNIT I**

**(9)**

Review of thermodynamics, Principle of Refrigeration, Refrigeration methods-Air refrigeration (Theory only)-Bell-Coleman refrigeration, steam jet refrigeration, and Vapour

compression refrigeration-Uses of P-H charts-Cascade refrigeration, Vapour absorption refrigeration, Comparison of performance and COP

**UNIT II** **(9)**

Refrigerants, properties - Selection of refrigerants. Equipments-compressors-reciprocating, rotary, Condensers-evaporators-Cooling towers – Fans – Ducts

**UNIT III** **(9)**

Review of fundamental properties of air, Psychrometric processes -By pass factor- Requirement of comfort air-conditioning, Comfort and comfort chart, Factors governing optimum effective temperature.

**UNIT IV** **(9)**

Types of heat sources-Heat transmission through buildings, solar heating, Internal heat sources (Sensible & latent), outside air and fresh air load, Estimation of total load.

**UNIT V** **(9)**

Air conditioning equipments-Air filters, humidifiers, dehumidifiers, air washer, Commercial & industrial air conditioning systems, central air conditioning system, Application of refrigeration-Ice plant, Food storage plants, milk chilling plants, cryogenic in medicine & biological use, application of Air conditioning system-Car Industry, Stores and Railway A/C

**TEXT BOOKS:**

1. Arora C.P-Refrigeration & Air conditioning, Tata Machine graw hill, 2008

**REFERENCES:**

1. Jordon and Prister, Refrigeration and Air-conditioning-Tata McGraw Hill.
2. Roy.J.Dossat-Principles of Refrigeration-low price edition, 2001

**Course Coordinator**

Mr.J.Manikandan

**HOD**

**Dr. K. Balasubramanian**

<b>U18PEME52</b>	<b>COMPUTATIONAL FLUID DYNAMICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fluid Mechanics and Machinery				
	Course Coordinator Name & Department – Dr.Ravi,Department of Mechanical Engineering				

**OBJECTIVE:**

- To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.
- To introduce Governing Equations of viscous fluid flows.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.

**COURSE OUTCOMES (COs)**

CO1	Analyze various numerical techniques to find solution of fluid dynamics and heat transfer problems.												
CO2	To develop governing equations of viscous fluid flows												
CO3	To understand the various discretization methods, solution procedures and turbulence modeling.												
CO4	To formulate the calculation of flow field												
CO5	To evaluate the performance of turbulence and algebraic models												
CO6	To examine the heat conduction of Finite Element Methods												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	2											
	CO2					3			2				
	CO3	2											3
	CO4					3					1		
	CO5	2		3		3							
	CO6	2											
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

**UNIT I****9**

Conservation of chemical species-The energy equation-Momentum equation-time averaged equations for turbulent flow-Turbulence-Kinetic energy equation-The general differential equation-Nature of co-ordination-Independent variable-Choice of co-ordinates-one way and two way coordinates

**UNIT II****9**

Nature of numerical methods-Methods of deriving of discretization equations-Taylor series formulation-Variational formulation-Methods of weighted residuals-Control volume formulation

**UNIT III****9**

Steady One Dimensional Conduction- Two and three dimensional conduction-Steady one dimensional convection and diffusion-Discretization equations for two dimensional convection and diffusion

**UNIT IV****9**

Representation of pressure-gradient and continuity equation-staggered grid-momentum equations-pressure and velocity correction-pressure correction equation.Introduction to Finite Element Method-solution of steady heat conduction by FEM-incompressible flow-simulation by FEM.

**UNIT V****9**

One, two equation model-high and low Reynolds number models-Reynolds stress models- Prediction of fluid and heat transfer using standard codes.

**TEXTBOOKS:**

1. Malasangara S., An Introduction to Computational Fluid Dynamics.,2<sup>nd</sup> edition.,TMG.,2010.
2. YunusCengel.,JohnCimbala., Fluid Mechanics,TMG.,2014.

**REFERENCES:**

1. Ghoshdastidar P.S-Computer Simulation of Flow and Heat Transfer-Tata McGraw Hill Publishing Company Ltd 1998.
2. Muralidhar K &Sundarrajan T-Computational Fluid Flow and Heat Transfer-Narosa, 2003
3. Versteeg H.K&Malalasekara W-An Introduction to Computational Fluid Dynamics- Longman.
4. [bookboon.com/en/computational-fluid-dynamics-ebook](http://bookboon.com/en/computational-fluid-dynamics-ebook)

**Course Coordinator**  
Dr.Ravi

**HOD****Dr. K. Balasubramanian**

U18PEME53	<b>MECHANICS OF FRACTURE</b>						<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>			
	Total Contact Hours - 45						3	0	0	3			
	Prerequisite – Mechanics of solids												
	Course Coordinator Name & Department – Mr.Jose Ananth Vino ,Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
The purpose is to give an introduction about fundamental theory in facture mechanics. Knowledge of failure mechanisms and the fracture mechanics is important in many fields of research and industrial applications..													
<b>COURSE OUTCOMES (COs)</b>													
CO1	The student will understand the different types of fractures and associated causes.												
CO2	The student will develop skills in deriving stress field and energy release rate around the crack tip and crack propagation under cyclic loading.												
CO3	Understanding of fracture mechanics and its application.												
CO4	Learn about fatigue crack growth and crack failures												
CO5	Will learn about fracture failure modes												
CO6	Learn fracture repair and analysis												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	3											

	CO2			3									
	CO3							2				1	
	CO4	3		3	3	2	2						
	CO5												
	CO6	3											
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I

9

Introduction- ductile fracture – brittle fracture. Crack in a structure-Griffith criterion cleavage fracture, , fatigue cracking- Service failure analysis. Elastic crack-Elastic crack tip stress field- Solution to crack problems, Effect of finite size stress intensity factor-Special cases- Irwin plastic zone correction – Actual shape of plastic zone- plane stress- plane strain

### UNIT II

9

Energy release rate- criterion for crack growth- Crack resistance curve-Principles of crack arrest- Crack arrest in practice.

### UNIT III

9

Fatigue crack growth test, stress intensity factor, factors affecting stress intensity factor- variable amplitude service loading, retardation model.

### UNIT IV

9

Elastic plastic fracture concepts- crack tip opening displacement- J using FEM.

### UNIT V

9

Fracture design- selection of materials-Fatigue crack growth rate curve- stress intensity factor range- Use of crack growth law.

### TEXTBOOKS:

1. Jean Lemaitre and Jean Louis Chaboche “Mechanics of solid Materials,” Cambridge university press, Cambridge, 1987.
2. Prashant Kumar, Elements of fracture mechanics, Wheeler publishing, 1999.

### REFERENCES:

1. David Broek- “Elementary engineering fracture mechanics” MartinusNijhoff publishers, 1982.
2. John M. Barsom and Stanley T Rolfe, “Fracture and fatigue control in structures”, Prentice Hall, Inc, USA, 1987.
3. [https://apm.iitm.ac.in/smlab/kramesh/book\\_4.htm](https://apm.iitm.ac.in/smlab/kramesh/book_4.htm)

**Course Coordinator**

**HOD**

Mr. Jose Ananth Vino

**Dr. K. Balasubramanian**

U18PEME54	<b>PRINCIPLES OF MANAGEMENT</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45										3	0	0	3
	Prerequisite – Professional Courses													
	Course Coordinator Name & Department – Dr.K.Balasubramanian Department of Mechanical Engineering													
<b>OBJECTIVES</b>														
<ul style="list-style-type: none"> <li>amiliarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior.</li> </ul>														
<b>COURSE OUTCOMES (COs)</b>														
CO1	Recall the concepts of Management													
CO2	Illustrate Management Functions													
CO3	Apply Organization Theory & Approach.													
CO4	Categorize the Concepts of Motivation													
CO5	Perceive the factors contributing to discipline													
CO6	Formulate and compile the concepts of Group Behavior													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1			3	3									
	CO2				3					3				
	CO3	1						3						
	CO4		1					3		2				
	CO5													
	CO6									2				
3	Category	Professional Elective												
4	Approval	47th Academic Council, July 2018												

### UNIT -I

9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor’s – Henry Fayol – Hawthorne experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

### UNIT- II

9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

### UNIT- III

9

Organizing – Theory & Approach – Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow’s Hersberg’s MacClelland’s theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

**UNIT- IV****9**

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

**UNIT -V 9**

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

**TEXT BOOKS:**

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

**REFERENCE BOOKS :**

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delh-110011, 2004.
2. Prasad L.M "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007
4. <https://www.extension.harvard.edu>

**Course Coordinator****HOD****Dr. K. Balasubramanian****Dr. K. Balasubramanian**

U18PEME61	<b>COMBUSTION ENGINEERING</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours – 45										3	0	0	3
	Prerequisite – IC ENGINES													
	Course Coordinator Name & Department – Mr.Manavalan , Department of Mechanical Engineering													
<b>OBJECTIVES</b>														
To understand and analyze the combustion with emphasis on engineering applications.														
<b>COURSE OUTCOMES (COs)</b>														
CO1	Understand various types of fuels and its ppts													
CO2	Students recalling the basic concept of gaseous fuels													
CO3	Will able to comparegaseous and liquid fuels													
CO4	Students are able to examinethe concept of solid fuels													
CO5	students will be able to explain the fluidized bed combustion													
CO6	students will be able to design and executethe fundamentals in combustion of fuels.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	I	j	k	l	

2	CO1	3											
	CO2	3		3				1					
	CO3	3		3		2	2			1		1	
	CO4	3		3									
	CO5	3					2		2				
	CO6	3		3									
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### OBJECTIVES:

To acquire the skills required to model, analyze and design different refrigeration as well as air conditioning processes and components

### CONTENTS:

#### UNIT I

9

Fuels and combustion, Theoretical and actual combustion processes, Enthalpy of formation and enthalpy of combustion, First law analysis of Reacting systems, Adiabatic flame temperature, Entropy change of reacting systems, Second law analysis of reacting systems, problems

#### UNIT II

(9)

Review of types of fuels, Types of flames, Energy balance and furnace efficiency, Burner type, Emissions from gas-fired furnaces, Emissions control, Chamber design, Detonation

#### UNIT III

9

Spray combustion in furnace, spray formation and droplet behaviour, Gas turbine operating parameters, combustor design, ignition delay, and detonation of liquid fuel sprays

#### UNIT IV

9

Drying of solid fuels, devolatilization of solid fuels, stoker-fired boilers, Refuse and biomass fired boilers, Pulverized coal-burning systems, Pulverized coal combustion, Emission from pulverized coal, Problems

#### UNIT V

9

Fluidization fundamentals, combustion in bubbling bed, atmospheric fluidized bed combustion systems, circulating fluidized beds, pressurized fluidized bed combustion, problems.

### TEXTBOOK:

1. Yunus.A.Cengel- A textbook of Thermodynamics

### REFERENCES:

1. Gary.L.Borman, Combustion Engineering-McGraw Hill international Edition,1998
2. Roger.A.Strehlow-Combustion fundamentals- McGraw Hill international Edition,1989.
3. [www.goodreads.com/book/show/3785353-combustion-engineering](http://www.goodreads.com/book/show/3785353-combustion-engineering)

Course Coordinator

HOD

Mr.Manavalan

Dr. K. Balasubramanian

		<b>DESIGN OF HEAT EXCHANGERS</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		Total Contact Hours - 45										3	0	0	3
U18PEME62		Prerequisite – HEAT AND MASS TRANSFER													
		Course Coordinator Name & Department – Mr. S. Karthikeyan/Mechanical													
<b>OBJECTIVES</b>															
To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.															
<b>COURSE OUTCOMES (COs)</b>															
CO1	Students will be able to define the concepts and working principle of heat exchangers.														
CO2	students will be able to explain heat exchanger design.														
CO3	students will be able to calculate compact heat exchanger design.														
CO4	students will be able to determine the concept of cooling tower.														
CO5	students will be able to explain the SHELL type heat exchangers														
CO6	students will be able to discuss the use of other types of heat exchangers, advantages and disadvantages														
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low															
1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l		
2	CO1	3													
	CO2			3		1				3		1	2		
	CO3	3					2								
	CO4			3		1		2							
	CO5									3			2		
	CO6	3				1									
3	Category	Professional Elective													
4	Approval	47th Academic Council, July 2018													

**UNIT I**

9

Thermal And Hydraulic design – Inner pipe – Annulus, Hairpin heat exchanger – Basic inner tube – Finned multi tubes – Parallel and series arrangements – Pressure drop, Constructional features. Heat pipes – Structures – Applications – Basic relations – Performance characteristics – Effect of working fluid and operating temperatures, Wick – Selection of materials – bore size.

**UNIT II**

9

Basic components – shell – tube bundles – baffles – type and geometry, design procedure – preliminary estimation of size, pressure drop and Heat transfer calculations – shell and tube sides – Kenn method – Bell – Delaware methods.

**UNIT III**

9

Compact Heat Exchangers – types – constructional features, heat transfer and pressure drop calculations – Finned plate and tube. Gasketed plate Heat Exchangers - constructional features plate, pack and flame – Operational characteristics – Flow arrangements, Heat transfer and pressure drop calculations, Performance analysis, Comparison with other types of heat exchangers.

#### **UNIT IV**

**9**

Shell and tube condensers – Horizontal and vertical types – Design and operational consideration, Plate condensers, Air cooled and direct contact type condenser for refrigeration, Evaporative condensers. Evaporators for refrigeration and air conditioning – Chillers – air coolers – thermal analysis – Shah, Kandhkar and Ghnkor and Winterom Correlations, Standard types.

#### **UNIT V**

**9**

Cooling towers - Types – Basic relation – Heat balance and heat transfer characteristics and effect of packing – Geometry, Spray design, Selection of pumps, fans, testing, Maintenance, environmental effects, wind load, typical installations.

#### **TEXTBOOK:**

1. Rajput R.K- Heat and mass Transfer- S Chand Publications, Jan 2008

#### **REFERENCES:**

1. Arthur.P.Fraas, - Heat exchanger Design, John Willey & Sons, 1997.
2. Holger Martin - Heat exchangers – Hemi sphere Publishing Corporation, London.
3. Kenn.D, - Process heat transfer – Tata McGraw Hill, 1980.
4. SadikKakal&Homgton Lin – Heat Exchangers – CRC Press, London, 1998.
5. <https://www.crcpress.com/Heat-Exchanger-Design-Handbook/.../978142...>

**Course Coordinator**

**HOD**

**Mr. S. Karthikeyan**

**Dr. K. Balasubramanian**

U18PEME63	<b>RAPID PROTOTYPING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45	3	0	0	3
	Prerequisite – Manufacturing Technology				
	Course Coordinator Name & Department – Mr. Lenin Rakesh ,Department of Mechanical Engineering				
<b>OBJECTIVES</b>					
<ul style="list-style-type: none"> <li>To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields.</li> </ul>					
<b>COURSE OUTCOMES (COs)</b>					
CO1	Generating a good understanding of RP history, its development and applications. Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.				
CO2	Students will be exposed to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.				
CO3	Students will learn and evaluate steriolithography methods and concepts for improvement.				
CO4	Students recognize and learn processes in CAD				
CO5	Students gain knowledge to build and analyse prototypes				

CO6	Students will be able to apply and process newer techniques and improved methodologies												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	l
2	CO1	3											
	CO2	3		3	2					3			
	CO3			3			2						
	CO4	3		3					2			1	
	CO5	3											
	CO6												
3	Category	Professional Elective											
4	Approval	47th Academic Council, July 2018											

### UNIT I

10

Introduction - Basic operation –impact of rapid proto typing and tooling on product development- benefits-applications.

### UNIT II

10

Rapid Prototyping Processes: Introduction –Classification-laminated object manufacturing-fused deposition modeling-stereolithography-solid ground curing –selective laser sintering-3D printing

### UNIT III

10

CAD Processes: Introduction –data requirements-solid modeling –surface modeling .geometric processing –interface formats-model preparation-slicing, support structures and machine instructions

### UNIT IV

5

Materials for Rapid Prototyping: Plastics- resins -metals-ceramics selection of materials for suitable processes – advantages-limitations

### UNIT V

10

Rapid Tooling Processes: Introduction - Classification in direct rapid tooling-silicon rubber Moulding-epoxy Moulding-electro forming-vacuum casting-vacuum forming-rapid tools for injection Moulding – direct rapid cooling processes –SLS rapid tool- shape deposition manufacturing- laser deposition lamination-rapid tooling roots

### TEXTBOOKS:

1. “Additive Manufacturing Technologies” by Ian Gibson and David Rosen
2. “Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit” by SabrieSoloman
3. “Design for Additive Manufacturing” by Dr Tom Page
4. Rapid Prototyping Principles and applications by Rafiq Noorani, John Wiley and Sons, Inc (R2)

### REFERENCES :

1. Paul F. Jacobs, Rapid Prototyping and Manufacture. Fundamentals of Stereolithography,1995
2. Rapid News, University of Warwick. UK 1995
3. Rapid Prototyping by Chee kai Chua, KahfaiLeong, Chu Sing Lim, 3<sup>rd</sup> Edition, ebook.

4. Rapid Prototyping reports, CAD/CAM publishing ,1991

**Course Coordinator**

**HOD**

**Dr. K. Balasubramanian**

U18PEME06 4	<b>PLANT LAYOUT AND MATERIAL HANDLING</b>							<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>		
	Total Contact Hours – 45							3	0	0	3		
	Prerequisite –Manufacturing Technology												
	Course Coordinator Name & Department – Mr. G. Sucharitha,Department of Mechanical Engineering												
<b>OBJECTIVES</b>													
To equip students with adequate knowledge for running an organization and to understand the integration of material handling systems.													
<b>COURSE OUTCOMES (COs)</b>													
CO1	Understand the procedures for systematic integration of organization.												
CO2	Students will be able to design various layouts for installing the industries are departments												
CO3	Students will be able to choose the right material handling system to the right place.												
CO4	Students will be able to make the models of buildings and other channels according to utilization.												
CO5	Students will be able to analyze the safety, movement of material and man in the plant.												
CO6	After completion of this course students able to describe the plant layout, material handling systems and different building utilities.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	G	H	i	J	K	l
2	CO1	3											

	CO2	3		3				1				
	CO3	3		3		2	2			1		1
	CO4	3		3								
	CO5	3					2		2			
	CO6	3		3								
3	Category	Professional Elective										
4	Approval	47 <sup>th</sup> Meeting of Academic Council, July 2018										

### UNIT I 8

Plant Location: Factors to be considered – influence of location on plant layout, selection of plant site, Consideration in facilities planning and layout. Equipments required for plant operation, Capacity, serviceability and flexibility and analysis in selection of equipments, space requirements, and man power requirements.

### UNIT II 8

Plant layout: Need for layout, types of layout, factors influencing product, process. Fixed and combination layout: tools and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models – machine data. Layout planning procedure. Visualization of layout, revision and improving existing layout, balancing of fabrication and assembly lines.

### UNIT III 10

Importance and scope. Principles of material handling. Planning, operating and costing Principles, types of material handling systems, factors influencing their choice. Assembly practices: Manufacturing and assembly, process planning, selective assembly.

### UNIT IV 12

Industrial building and utilities: Centralized electrical, pneumatic water line systems. Types of buildings, lighting, heating, air conditioning and ventilation utilities - planning and maintenance, waste handling, statutory requirements. Packing and storage materials: Importance of Packaging, layout for Packaging – Packaging machinery – wrapping and Packing materials, cushion materials.

### UNIT V 7

Motion analysis, flow analysis, graphic analysis, safety analysis, equipment cost analysis, palletization analysis, analysis of operation, material handling surveys.

#### TEXT BOOKS :

1. Agarwal, Plant layout and material handling, Jain brothers publication.
2. Sharma S.C, Plant layout and material handling, Khanna publishers.

#### REFERENCES :

1. Oberman. Ya, Material handling, Mir publishers.1980
2. Sharma S.C, Material Management And Material Handling, Khanna Publishers.1995.
3. Shubin J A, Plant layout, P H I publications.1965
4. <https://books.google.com/.../Plant Layout and Material Handling.html?...>

**Course Coordinator**  
Mr. G. Sucharitha

**HOD**  
Dr. K. Balasubramanian

### OPEN ELECTIVES

U18OEME001	<b>DESIGN FOR MANUFACTURING AND ASSEMBLY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45	3	0	0	3
	Prerequisite – Manufacturing Technology				
	Course Coordinator Name & Department – Mr. Arun Rejus/Department Mechanical Engineering				
Approval	47th Academic Council, July 2018				

### SYLLABUS

#### Unit 1

Introduction Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Selection of Materials and Shapes

#### Unit 2

Properties of Engineering Materials, Selection of Materials – I, Selection of Materials – II, Case Studies – I, Selection of Shapes, Co-selection of Materials and Shapes, Case Studies – II,

#### Unit 3:

Selection of Manufacturing Processes, Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design for Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy, Design for Polymer Processing, Co-selection of Materials and Processes, Case-Studies – III

#### Unit 4

Design for Assembly, Review of Assembly Processes, Design for Welding – I, Design for Welding – II, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case-Studies – IV

#### Unit 5

Design for Reliability, Failure Mode and Effect Analysis and Quality, Design for Quality, Design for Reliability, Approach to Robust Design, Design for Optimization,

#### REFERENCES

1. M F Ashby and K Johnson, Materials and Design - the art and science of material selection in product design, Butterworth-Heinemann, 03.
2. G Dieter, Engineering Design - a materials and processing approach, McGraw Hill, NY, 00.
3. M F Ashby, Material Selection in Mechanical Design, Butterworth-Heinemann, 1999.
4. T H Courtney, Mechanical Behavior of Materials, McGraw Hill, NY, 00.
5. K G Swift and J D Booker, Process selection: from design to manufacture, London: Arnold, 1997.
6. S S Rao, Engineering Optimization: theory and practice, John Wiley, NY, 1996.
7. G Boothroyd, P Dewhurst and W Knight, Product design for manufacture and assembly, John Wiley, NY: Marcel Dekkar, 1994.
8. J G Bralla, Handbook for Product Design for Manufacture, McGraw Hill, NY, 1998.
9. Houldcroft, Which Process – an introduction to welding and related processes and guide to their selection, Cambridge, Abington Pub., 1990.
10. ASTM Design handbook.

#### Course Coordinator

Mr. Arun Rejus

#### HOD

Dr. K. Balasubramanian

U18OEME002	<b>INDUSTRIAL SAFETY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45	3	0	0	3
	Prerequisite –				
	Course Coordinator Name & Department – Mrs.G.Sucharitha /Mechanical				
Approval	47th Academic Council, July 2018				

**Unit-I:** Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**Unit-II:** Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**Unit-III:** Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**Unit-IV:** Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

**Unit-V:** Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

**Reference:**

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

**Course Coordinator**

Mrs.G.Sucharitha

**HOD**

**Dr. K. Balasubramanian**

U18OEME003	<b>REFRIGERATION AND CRYOGENICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45	3	0	0	3
	Prerequisite –				
	Course Coordinator Name & Department – Mr.J.Manikandan, Department Mechanical Engineering				
Approval	47th Academic Council, July 2018				

**Unit I**

Vapour compression refrigeration, actual cycle, second law efficiency,

**Unit II**

Multistage compression with inter-cooling, Multi-evaporator systems, Cascade systems,

**Unit III**

Performance characteristics and capacity control of reciprocating and centrifugal compressors, screw compressor and scroll compressor,

**Unit IV**

Design, selection of evaporators, condensers, control systems, motor selection, Refrigerants, alternative refrigerants, CFC/HCFC phase-out regulations, Refrigeration applications, food preservation, transport,

**Unit V**

Introduction to Vapor absorption refrigeration, single effect and double effect systems, Gas liquefaction systems - Linde-Hampson, Linde dual pressure, Claude cycle.

**References:**

1. R.J.Dossat, "Principles of Refrigeration", Pearson Education Asia, 2001.
2. C.P.Arora, "Refrigeration and Air-conditioning", Tata McGraw-Hill, 2000.
3. Stoecker & Jones, "Refrigeration and Air-conditioning", McGraw Hill Book Company, New York, 1982.
4. Jordan & Priester, "Refrigeration and Air-conditioning".
5. A.R.Trott, "Refrigeration and Air-conditioning", Butterworths, 2000.
6. J.L.Threlkeld, "Thermal Environmental Engineering", Prentice Hall, 1970.
7. R.Barron, "Cryogenic systems", McGraw-Hill Company, New York, 1985.
8. G.G.Hasseldon. "Cryogenic Fundamentals", Academic Press.
9. Bailey, "Advanced Cryogenics", Plenum Press, London, 1971.
10. W.F.Stoecker, "Industrial Refrigeration Handbook", McGraw-Hill, 1998.
11. John A.Corinchock, "Technician's Guide to Refrigeration systems", McGrawHill.
12. P.C.Koelet, "Industrial Refrigeration: Principles, Design and Applications", Macmillan, 1992.
13. ASHRAE HANDBOOKS (i) Fundamentals (ii) Refrigeration.
14. Graham Walker, "Miniature Refrigerators for Cryogenic Sensors and Cold Electronics", Clarendon Press, 1989

**Course Coordinator**

Mr.J.Manikandan

**HOD**

Dr. K. Balasubramanian

U18OEME004	<b>PRODUCTION DESIGN &amp; DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	Total Contact Hours –45	3	0	0	3
	Prerequisite –				
	Course Coordinator Name & Department – Dr.V.Balambica, Department Mechanical Engineering				
Approval	47th Academic Council, July 2018				





