



**PERIYAR
MANIAMMAI**
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ skill Development offered by the Mechanical engineering

DEPARTMENT OF MECHANICAL ENGINEERING

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	ProgrammeName
i.	Bachelor of Technology(Mechanical Engineering)(Full Time)
ii.	Master of Technology(Renewable Energy)(Full Time)
iii.	Master of Technology(Renewable Energy)(Part Time)

2. Syllabus of the courses as per the list.

Legend : Words highlighted with **Blue Color** - Entrepreneurship
Words highlighted with **Red Color** - Employability
Words highlighted with **Purple Color** - Skill Development

Name of the Course	Course Code	Year of introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
2020-21 ACADEMIC YEAR			
Calculus and Linear Algebra	XMA101	2018-19	*****
Programming for Problem Solving	XCP102	2018-19	*****
English	XGS103	2018-19	Skill Development – Assignment, Note Taking, Library Skills, Group Discussion
Applied Chemistry for Engineers	XAC104	2018-19	*****
Workshop Practices	XWP105	2018-19	Skill Development - Hands on Training, Record Note
Calculus, Ordinary Differential Equations and Complex Variable	XMA201	2018-19	*****
Environmental Sciences	XES202	2018-19	Skill Development - Assignment, Oral Presentation, Seminar, Debate, Group Discussion
Electrical and Electronic Engineering Systems	XBE203	2018-19	*****
Applied Physics for Engineers	XAP204	2018-19	*****
Engineering Graphics	XEG205	2018-19	Skill Development understand the product or machine design details and dimensions
PDE, Probability & Statistics	XME301	2018-19	*****
Thermodynamics	XME302	2018-19	*****
Strength of Materials	XME303	2018-19	Skill Development -One day training course on 3D stress analysis in CAD systems. Activity: Creating stress distribution in mechanical components
Engineering Mechanics	XEM304	2018-19	*****

Entrepreneurship Development	XUM305	2015-16	Entrepreneurship-Business plan preparation, Chart work, Assignment, Case study
Manufacturing Processes	XME306	2018-19	Skill Development on Jig design, Linear and angular measuring equipments principle of operation and applications, Solve linear programming problems.
Inplant Training – I	XME307	2015-16	Employability- Case study Report, Preparation of Report, Industrial Training, IPT book preparation
Applied Thermodynamics	XME401	2018-19	*****
Solid Mechanics	XME402	2018-19	Skill Development on Three day training course on design and analysis software (ANSYS) Activity: Stress and deformation study on basic mechanical elements using ANSYS.
Human Ethics, Values, Rights and Gender Equality	XUM403	2015-16	Skill Development - Assignment, Oral Presentation, Seminar, Debate, Group Discussion
Fluid Mechanics & Fluid Machines	XME404	2018-19	Skill Development -Mettur Dam visit
Materials Engineering	XME405	2018-19	*****
Instrumentation & Control	XME406	2018-19	Skill Development- on understanding of various Instruments
Operation Research	XME501	2008-09	*****
Heat Transfer	XME502	2008-09	*****
Automobile Engineering	XME503	2013-14	*****
CAD/CAM	XME504	2008-09	Skill development Two day training on CAM simulation at CAD/CAM lab, Geometric modeling analysis.
Kinematics & Theory of Machines	XME505	2018-19	*****

Constitution of India	XUM506	2018-19	Skill Development on Various laws and acts
Mechanical Engineering Laboratory I (Thermal)	XME507	2018-19	*****
Inplant Training – II	XME508	2015-16	Employability- Case study Report, Preparation of Report, Industrial Training, IPT book preparation
CNC Programming for Lathe Operations	XMEM01	2018-19	Skill Development on CNC Part programming and Lathe Operations
Economics for Engineers	XUM601	2015-16	Skill Development- Case study, Assignment, Seminar, Slip test
Manufacturing Technology	XME602	2015-16	Skill Development on Jig design, Linear and angular measuring equipments principle of operation and applications, Solve linear programming problems.
Design of Machine Elements	XME603	2008-09	*****
Elective-I			*****
Elective-II			*****
Mechanical Engineering Laboratory II (Design)	XME606	2018-19	*****
Pneumatics and Hydraulics	XMEM02	2018-19	Skill Development on various Pneumatics and Hydraulics applications
Open Elective – II			*****
Fluid Power Engineering and Mechatronics	XME702	2013-14	*****
Heat and Mass Transfer	XME703	2008-09	*****
Professional Elective – III	XME704		*****
Professional Elective – IV	XME705		*****
Cyber Security	XUM706	2013-14	*****

Project Phase – I	XME707	2015-16	Employability - Design, Analysis Fabrication, Testing , Report preparation
Career Development Skills	XGS708	2015-16	Skill Development - Assignment, Seminar, Group Discussion
In-plant Training – III	XME709	2016-17	Employability - Case study Report, Preparation of Report, Industrial Training, IPT book preparation
Open Elective – III			*****
Professional Elective – V	XME802		*****
Professional Elective – VI	XME803		*****
Project Phase – II	XME804	2015-16	Employability - Design, Analysis Fabrication, Testing , Report preparation
B.TECH -MECHANICAL ENGINEERING - PART TIME			
2020-21 – ACADEMIC YEAR – NIL			
M.TECH RENEWABLE ENERGY (FULL TIME)			
2020-21 – ACADEMIC YEAR			
Solar Energy Systems	YRE101	2007-08	*****
Wind energy, Tidal energy and OTEC	YRE102	2007-08	*****
Process Modelling and Simulation in Energy Systems	YRE103	2007-08	Skill Development on Simulation and modeling of various energy equipments
Elective – I		2007-08	*****
Elective – II		2007-08	*****
Solar Energy Lab	YRE106	2007-08	*****
Research Methodology and IPR	YRM107	2018-19	Skill Development on how to write the paper and patent it

English for Research Paper Writing	YEGOE1	2018-19	Skill Development– Assignment, Note Taking, Library Skills, Group Discussion
MAT and SCI Lab	YRE109	2018-19	*****
Bio Energy Systems	YRE201	2007-08	*****
Computational Fluid Dynamics	YRE202	2007-08	Skill Development on flow analysis
Electrical Energy Technology	YRE203	2007-08	*****
Elective – III		2007-08	*****
Elective – IV		2007-08	*****
Bio Energy and CFD Lab	YRE206	2007-08	*****
Mini Project	YRE207	2018-19	Employability- Design, Analysis Fabrication, Testing , Report preparation
Constitution of India	YPSOE1	2018-19	Skill Development on Various laws and acts
Project Phase – I	YRE301	2007-08	Employability- Design, Analysis Fabrication, Testing , Report preparation
Elective - V		2007-08	*****
Open Elective Course		2018-19	*****
Project Phase – II	YRE401	2007-08	Employability- Design, Analysis Fabrication, Testing , Report preparation
M.Tech Renewable Energy (Part Time)			
2020-21 – ACADEMIC YEAR			
Solar Energy Systems	PYRE101	2007-08	*****
Wind Energy, Tidal Energy and OTEC	PYRE102	2007-08	Employability on Various energy sectors
Elective – I		2007-08	*****

Solar Energy Lab	PYRE104	2007-08	*****
Bio-Energy Systems	PYRE201	2007-08	*****
Research Methodology and IPR	PYRE202 *	2018-19	Skill Development on how to write the paper and patent it
Elective – II		2007-08	*****
Bio and Thermal Energy Lab	PYRE204	2007-08	*****

SYLLABUS FOR B.TECH MECHANICAL (FT)
ACADEMIC YEAR 2020-21

Subject Name		English	
Subject Code		XGS103	
L –T –P –C		C:P:A	L –T –P –H
2- 0 – 1– 3		2.6:0.4:0	2- 0– 2 – 4
Course Outcome			Domain/Level C or P or A
CO1	<i>Ability</i> to recall the meaning for proper usage		Cognitive (Remembering)
CO2	<i>Apply</i> the techniques in sentence patterns		Cognitive (Applying)
CO3	<i>Identify</i> the common errors in sentences		Cognitive (Remembering)
CO4	<i>Construct</i> the Nature and Style of sensible Writing		Cognitive(Creating)
CO5	<i>Practicing</i> the writing skills		Psychomotor (Guided response)
CO6	<i>Grasping</i> the techniques in learning sounds and etiquettes		Psychomotor (Adapting)
COURSE CONTENT			
UNIT I	Vocabulary Building		9 hrs
1.1 The concept of Word Formation			
1.2 Root words from foreign languages and their use in English			
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives			
1.4 Synonyms, antonyms, and standard abbreviations.			
UNIT II	Basic Writing Skills		9 hrs
2.1 Sentence Structures			
2.2 Use of phrases and clauses in sentences			

2.3 Importance of proper punctuation		
2.4 Creating coherence		
2.5 Organizing principles of paragraphs in documents		
2.6 Techniques for writing precisely		
UNIT III	Identifying Common Errors in Writing	9 hrs
3.1 Subject-verb agreement		
3.2 Noun-pronoun agreement		
3.3 Misplaced modifiers		
3.4 Articles		
3.5 Prepositions		
3.6 Redundancies		
3.7 Clichés		
UNIT IV	Nature and Style of sensible Writing	9 hrs
4.1 Describing		
4.2 Defining		
4.3 Classifying		
4.4 Providing examples or evidence		
4.5 Writing introduction and conclusion		
UNIT V	Writing Practices	9 hrs
5.1 Comprehension		
5.2 Précis Writing		
5.3 Essay Writing		
UNIT VI	Oral Communication	
(This unit involves interactive practice sessions in Language Lab)		
<input type="checkbox"/> Listening Comprehension		
<input type="checkbox"/> Pronunciation, Intonation, Stress and Rhythm		
<input type="checkbox"/> Common Everyday Situations: Conversations and Dialogues		
<input type="checkbox"/> Communication at Workplace		
<input type="checkbox"/> Interviews		
<input type="checkbox"/> Formal Presentations		
L = 30 hrs T = 0 hrs P=15 hrs Total = 45 hrs		
Suggested Readings		
(i) Practical English Usage. Michael Swan. OUP. 1995		
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007		
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001		
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006		
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011		
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press		

Mapping of Cos with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0

1 - Low, 2 – Medium, 3- High

Subject Name		Workshop Practices
Subject Code		XWP105
L –T –P –C		C:P:A
2- 0 – 2– 3		1:3:0
Course Outcome		Domain/Level C or P or A
CO1	<i>Summarize</i> the machining methods and <i>Practice</i> machining operation.	Cognitive (Understand) Psychomotor (Guided Response)
CO2	<i>Defining</i> metal casting process, moulding methods and <i>relates</i> Casting and Smithy applications.	Cognitive (Remember) Psychomotor (Perception)
CO3	<i>Plan</i> basic carpentry and fitting operation and <i>Practice</i> carpentry and fitting operations.	Cognitive (Apply) Psychomotor (Guided Response)
CO4	<i>Summarize</i> metal joining operation and <i>Practice</i> welding operation.	Cognitive (Understand) Psychomotor (Guided Response)
CO5	<i>Illustrate</i> the, electrical and electronics basics and <i>Makes</i> appropriate connections.	Cognitive (Understand) Psychomotor (Origination)
COURSE CONTENT		
EXP.NO	TITLE	CO RELATION
1	Introduction to machining process	CO1
2	Plain turning using lathe operation	CO1
3	Introduction to CNC	CO1
4	Demonstration of plain turning using CNC	CO1
5	Study of metal casting operation	CO2

6	Demonstration of moulding process	CO2
7	Study of smithy operation	CO2
8	Study of carpentry tools	CO3
9	Half lap joint – Carpentry	CO3
10	Mortise and Tenon joint – Carpentry	CO3
11	Study of fitting tools	CO3
12	Square fitting	CO3
13	Triangular fitting	CO3
14	STUDY OF WELDING TOOLS	CO4
15	Square butt joint – welding	CO4
16	Tee joint – Welding	CO4
17	Introduction to house wiring	CO5
18	One lamp controlled by one switch	CO5
19	Two lamps controlled by single switch	CO5
20	Staircase wiring	CO5

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
3. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES

1. <http://nptel.ac.in/courses/112107145/>

Mapping of COs with PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1			1	1		1	2
CO2	2	1	2	2	1			1	1		1	2
CO3	2	1	2	2	1			1	1		1	2
CO4	2	1	2	2	1			1	1		1	2
CO5	2	1	2	2	1			1	1		1	2
Total	10	5	10	10	5			5	5		5	10

1 - Low, 2 – Medium, 3- High

Subject Name		ENVIRONMENTAL SCIENCES	
Subject Code		XES202	
L –T –P –C 3- 0 – 0– 0		C:P:A 1.4:0.3:0.3	L –T –P –H 3- 0– 0 – 3
Course Outcome			Domain/Level C or P or A
CO1	<i>Describe</i> the significance of natural resources and <i>explain</i> anthropogenic impacts.		Cognitive (Remember, Understand)
CO2	<i>Illustrate</i> the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.		Cognitive(Understand)
CO3	<i>Identify</i> the facts, consequences, preventive measures of major pollutions and <i>recognize</i> the disaster phenomenon		Cognitive(Remember) Affective(Receive)
CO4	<i>Explain</i> the socio-economic, policy dynamics and <i>practice</i> the control measures of global issues for sustainable development.		Cognitive (Understand, Apply)
CO5	<i>Recognize</i> the impact of population and the concept of various welfare programs, and <i>apply</i> themodern technology towards environmental protection.		Cognitive(Apply, Analyze)
COURSE CONTENT			
UNIT I	INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY		12 hrs
<p>Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, casestudies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: effects of modern agriculture, 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 – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.</p>			
UNIT II	ECOSYSTEMS AND BIODIVERSITY		7 hrs
<p>Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.</p>			
UNIT III	ENVIRONMENTAL POLLUTION		10 hrs
<p>Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.</p>			

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	10 hrs
<p>Rain water harvesting – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act– Public awareness.</p>		
UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	6 hrs
<p>Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health.</p>		
<p>L = 45 hrs T = 0 hrs P=0 hrs Total = 45 hrs</p>		
<p>TEXT BOOKS</p>		
<ol style="list-style-type: none"> 1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000. 2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003. 3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003. 4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006. 5. Introduction to International disaster management, Butterworth Heinemann, 2006. 6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004. 		
<p>REFERENCES</p>		
<ol style="list-style-type: none"> 1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009. 2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001. 3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012. 4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003. 5. Sundar, Disaster Management, Sarup& Sons, New Delhi, 2007. 6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006. 		
<p>E-REFERENCES</p>		
<ol style="list-style-type: none"> 1. http://www.e-booksdirectory.com/details.php?ebook=10526 2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science 3. https://www.free-ebooks.net/ebook/What-is-Biodiversity 4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4 5. http://bookboon.com/en/pollution-prevention-and-control-ebook 6. http://www.e-booksdirectory.com/details.php?ebook=8557 7. http://www.e-booksdirectory.com/details.php?ebook=6804 8. http://bookboon.com/en/atmospheric-pollution-ebook 		

9. <http://www.e-booksdirectory.com/details.php?ebook=3749>
10. <http://www.e-booksdirectory.com/details.php?ebook=2604>
11. <http://www.e-booksdirectory.com/details.php?ebook=2116>
12. <http://www.e-booksdirectory.com/details.php?ebook=1026>
13. <http://www.faadooengineers.com/threads/7894-Environmental-Science>

Mapping of COs with GA

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	3											1
CO2	2					2	1			1		1
CO3	2	1	3			3	1		2	1		1
CO4	1	1	2			3	2	3				1
CO5	2	1	1			3						1
Total	10	3	6			11	4	3	2	2		5

1 - Low, 2 - Medium, 3- High

Subject Name		Engineering Graphics	
Subject Code		XEG205	
L –T –P –C		C:P:A	L –T –P –H
2- 0 – 1– 3		1.75:1:0.25	2- 0– 2 – 4
Course Outcome		Domain/Level	
		C or P or A	
CO1	<i>Apply</i> the national and international standards, <i>construct and practice</i> various curves	Cognitive (Apply) Psychomotor (Guided response) Affective (Responds to Phenomena)	
CO2	<i>Interpret, construct and practice</i> orthographic projections of points, straight lines and planes.	Cognitive (Understand) Psychomotor (Mechanism) Affective (Responds to Phenomena)	
CO3	<i>Construct Sketch and Practice</i> projection of solids in various positions and true shape of sectioned solids.	Cognitive (Apply) Psychomotor (Complex over response) Affective (Responds to phenomena)	
CO4	<i>Interpret, Sketch and Practice</i> the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive (Understand) Psychomotor (Complex over response) Affective (Responds to phenomena)	

CO5	Construct sketch and practice isometric and perspective views of simple and truncated solids.	Cognitive (Apply) Psychomotor (Complex over response) Affective (Responds to phenomena)
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Objectives:

- ❖ to prepare the student to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- ❖ to prepare the student to communicate effectively
- ❖ to prepare the student to use the techniques, skills, and modern engineering tools necessary for engineering practice

COURSE CONTENT

UNIT I	INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE	12+6 hrs
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Importance of graphics in engineering applications– use of drafting instruments – BIS specifications and conventions as per SP 46-2003. Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects. Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves. Practice on basic tools of CAD

UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	12+6 hrs
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General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection-CAD practice on points and lines

UNIT III	PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS	12+6 hrs
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Projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections-CAD practice on solid models

UNIT IV	DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS	12+6 hrs
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Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection –prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset-CAD practice on intersection of solids.

UNIT V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	12+6 hrs
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods-CAD practice on isometric view		
L = 30 hrs T = 0 hrs P=60 hrs Total = 90 hrs		
TEXT BOOKS		
1. Bhatt,N.D, “Engineering Drawing”, Charotar Publishing House, 46 th Edition-2003. 2. Natarajan,K.V, “ A Textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006 . 3. <u>Dr. P.K. Srividhya, P. Pandiyaraj, “Engineering Graphics”, PMU Publications, Vallam, 2013</u>		
REFERENCES		
1. Luzadder and Duff, “Fundamentals of Engineering Drawing” Prentice Hall of India PvtLtd, XI Edition - 2001. 2. Venugopal,K. and Prabhu Raja, V., “Engineering Graphics”, New Age International(P) Ltd., 2008. 3. Gopalakrishnan.K.R., “Engineering Drawing I & II”, Subhas Publications, 1998. 4. Shah,M.B and Rana,B.C.,”Engineering Drawing”, Pearson Education,2005.		
E-REFERENCES		
1. http://periyarnet/Econtent 2. http://nptel.ac.in/courses/112103019/		

Mapping of COs with PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	2	3	1	1	2	3	3	3	
CO2	3	3	3	1	3	1	3	1	1	1	2	3	3	
CO3	3	3	3	1	3	1	3	1	1	1	2	3	3	
CO4	3	3	3	1	3	1	3	1	1	1	2	3	3	
CO5	3	3	3	1	3	1	3	1	1	1	2	3	3	
Total	15	15	15	6	15	6	15	5	5	6	11	15	15	

1 - Low, 2 – Medium, 3- High

Subject Name	ENGINEERING THERMODYNAMICS		
Subject Code	XME302		
L –T –P –C 3- 1 – 0- 4	C:P:A 4:0:0	L –T –P –H 3- 2 – 0 – 5	
Course Outcomes			Domain C or P or A
CO1	Describe the thermodynamic properties, process and cycle. Moreover, formulating various thermodynamics laws.		C (knowledge, application,) P(perception, set) :
CO2	Describe Carnot cycle, Perpetual motion machine and Kelvin’s Plank statement, Clausius statement. It also explains refrigeration and heat pump		C (knowledge, analysis) P (perception, set, mechanism)
CO3	Describe the properties of solid, liquid and vapour. Moreover explains the Rankine cycle, Reheat cycle and Regenerative cycle.		C (knowledge, comprehension and applications) P (perception, set, mechanism)
CO4	Describe the properties of ideal and real gases and Avagadro’s law. It also describe Dalton’s law partial pressure		C (knowledge, application) P(perception, set , mechanism)
CO5	Describe the Psychrometry property and chart. Moreover, it also describe various psychrometric process such as sensible, latent heat exchange process and adiabatic mixing , evaporative cooling process		C (knowledge, application , analysis) P(perception, set, mechanism)
COURSE CONTENT			
UNIT-I	BASIC CONCEPTS AND LAWS OF THERMODYNAMICS		9+3 hrs
Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments..			
UNIT –II	ENTROPY AND AVAILABILITY		9+3 hrs
Second law of thermodynamics – Kelvin’s and Clausius statements of second law, Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability – Basics of energy in non-flow processes.			
UNIT-III	PROPERTIES OF SUBSTANCES AND STEAM CYCLES		9+3 hrs
Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic			

properties of steam. Calculations of work done and heat transfer in non-flow and flow processes. Standard Rankine cycle, Reheat and regenerative cycle.

UNIT-IV GASES AND THERMO DYNAMIC RELATIONS 9+3 hrs

Gas mixtures – Properties of ideal and real gases, equation of state, Avagadro’s law, Vander Waal’s equation of states, compressibility, compressibility chart. Dalton’s law of partial pressure, Exact differentials, T-D, relations, Maxwell relations, ClausiusClapeyron equations, Joule Thomson Coefficient.

UNIT-V PSYCHROMETRY AND PSYCHROMETRIC CHART 9+3 hrs

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing and evaporative cooling. Refrigeration – Carnot cycle and air refrigeration.

L=45 hrs T =15 hrs Total = 60 hrs

TEXT BOOKS

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2008.
2. Lynn D Russell, George A, Adebisi “Engineering Thermodynamics” Indian Edition, Oxford University Press, New Delhi, 2007.

REFERENCES

1. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
2. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 2003.
3. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2005.
4. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum’s Outline Series, Tata McGraw-Hill, New Delhi, 2004.

E-REFERENCES

1. <http://nptel.iitm.ac.in/courses>
2. <http://www.intechopen.com>

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1	1			1	3		3	3		2
CO2	3	2	1		1				3		3	3		2
CO3	3	2	1	1	2				3	1	3	3		2
CO4	2	2	1		2				2		1	2		2
CO5	2	2	2		2				2	1	3	2		2
	13	10	6	2	8			1	13	2	13	13		10

1 - Low , 2 – Medium , 3- High

Subject Name	STRENGTH OF MATERIALS	
Subject Code	XME303	
L –T –P –C 3- 1 – 0– 4	C:P:A 3.5:0.25:0.25	L –T –P –H 3- 1– 0 – 4
Course Outcome		Domain/Level C or P or A
CO1	After completing this course, the students should be able to recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components	Cognitive
CO2	The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading	Cognitive
CO3	The students will be able to understand inertia and different types of springs and evaluate the different types of inertia and deflection of different types of beams with different loading conditions.	Cognitive
CO4	The students will be able to understand torsion on shaft and springs and evaluate deflection, torsional stresses on shaft, helical spring and leaf spring	Cognitive
CO5	After completing this course, The students will be able to understand and compute stresses in hollow cylindrical and spherical objects.	Cognitive
Objectives		
<ul style="list-style-type: none"> ❖ 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 ❖ To calculate the elastic deformation occurring in various simple geometries for different types of loading 		
COURSE CONTENT		
UNIT I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	8 hrs
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 - LOADS AND STRESSES	8 hrs
Beams and types transverse loading on beams- shear force and bend 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	DEFLECTION OF BEAMS	8 hrs
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 AND SHAFTS	8 hrs
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	ANALYSIS OF STRESSES IN TWO DIMENSIONS	8 hrs
Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure		
L = 40 hrs T = 12 hrs P=0 hrs Total = 52 hrs		
TEXT BOOKS / REFERENCES		
1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi,2001. 2. R. Subramanian, Strength of Materials, Oxford University Press,2007. 3. Ferdinand P. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.		

Mapping of COs with PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	3	3	2	3	3	1	2	1	2	1	2	3	2	
CO2	3	3	2	3	3	1	2	1	2	1	3	3	2	
CO3	3	3	2	3	3	1	2	1	2	1	2	3	2	
CO4	3	3	2	3	3	1	2	1	2	1	2	3	2	
CO5	3	3	2	3	3	1	2	1	2	1	3	3	2	
Total	15	15	10	15	15	5	10	5	10	5	12	15	10	

1 - Low, 2 - Medium, 3- High

Subject Name	ENTREPRENEURSHIP DEVELOPMENT	
Subject Code	XUM305	
L –T –P –C 3- 0 – 0– 3	C:P:A 2.7:0:0.3	L –T –P –H 3- 0– 0 – 3
Course Outcome	Domain/Level C or P or A	
CO1	<i>Recognise</i> and <i>describe</i> the personal traits of an entrepreneur.	C (Understand) A(Receiving)
CO2	<i>Determine</i> the new venture ideas and <i>analyse</i> the feasibility report.	C(Understand, Analyze)
CO3	<i>Develop</i> the business plan and <i>analyse</i> the plan as an individual or in team.	C (Analyze) A(Receiving)
CO4	<i>Describe</i> various parameters to be taken into consideration for launching and managing small business.	C (Understand)
CO5	<i>Explain</i> the technological management and Intellectual Property Rights	C (Understand)
COURSE CONTENT		

UNIT I	ENTREPRENEURIAL TRAITS AND FUNCTIONS	9 hrs
Definition of Entrepreneurship; competencies and traits of an entrepreneur; factors affecting Entrepreneurship Development; Role of Family and Society ; Achievement Motivation; Entrepreneurship as a career and national development;		
UNIT II	NEW PRODUCT DEVELOPMENT AND VENTURE CREATION	9hrs
Ideation to Concept development; Sources and Criteria for Selection of Product; market assessment ; Feasibility Report ;Project Profile; processes involved in starting a new venture; legal formalities; Ownership; Case Study.		
UNIT III	ENTREPRENEURIAL FINANCE	9 hrs
Financial forecasting for a new venture; Finance mobilization; Business plan preparation; Sources of Financing, Angel Investors and Venture Capital; Government support in startup promotion.		
UNIT IV	LAUNCHING OF SMALL BUSINESS AND ITS MANGEMENT	9hrs
Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units.		
UNIT V	TECHNOLOGY MANAGEMENT, IPR PORTFOLIO FOR NEW PRODUCT VENTURE	9hrs
Technology management; Impact of technology on society and business; Role of Government in supporting Technology Development and IPR protection; Entrepreneurship Development Training and Other Support Services.		
L = 45 hrs T = 0 hrs P=0hrs Total = 45hrs		
TEXT BOOKS		
1. Hisrich, 2016, <i>Entrepreneurship</i> , Tata McGraw Hill, New Delhi. 2. S.S.Khanka, 2013, <i>Entrepreneurial Development</i> , S.Chand and Company Limited, New Delhi.		
REFERENCES		
1. Mathew Manimala, 2005, <i>Entrepreneurship Theory at the Crossroads, Paradigms & Praxis</i> , Biztrantra ,2nd Edition. 2. Prasanna Chandra, 2009, <i>Projects – Planning, Analysis, Selection, Implementation and Reviews</i> , Tata McGraw-Hill. 3. P.Saravanel, 1997, <i>Entrepreneurial Development</i> , Ess Pee kay Publishing House, Chennai. 4. Arya Kumar,2012, <i>Entrepreneurship: Creating and Leading an Entrepreneurial Organisation</i> , Pearson Education India. 5. Donald F Kuratko, T.V Rao, 2012, <i>Entrepreneurship: A South Asian perspective</i> , Cengage Learning India. 6. Dinesh Awasthi, Raman Jaggi, V.Padmanand, Suggested Reading / Reference Material for Entrepreneurship Development Programmes (EDP/WEDP/TEDP), EDI Publication, Entrepreneurship Development Institute of India, Ahmedabad. Available from: http://www.ediindia.org/doc/EDP-TEDP.pdf		

E-REFERENCES

1. Jeff Hawkins, “ Characteristics of a successful entrepreneur”, ALISON Online entrepreneurship courses, “<https://alison.com/learn/entrepreneurial-skills>”
2. Jeff Cornwall, “Entrepreneurship -- From Idea to Launch”, Udemy online Education, <https://www.udemy.com/entrepreneurship-from-idea-to-launch/>

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	1	0	3	1	0	3	1	2	2	1	1
CO2	1	2	3	1	0	3	1	3	3	1	2	2	1	1
CO3	1	2	3	1	0	3	1	0	3	1	2	2	1	1
CO4	1	2	2	1	0	3	1	1	3	3	3	3	1	1
CO5	1	3	3	1	0	3	1	3	3	3	3	3	1	1
	5	10	14	5	0	15	5	7	15	9	12	12	5	5

1 - Low , 2 – Medium , 3- High

Subject Name	MANUFACTURING PROCESSES		
Subject Code	XME306		
L –T –P –C 3- 0 – 0– 3	C:P:A 3:0:0		L –T –P –H 3- 0– 0 – 3
Course Outcome		Domain/Level C or P or A	
CO1	Summarise the metal casting and metal forming process. Identify the defects in the metal casting process.		C (Understand)
CO2	Relate the various cutting force components for the formation of chip. Identify the tool wear, tool life, cutting tool materials, cutting fluids.		C(Apply)
CO3	Compare various additive manufacturing and joining process		C (Understand)
CO4	Explain electrical energy and chemical based unconventional machining process		C (Understand)
CO5	Explain mechanical and thermal energy based unconventional machining process		C (Understand)
Objectives: 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			
COURSE CONTENT			
UNIT I	CONVENTIONAL MANUFACTURING PROCESSES		9 hrs
Casting and moulding: Metal casting processes and equipment, Heat transfer and			

solidification, shrinkage, riser design, casting defects and residual stresses. **Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.**

UNIT II	METAL CUTTING	9hrs
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Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining

UNIT III	ADDITIVE MANUFACTURING AND JOINING PROCESS	9 hrs
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Rapid prototyping and rapid tooling
Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

UNIT IV	UNCONVENTIONAL MACHINING PROCESSES – ELECTRICAL ENERGY AND CHEMICAL BASED PROCESS	9hrs
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Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish.

UNIT V	UNCONVENTIONAL MACHINING PROCESSES – MECHANICAL AND THERMAL ENERGY BASED PROCESS	9hrs
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Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters

L = 45 hrs T = 0 hrs P=0hrs Total = 45hrs

TEXT BOOKS

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India,2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing

REFERENCES

1. Paul Degarma E, Black J.T. and Ronald A. Kosher, Elighth Edition, Materials and Processes, in Manufacturing Prentice – Hall of India, 2003.
2. Sharma, P.C., A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
3. P.N. Rao, Manufacturing Technology- Foundry, Forming and Welding, TMH-2003; 2nd Edition, 2003
4. Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson Education, 2006.
5. Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.
6. McGeough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998

8. 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.

E-REFERENCES

1. <http://nptel.iitm.ac.in/courses>

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	2	-	1	2	3	3	
CO2	3	3	3	1	2	-	-	2	-	1	2	3	3	
CO3	3	3	3	1	2	-	-	2	-	1	2	3	3	
CO4	3	3	3	-	2	-	-	2	-	1	2	3	3	
CO5	3	3	3	-	2	-	-	2	-	1	2	3	3	
	15	15	15	2	10	-	-	10	-	5	10	15	15	

1 - Low, 2 – Medium, 3- High

Subject Name	Inplant Training – I (15 days)		
Subject Code	XME307		
L –T –P –C 0- 0 – 2– 0	C:P:A 0:2:0		L –T –P –H 0- 0– 2– 0
Course Outcome			Domain/Level C or P or A
Objectives: This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.			

Course Name	SOLID MECHANICS		
Course Code	XME402		
L –T –P –C 3 – 1 – 0– 4	C:P:A 3.5:0.25:0.25		L –T –P –H 3–1– 0– 4
Course Outcome			Domain/Level C or P or A
CO1	Understand and apply the concepts of 3-dimensional state of strain and stress under different types of loading		C (U), C (App)
CO2	Understand and apply constitutive relations for simple geometries		C (U), C (App)

CO3	Apply the deformation concepts for plane stress and plane strain problems	C (App)
CO4	Apply the deformation concepts for complex cases	C (App)
CO5	Understand and apply energy and potential methods.	C (U), C (App)

Objectives:

The objective is to present the mathematical and physical principles in understanding the linear continuum behavior of solids.

COURSE CONTENT

UNIT I	STRAIN AND STRESS	9+6=15 Hours
Introduction to Cartesian tensors, Strains: Concept of strain, derivation of small strain tensor and compatibility, Stress: Derivation of Cauchy relations and equilibrium and symmetry equations, principal stresses and directions		
UNIT II	CONSTITUTIVE EQUATIONS	9+6 = 15 Hours
Constitutive equations: Generalized Hooke's law, Linear elasticity, Material symmetry; Boundary Value Problems: concepts of uniqueness and superposition.		
UNIT III	PLANE STRESS AND PLANE STRAIN	9+6 = 15 Hours
Plane stress and plane strain problems, introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems.		
UNIT IV	APPLICATION TO COMPLEX CASES	9+6 = 15 Hours
Application to thick cylinders, rotating discs, torsion of non-circular cross-sections, stress concentration problems, thermo-elasticity, 2-d contact problems.		
UNIT V	ENERGY METHODS	9+6 = 15 Hours
Solutions using potentials. Energy methods. Introduction to plasticity.		
L = 45 Hours		Tutorial = 15 Hours
Total = 60 Hours		

TEXT BOOKS

1. G. T. Mase, R. E. Smelser and G. E. Mase, Continuum Mechanics for Engineers, Third Edition, CRC Press, 2004.
2. Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International, 1965.
3. Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall international, 1969.

REFERENCES

1. S. M. A. Kazimi, Solid Mechanics, First Edition, Tata McGraw Hill Publications, 2001.

E-REFERENCES

1. <https://nptel.ac.in/courses/112107147>
2. <https://nptel.ac.in/syllabus/105101003>

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	-	2	1	-	-	-	1	-	-	-	2	
CO2	3	2	-	2	1	-	-	-	1	-	1	1	2	
CO3	3	1	-	1	1	-	-	1	1	-	1	1	2	
CO4	3	2	-	2	1	-	-	-	1	-	-	-	2	
CO5	3	3	3	3	2	-	-	2	1	-	3	3	2	
	15	10	3	10	6			3	5		5	5	10	

1 - Low, 2 - Medium, 3- High

Course Name	HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY		
Course Code	XUM403		
L -T -P -C 3 - 0 - 0 - 0	C:P:A 3:0:0		L -T -P -H 3-0- 0 - 3
Course Outcome			Domain/Level C or P or A
CO1	<i>Relate</i> and <i>Interpret</i> the human ethics and human relationships		C(Remember, Understand)
CO2	<i>Explain</i> and <i>Apply</i> gender issues, equality and violence against women		C(Understand, Apply)
CO3	<i>Classify</i> and <i>Develop</i> the identify of women issues and challenges.		C (Analyze) A (Receive)
CO4	<i>Classify</i> and <i>Dissect</i> human rights and report on violations.		C(Understand. Analyze)
CO5	<i>List</i> and respond to family values, universal brotherhood, fight against corruption by common man and good governance.		C (Remember) A(Respond)
COURSE CONTENT			
UNIT I	HUMAN ETHICS AND VALUES		7 Hours
Human Ethics and values - Understanding of oneself and others- motives and needs- Social service, Social Justice, Dignity and worth, Harmony in human relationship: Family and Society, Integrity and Competence, Caring and Sharing, Honesty and Courage, WHO's holistic development - Valuing Time, Co-operation, Commitment, Sympathy and Empathy, Self respect, Self-Confidence, character building and Personality.			
UNIT II	GENDER EQUALITY		9 Hours
Gender Equality - Gender Vs Sex, Concepts, definition, Gender equity, equality, and empowerment. Status of Women in India Social, Economical, Education, Health, Employment, HDI, GDI, GEM. Contributions of Dr.B.R. Ambedkar, ThanthaiPeriyar and Phule to Women Empowerment.			
UNIT III	WOMEN ISSUES AND CHALLENGES		9 Hours

Table 1: Mapping of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1								2						
CO2								3	1					
CO3								2						
CO4								3		2				
CO5								3	2	2		2		
Total		2						13	3	4		2		
Scale Value		1						3	1	1		1		

1 – 5 → 1, 6-10 → 2, 11 – 15 → 3 – No relation, 1 – Low relation, 2 – Medium relation, 3 – High relation

Course Name	FLUID MECHANICS & FLUID MACHINES		
Course Code	XME404		
L –T –P –C 3 – 1 – 0 – 4	C:P:A 3.5:0.25:0.25		L –T –P –H 3–1– 0 – 4
Course Outcome			Domain/Level C or P or A
CO1	Recalling of fluids properties and understanding the equations related to fluid flow. Ability to solve problems related to momentum equation and Bernoulli’s equation		Cognitive- Remembering, understanding and apply
CO2	Understanding the concept of incompressible fluid flow fluid flow through channels and ducts. Discuss the concept of boundary layer and ability apply Darcy Weisbach equation in different condition		Cognitive- Understanding and apply
CO3	Understanding the need and methods of dimensional analysis and ability to derive equations using dimensional analysis		Cognitive- Understanding and apply
CO4	Explain the working of different types of pumps and ability to analyze its performance		Cognitive- Understanding analyze and apply
CO5	Explain the working of different types of turbines and ability to analyze its performance		Cognitive- Understanding analyze and apply
Objectives			
<ul style="list-style-type: none"> ❖ To learn about the application of mass and momentum conservation laws for fluid flows ❖ To understand the importance of dimensional analysis 			

- ❖ To obtain the velocity and pressure variations in various types of simple flows
- ❖ To analyze the flow in water pumps and turbines.

COURSE CONTENT

UNIT I	BASIC CONCEPTS AND PROPERTIES OF FLUIDS	9 Hours
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	IN COMPRESSIBLE FLUID FLOW	9 Hours
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	DIMENSIONAL ANALYSIS	6 Hours
Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis		
UNIT IV	HYDRAULIC PUMPS	8 Hours
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	HYDRAULIC TURBINES	8 Hours
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		
L = 40 Hours	Tutorial = 12 Hours	Total = 52 Hours
TEXT BOOKS / REFERENCE BOOKS		
<ol style="list-style-type: none"> 1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 2003. 2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007. 3. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, DhanpatRai& Sons, Delhi, 2008. 4. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2nd Edition, 2004. 5. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 2005. 6. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, 2008. 		

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3	1	1	1	1	1	1	1		2
CO2	3	3	2	1	3	1	1	2	2	2	1	2		2
CO3	3	3	0	1	3	1	0	2	1	1	0	1		2
CO4	3	3	1	2	3	1	1	2	2	2	1	2		2
CO5	3	3	2	2	3	1	1	2	2	2	1	2		2
Tot	15	15	6	7	15	5	4	9	10	10	4	8		10

1 - Low, 2 - Medium, 3- High

Course Name	INSTRUMENTATION & CONTROL		
Course Code	XME406		
L -T -P -C 3 - 1 - 0 - 4	C:P:A 3.5:0.25:0.25		L -T -P -H 3-1- 0 - 4
Course Outcome		Domain/Level C or P or A	
CO1	<i>Understand</i> the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices.		C (Understand)
CO2	<i>Understand</i> the instrumentation system and elements.		C (Understand)
CO3	<i>Design</i> various Controllers		C (Create)
CO4	<i>Understand</i> the instrumentation system models and functions.		C (Understand)
CO5	<i>Create</i> a project using Instrumentation systems.		C (Create)
Objectives:			
1. To provide a basic knowledge about measurement systems and their components			
2. To learn about various sensors used for measurement of mechanical quantities			
3. To learn about system stability and control			
4. To integrate the measurement systems with the process for process monitoring and control			
COURSE CONTENT			
UNIT I	Measurement systems and Characteristics		9 Hours
Measurement systems and performance – accuracy, range, resolution, error sources.			
UNIT II	Instrumentation systems and elements		9 Hours
Instrumentation system elements – sensors for common engineering measurements; Signal processing and conditioning; correction elements- actuators: pneumatic, hydraulic, electric.			
UNIT III	Controllers		8 Hours
Control systems – basic elements, open/closed loop, design of block diagram; control methodP, PI, PID, when to choose what, tuning of controllers.			

UNIT IV	Models	8 Hours
System models, transfer function and system response, frequency response; Nyquist diagrams and their use.		
UNIT V	Project	6 Hours
Practical group based project utilizing above concepts.		
L = 40 Hours	Tutorial = 12 Hours	Total = 52 Hours
TEXT BOOKS / REFERENCE BOOKS		
1. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 200		
2. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, Mechanical Measurements (6 th Edition) 6th Edition, Pearson Education India, 2007. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,		

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													1	1
CO2													1	1
CO3													1	1
CO4													1	1
CO5													1	1
Tot													5	5

1 - Low, 2 - Medium, 3- High

Subject Name	CAD / CAM		
Subject Code	XME504		
L –T –P –C 3 - 0 – 0– 3	C:P:A 3:0:0		L –T –P –H 3- 0– 0 – 3
Course Outcome			Domain/Level C or P or A
CO1	<i>Define</i> Design Process, CAD, CAM and <i>explain</i> various stages of design and different types of design process <i>explain</i> the DOM concept CAM along with benefits of CAD		C(Remember, Understand)
CO2	<i>Classify</i> and <i>explain</i> different graphical primitives and transformations systems along with complex geometry generation techniques. <i>Classify</i> and <i>outline</i> the various Data structure and management systems.		C(Remember, Understand)
CO3	<i>Define</i> modeling and <i>Classify</i> different types of geometric models also <i>outline</i> different features of solid modeling packages		C(Remember, Understand)
CO4	<i>Explain</i> and <i>contrast</i> NCCNC DNC also <i>illustrate</i> various tools		C(Understand)

	,devices and mechanisms used inside NC,CNC and DNC	
CO5	List important NC Codes and <i>create</i> CNC code for simple CNC operations like turning and facing.	C(Remember, Create)
COURSE CONTENT		
UNIT I	DESIGN PROCESS	9 hrs
The design process - Morphology of design - Product cycle - Sequential and concurrent engineering - Role of computers - Computer Aided Engineering - Computer Aided Design - Design for Manufacturability – Computer Aided Manufacturing - Benefits of CAD.		
UNIT II	INTERACTIVE COMPUTER GRAPHICS AND DATA STRUCTURES	9hrs
Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D – Viewing transformation - Clipping - hidden line elimination - Mathematical formulation for graphics - Curve generation techniques. Model storages and Data structure - Information system. Engineering Data Management System. Hierarchical data structure. Network data structure - Relational data structure. Data storage, search and retrieval methods. Recent trends in Data Structures.		
UNIT III	SOLID MODELING	9 hrs
Geometric Modeling - Wireframe, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modeling Packages - Parametric and features - Interfaces to drafting, Design Analysis.		
UNIT IV	CONSTRUCTIONAL FEATURES OF CNC MACHINES	9 hrs
Numerical Control (DNC Systems). Design considerations of CNC machines for improving machining accuracy-Structural members-Slideways - Sides linear bearings - Ball screws - Spindle drives and feed drives - work holding devices and tool holding devices -Automatic Tool changers. Feedback devices - Principles of Operation-Machining Centres - Tooling for CNC machines.		
UNIT V	PART PROGRAMMING FOR CNC MACHINES	9 hrs
Numerical control codes - Standards - Manual Programming - Canned cycles and subroutines – Computer Assisted Programming, CAD / CAM approach to NC part programming - APT language, machining from 3D models. Validation of Programs.		
L = 45 hrs T = 0 hrs P=0hrs Total = 45 hrs		
TEXT BOOKS		
1. Ibrahim Zeid, " CAD - CAM Theory and Practice ", Tata McGraw-Hill Publishing Co. Ltd., 1998. 2. Sadhu Singh, " Computer Aided Design and Manufacturing ", Khanna Publishers, New Delhi, 1998.		
REFERENCES		
1. P.Radhakrishnan, "Computer Numerical Control ", New Central Book Agency, 1992. 2. Groover and Zimmers, " CAD / CAM : Computer Aided Design and Manufacturing Prentice Hall of India, New Delhi, 1994.		
E-REFERENCES		
1. http://nptel.iitm.ac.in/video.php?subjectId=112102101 2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Computer%20Aided%20Design%20&%20ManufacturingI/index.htm 3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Computer%20Aided%20Design%20&%20ManufacturingII/index.htm		

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	2	1	3	1	1	2	2	3	3	
CO2	3	2	2	3	3	1	3	1	1	3	2	3	3	
CO3	3	2	2	3	2	1	3	1	1	3	2	3	3	
CO4	3	2	2	3	3	1	3	1	1	2	2	3	3	
CO5	3	3	2	3	2	1	3	1	2	3	3	3	3	
Total	15	11	10	15	12	5	15	5	6	13	11	15	15	

1 - Low, 2 - Medium, 3- High

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 ₀	PO1 ₁	PO1 ₂
CO1	3	1		1			1		1		1	
CO2	3	1		1			1		1			
CO3	3	1		1			1		1			
CO4	3	1		1			1		1		1	
CO5	3	1		1			1		1			
Tot	15	5	0	5	0	0	5	0	5	0	2	0

1 - Low, 2 - Medium, 3- High

Semester	V		
Subject Name	Constitution of India		
Subject Code	XUM506		
L -T -P -C	C:P:A		L -T -P -H
2- 0 - 0 - 0	0:0:0		2- 0- 0 - 2
Course Outcome	Domain/Level C or P or A		
COURSE CONTENT			
	CO Relation		
1.	Meaning of the constitute		
2.	on law andconstitutionalism		
3.	Historical perspective of the Constitution ofIndia		

4.	Salient features and characteristics of the Constitution of India
5.	Scheme of the fundamental rights
6.	The scheme of the Fundamental Duties and its legal status
7.	The Directive Principles of State Policy – Its importance and implementation
8.	Federal structure and distribution of legislative and financial powers between the Union and the States
9.	Parliamentary Form of Government in India – The constitution powers and status of the President of India
10.	Amendment of the Constitutional Powers and Procedure
11.	The historical perspectives of the constitutional amendments in India
12.	Emergency Provisions : National Emergency, President Rule, Financial Emergency
13.	Local Self Government – Constitutional Scheme in India
14.	Scheme of the Fundamental Right to Equality
15.	Scheme of the Fundamental Right to certain Freedom under Article 19
16.	Scope of the Right to Life and Personal Liberty under Article 21.
TEXT BOOKS	
1. Introduction to Constitution of India, D.D. Basu, Lexis Nexis	
2. The Constitution of India, PM Bhakshi, Universal Law	

Subject Name	Inplant Training – II		
Subject Code	XME508		
L –T –P –C 0- 0 – 2– 0	C:P:A 0:2:0	L –T –P –H 0- 0– 2 – 0	
Course Outcome			Domain/Level C or P or A
Objectives: This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.			

XMEM01	CNC Programming for Lathe Operations	L T P C 0 0 2 0
<p>CNC Machines Numerical control – definition – components of NC systems, Development of NC, DNC, CNC, and adaptive control systems, Working principle of a CNC system, features and advantages of CNC machines Introduction to CNC systems - Fanuc OI, Siemens 840D, Heidenhein, current trends in programming, Human Machine Interface software – Siemens – Fanuc systems</p> <p>CNC Hardware System CNC system elements, Drives, Slide ways, Feedback devices, ATC and Tool Magazines, and Machine Control Units</p> <p>CNC Part Programming for lathe operations Part program structure, CNC program procedure – coordinate system, Sequence number, preparatory functions and G codes, miscellaneous functions and M codes, NC dimensioning – reference points – machine zero, work zero, tool zero and tool offsets, Types of motion control: point-to-point, paraxial and contouring Part Program – tool information – speed – feed data – interpolations, Macro – subroutines – canned cycles - Mirror images –Sample programs for lathe operations , Conversational automatic programming, and APT programming- Introduction to Computer assisted part programming – EdgeCAM, Master CAM etc.,</p>		

Subject Name		Economics for Engineers	
Subject Code		XUM601	
L –T –P –C 3 - 0 – 0– 3		C:P:A 2.64:0.24:0.12	L –T –P –H 3- 0– 0 – 3
Course Outcome			Domain/Level C or P or A
CO1	<i>Explain</i> the concepts of economics in engineering and <i>identify</i> element of cost to prepare cost sheet	C(Understand) P(Perception)	
CO2	<i>Calculate and Explain</i> the Break-even point and marginal costing	C(Apply, Understand) P(Perception)	
CO3	<i>Summarize</i> and <i>Use</i> value engineering procedure for cost analysis	C(Understand) A(Receive)	
CO4	<i>Estimate</i> replacement problem	C(Understand)	
CO5	<i>Compute, Explain</i> and <i>make Use of</i> different methods of depreciation	C(Understand, Apply)	
COURSE CONTENT			
UNIT I	INTRODUCTION TO ECONOMICS		8 hrs
Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- types of costing, element of costs, preparation of cost sheet and estimation, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost			

UNIT II	BREAK-EVEN ANALYSIS & SOCIAL COST BENEFIT ANALYSIS	12 hrs
Margin of Safety, Profit, Cost & Quantity analysis-Product Mix decisions and CVP analysis, Profit/Volume Ratio (P/V Ratio), Application of Marginal costing, Limitations Social Cost Benefit Analysis: compare different project alternatives, Calculate direct, indirect and external effects; Monetizing effects; Result of a social cost benefit analysis.		
UNIT III	VALUE ENGINEERING & COST ACCOUNTING	10 hrs
Value engineering – Function, aims, Value engineering procedure - Make or buy decision Business operating costs, Business overhead costs, Equipment operating costs		
UNIT IV	REPLACEMENT ANALYSIS	7 hrs
Replacement analysis –Types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset.		
UNIT V	DEPRECIATION	8 hrs
Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the year's digits method of depreciation, sinking fund method of depreciation, Annuity method of depreciation, service output method of depreciation.		
L = 45 hrs T = 0 hrs P=0hrs Total = 45 hrs		
TEXT BOOKS		
1. Sp Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K Global Publications, Faridabad, Haryana, 2012 2. S.P. Jain & Narang, "Cost accounting – Principles and Practice", Kalyani Publishers, Calcutta, 2012 3. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001. 4. William G. Sullivan, James A. Bontadelli & Elin M. Wicks, "Engineering Economy", Prentice Hall International, New York, 2001.		
REFERENCES		
1. Luke M Froeb / Brian T Mccann, "Managerial Economics – A problem solving approach" Thomson learning 2007 2. Truett & Truett, "Managerial economics- Analysis, problems & cases" Wiley India 8th edition 2004. 3. Chan S. Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002. 4. Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002		
E-REFERENCES - 1. http://nptel.iitm.ac.in/video.php		

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	0	1	0	0	1	1	1	2	2	3
CO2	2	2	1	2	0	0	2	1	1	2	3	3
CO3	2	2	1	3	0	0	2	2	1	2	2	3
CO4	1	2	1	2	0	0	0	1	1	1	2	3
CO5	1	2	0	1	0	0	1	1	0	1	2	3
Total	7	10	3	9	0	0	6	6	4	8	11	15

1 - Low, 2 – Medium, 3- High

Semester		VI	
Subject Name		Manufacturing Technology	
Subject Code		XME 602	
L –T –P –C 4- 0 – 0– 4		C:P:A 4:0:0	L –T –P –H 4- 0– 0 – 4
Course Outcome			Domain/Level C or P or A
CO1	Construct the Degrees of freedom, principles of location and clamping, principles of jig design, fool proofing, elements of jigs, locates fixture design		C(Creating) A(Receiving)
CO2	Explain the basic principles of measurements classify the various linear and angular measuring equipments and distinguish their principle of operation and applications.		C (Evaluating) P (Perception)
CO3	Explain the Assembly of different components		C (Remembering)
CO4	Explain and demonstrate the basic concepts of PERT- CPM and their applications in product planning control.		C (Understand)
CO5	Explain the basic concepts of optimization and To Formulate and Solve linear programming problems.		C (understand)
Objectives			
<p>(i) To provide knowledge on machines and related tools for manufacturing various components.</p> <p>(ii) To understand the relationship between process and system in manufacturing domain.</p> <p>(iii) To identify the techniques for the quality assurance of the products and the optimality of the process in terms of resources and time management.</p>			
COURSE CONTENT			
UNIT I	JIGS, FIXTURES AND PRESS TOOLS		12 hrs
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	FORM MEASUREMENT		16 hrs
Dimensions, forms and surface measurements, Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; Metrology in tool wear and part quality including surface integrity, alignment and testing methods; tolerance analysis in manufacturing and assembly. Process metrology for emerging machining processes such as microscale machining, Inspection and workpiece quality			
UNIT III	ASSEMBLY PRACTICES		6 hrs

Manufacturing and assembly, process planning, selective assembly, Material handling and devices		
UNIT IV	LINEAR MODELS,PROJECT SCHEDULING BY PERT-CPM	8 hrs
Linear programming, objective function and constraints, graphical method, Simplex and duplex algorithms, transportation assignment, Travelling Salesman problem; Network models: shortest route, minimal spanning tree, maximum flow model- Project networks: CPM and PERT, critical path scheduling		
UNIT V	Production planning& control	8 hrs
Forecasting models, aggregate production planning, materials requirement planning. Inventory Models: Economic Order Quantity, quantity discount models, stochastic inventory models, practical inventory control models, JIT. Simple queuing theory models		
L = 50 hrs T = 0 hrs P=0hrs Total = 50 hrs		
TEXT BOOKS		
<ol style="list-style-type: none"> 1. Donaldson C and Le Cain C H, "Tool Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004. 2. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005 3.Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014 4. Taha H. A., Operations Research, 6th Edition, Prentice Hall of India, 2003. 5. Shenoy G.V. and Shrivastava U.K., Operations Research for Management, Wiley Eastern, 1994. 6.Automation, Production Systems, & CIM by Grover; Prentice Hall 2. CAD CAM by C. McMahan and J. Browne; published by Addison-Wesley. 		
REFERENCES		
<ol style="list-style-type: none"> 1. Bhattacharyya A, "Metal Cutting Theory and Practice", New Central Books Agency (P) Ltd, Calcutta, 2000. 2. Fundamentals of Operations Research, Advanced Operation Research Prof.G.Srinivasan, Department of Management Studies, Indian Institute of Technology, Madras. 3.Modern Production/ Operations Management, E. S. Buffa and R. K. Sarin, John Wiley International, 1994. 		
E-REFERENCES		
http://nptel.iitm.ac.in/courses		

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	1	-	-	1	-	-	1	3	
CO2	2	2	-	-	-	1	1	-	-	-	-	1	3	
CO3	2	1	-	-	2	1	1	-	-	-	-	1	3	
CO4	2	1	-	-	1	1	1	-	1	-	-	1	3	
CO5	1	-	-	-	1	1	-	-	1	-	-	1	3	
Tot	9	5			4	5	3	3				5	15	

1 - Low, 2 - Medium, 3- High

S.No	Theory Session	Lab Session
1.	Introduction about Automation	Basic Hydraulics and Hydraulic equipments such as Pumps, motor, Cylinders, Check valves, Direction control valves
2.	Basic Hydraulics and Hydraulic equipments: Pilot operated check valves, throttle valves, solenoid valves, etc.,	Hydraulic Lab: Simple hydraulic circuits using hydraulic equipments, cylinder and motor by manual operation
3.	Development of Hydraulic circuits using Check valves, direction control valves, Pilot operated check valves, throttle valves etc.,	Hydraulic Lab: Hydraulic circuits using Check valves, throttle valve, meter in and meter out circuits
4.	Working principles of solenoid valves, Relay and development of relay logic circuits	Hydraulic Lab: Hydraulic circuits using relay logic
5.	Timers : Switch On delay and Switch off delay	Hydraulic Lab: Hydraulic circuits using on delay and off delay
6.	Sensors: Different types of Proximate sensors	Sensoric Lab: Identification of metal and non metal using sensors, Calculation of range of sensors.
7.	Development of hydraulic circuits using sensors	Hydraulic Lab: Hydraulic circuits using sensors
8.	Pressure Switches	Hydraulic Lab: Hydraulic circuits using Pressure switch
9.	Development of hydraulic circuits by Combination of two cylinders	Hydraulic Lab: Sequential hydraulic circuits using two cylinders
10.	Introduction about Pneumatics	Basic Pneumatics and Pneumatics equipments such as Pumps, motor, Cylinders, Check valves, Direction control valves
11.	Basic Pneumatics and Pneumatics equipments: Pilot operated check valves, throttle valves, solenoid valves, etc.,	Pneumatics Lab: Simple Pneumatics circuits using Pneumatics equipments, cylinder and motor by manual operation
12.	Development of Pneumatics circuits using Check valves, direction control valves, Pilot operated check valves, throttle valves etc.,	Pneumatics Lab: Pneumatics circuits using Check valves, throttle valve, meter in and meter out circuits
13.	Working principles of solenoid valves, Relay and development of relay logic circuits	Pneumatics Lab: Pneumatics circuits using relay logic
14.	Timers : Switch On delay and Switch off delay	Pneumatics Lab: Pneumatics circuits using on delay and off delay
15.	Sensors: Different types of Proximate sensors	Sensoric Lab: Identification of metal and non metal using sensors, Calculation of range of sensors.
16.	What is PLC?	Basic concepts of PLC <i>Graphical Symbols of Pneumatics Circuits,</i> Working of PLC & General Applications

17.	IndracontrolPLC's–TechnicalDetails	HardwareDetailsofL10/L20 DocumentationprovidedinCD RelatedSoftwareforPLC
18.	Related Software for PLC	Detailed presentation on inline products, Technical & hardware details on -digital I/O -analog I/o -Bus couplers -Function modules
19.	Indra worksSoftwareInstallation	IndraworksSoftwarefeaturesexplanationindetail , Indralogicstandardsettings, ProjectdevelopmentinIndraworks HardwareConfiguration
20.	ProjectDevelopmentinIndralogic	LogicDevelopment - LadderDiagram - AddressingofDigitalI/O's CreatingParallelPaths(Network) - ProgrammingLanguage Selection/Conversion
21.	LogicDevelopment - VariableDeclaration(Local/Global) - DeclarationinTabularFormat	- FunctionBlocks(Timers,Countersetc.) - Exercises Segregationofprogramsbasedonfunctionality orapplication
22.	Set ,Reset concepts - Exercises	Communication parameters settings
23.	LogicDevelopment - AddressingDigitalI/O's	orkingwithDigitalI/O's, ConfiguringDigitalI/O's , - Exercises
24.	Exercise	Exercise
25.	Exercise	TesT And feedback session
26.	IntroductiontoSensorics WhatareSensors? ClassificationofSensors DifferenttypesofsensorsusedinAutomationTechnologies CharacteristicsofInductive,Capacitive,Ultrasonic,PhotoelectricandMagneticproximitysensors Comparisonofsensors	Experiment01:Behaviorofthecapacitivesensor
27.	Behaviorofresistivesensors	Behaviorofinductivesensor
28.	Role of the Sensors in Mechatronixcs, Robotics and Automation	Real time problems and solutions
29.	Exercise	Experiment01:Behaviorofthecapacitivesensor
30.	Test And feedback session	

XMEM02		Pneumatics and Hydraulics		L T P C 0 0 2 0	
Subject Name		PROJECT PHASE -1 & PROJECT PHASE II			
Subject Code		XME707 & XME804			
L -T -P -C 0- 0 - 2- 2		L-T-P-C 0 -0 -12 -12		C:P:A C: P: A 1:0.5:0.5 6:3:3	
Course Outcome					Domain/Level C or P or A
CO1	Identify the Engineering Problem relevant to the domain interest.				Cog- Analyze
CO2	Interpret and Infer Literature survey for its worthiness.				Cog- Analyze, Cog- Apply
CO3	Analyse and identify an appropriate technique for solve the problem.				Cog - Analyze, Apply
CO4	Perform experimentation /Simulation/Programming/Fabrication, Collect and <i>interpret</i> data.				Psy, Cog- CoR, Create, Apply
CO5	Record and Report the technical findings as a document.				Cog - Remember, Understand
CO6	Devote oneself as a responsible member and display as a leader in a team <i>tomanage</i> projects.				Aff, Cog- Value, Organization, Create
CO7	Responding of project findings among the technocrats.				Aff- Responding

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1	2	1	1	1	1	1	2
CO2	2	2	1	2	1	3	1	1	1	2	1	2
CO3	2	2	1	2	1	2	1	1	1	3	1	1
CO4	2	2	1	3	1	2	0	1	1	3	1	2
CO5	2	2	1	2	2	1	1	2	2	0	2	1
	10	10	5	11	6	10	4	6	6	9	6	8

1 - Low, 2 - Medium, 3- High

Subject Name		CAREER DEVELOPMENT SKILLS	
Subject Code		XGS708	
L –T –P –C 0- 0- 0 - 0		C:P:A 0.5:0.5:0	L –T –P –H 1- 0 –0- 1
Course Outcome			Domain/Level C or P or A
CO1	Distinguish between Resume and Curriculum Vitae and its various forms		C (Analyze)
CO2	Define the different types of interviews		C(Remember)
CO3	Perform in the forum where the skills will be exhibited		P (Guidee Response)
COURSE CONTENT			
UNIT I	RESUME & CV WRITING		6hrs
Difference between Resume and CV; characteristics of resume and CV; basic elements of CV and Resume, use of graphics in resume and CV; forms and functions of Cover Letters.			
UNIT II	INTERVIEW SKILLS		6hrs
Various types of interviews- types of questions asked; body language, etiquette and dress code in interview, interview mistakes, telephonic interview, frequently asked questions. Planning for the interview.			
UNIT III	WORKSHOPS		6hrs
Mock interviews – Group Discussions –Panel Interview – Informal Interview			
L-18 hrs Total = 18 hrs			
TEXT BOOKS			
<ol style="list-style-type: none"> 1. Paul McGee, How To Write a CV That Really Works: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Hachette UK, 2014 2. Mary Ellen Guffey, Dana Loewy Essentials of Business Communication, Cengage Learning, 2012 3. D.S. Paul. Interview Skills: Goodwill Publishing House: New Delhi. 2017 4. Barun Mitra. Personality Development and Soft Skills. Oxford University Press, 2012 5. Michael Spiropoulos, Interview Skills that win the job: Simple techniques for answering all the tough questions, Allen & Unwin, 2005 6. William L. Fleisher, Effective Interviewing and Interrogation Techniques, Nathan J. Gordon, Academic Press, 2010. 			
E-REFERENCES			
<ol style="list-style-type: none"> 1. http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf 2. http://www.amu.apus.edu/career-services/interviewing/types.htm 3. http://www.careerthinker.com/interviewing/types-of-interview/ 			

Mapping of COs with Pos

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	0	2	0	0	1	0	0	0	0	0	0	0
CO2	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO3	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO4	3	2	3	2	3	2	2	0	2	0	2	2	1	0
CO5	2	2	0	2	0	0	1	0	0	0	0	0	0	0
CO6	1	2	0	3	0	2	2	2	2	0	2	2	0	0
	15	12	9	13	9	8	10	2	8	0	8	8	3	0

1 - Low, 2 - Medium, 3 - High

Subject Name	INPLANT TRAINING-III		
Subject Code	XME709		
L -T -P -C	C:P:A	L -T -P -H	
0- 0 -2- 2	1:0.5:0.5	0- 0 -0 -0	
Course Outcomes			Domain C or P or A
CO1	Relate classroom theory with workplace practice		Cog(U)
CO2	Comply with Factory discipline, management and business practices.		Affective(Respond)
CO3	Demonstrates teamwork and time management.		Affective (Value)
CO4	Describe and Display hands-on experience on practical skills obtained during the programme.		Psychomotor (Perception , Set)
CO5	Summarize the tasks and activities done by technical documents and oral presentations. <i>All COs are equally weighted</i>		Cog(E)

Mapping of Cos with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2							1	3			1	
CO3									3	1	3	1
CO4		1	2	1	3							3
CO5				3						3		1
	2	1	2	4	3	0	1	3	3	4	4	5

1-Low , 2 - Medium, 3-High

SYLLABUS FOR
M.Tech Renewable Energy (FT) – 2020-21 – ACADEMIC YEAR

YRE 103- PROCESS MODELLING AND SIMULATION IN ENERGY SYSTEMS

3 0 0 3

UNIT – I **6**

Introduction to modeling, a systematic approach to model building, classification of models. **Modeling Techniques-Response function and Numerical methods-** Conservation principles, thermodynamic principles of process systems

UNIT-II **9**

Introduction to development of steady state and dynamic lumped and distributed parameters models based on first principles, Analysis of ill-conditioned systems, **Block diagrams and computer simulation, Modeling of process elements consisting of Mechanical (translational and rotational) electro- Mechanical ,fluid flow, thermal and chemical reaction system elements**

UNIT-III **9**

Development of grey box models.Empirical model building.Statistical model calibration and validation. Population balance models. Examples.

UNIT-IV **12**

Solution strategies for lumped parameter models.Stiff differential equations. Solution methods for initial value and boundary value problems. Euler’s method.R-K method.shootingmethod,fnite difference methods. Solving problems using MATLAB/ SCILAB

UNIT- V **9**

Solution strategies for distributed parameter models.Solving parabolic, elliptic and hyperbolic partial differential equations.Finite element and finite volume methods.

L:45; T:15; Total:60

TEXT BOOKS

1. K.M. Hangos and I.T Cameron,” Process Modelling and Model analysis”.academic Press 2001.
2. W. L Luyben, “ Process Modelling, Simulation and control for chemical Engineers” 2ndEdn, McGraw Hill Book Co, New York,1990
3. W.F Ramirez “ Computational Methods for Process Simulation” Butterworths,1995

REFERENCES

1. 1.Mark E. Davis,” Numerical Methods and Modelling for Chemical Engineers” JohnWiley& Sons,1984.
2. 2.Singiresu S. Rao “Applied Numerical Methods for Engineers and Scientists” Prentice hall, Upper saddle River , NJ 2001
3. 3.Francis vanek, Louis D. Albright,” Energy systems Engineering” McGraw- Hill book Company, N.Y 2008
4. “Power System Engineering” 2ndEd.D.P Kothari, I.J. Nagrath, Tata MaGraw- Hill Co 2008.

UNIT 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. Mayall , "Industrial Design", McGraw Hill, 1992.
5. Niebel , "Product Design", McGraw Hill, 1974.
6. Model Curriculum of Engineering & Technology PG Courses [Volume -II] 125 Asimov, "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

YEGOE1- ENGLISH FOR RESEARCH PAPER WRITING

UNIT 1:- Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT 2:- Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction **4**

UNIT 3:- Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. **4**

UNIT 4:- key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature. **4**

UNIT 5:- Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions **4**

UNIT 6:- useful phrases, how to ensure paper is as good as it could possibly be the first- time submission **4**

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

YRE 202 - COMPUTATIONAL FLUID DYNAMICS

3 1 0 4

UNIT - I GOVERNING DIFFERENTIAL EQUATION AND FINITE

DIFFERENCE METHOD

10

Classification, Initial and Boundary conditions, Initial and Boundary value problems. **Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.**

UNIT - II CONDUCTION HEAT TRANSFER

8

Steady one-dimensional conduction, Two and Three-dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT - III INCOMPRESSIBLE FLUID FLOW

7

Governing Equations, **Stream Function - Vorticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, Finite difference approach.**

UNIT - IV CONVECTION HEAT TRANSFER AND FEM

10

Steady One-Dimensional and Two-Dimensional Convection - Diffusion, Unsteady one-dimensional convection -Diffusion, Unsteady two-dimensional convection - Diffusion -

Introduction to finite element method - Solution of steady heat conduction by FEM - Incompressible flow - Simulation by FEM.

UNIT - V TURBULENCE MODELS

10

Algebraic Models - One equation model, K-I Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

L:45; T:15; Total :60

TEXT BOOK

1. Anderson ,D.A Tannehill, I I and Pletcher , R,H “Computational Fluid Mechanics and Heat transfer” Narosa Publication House, NewYork, USA,1984

REFERENCES:

1. Muralidhar, K.,andSundararajan,T., "Computational Fluid Flow and Heat Transfer", NarosaPublishingHouse ,New Delhi1995.
2. Ghoshdasdidar, P.S.,"Computer Simulation of flow and heat transfer" Tata McGraw-Hill PublishingCompany Ltd., 1998.
3. Anderson, D.A.,Tannehill, I.I., and Pletcher, R.H., “Computational Fluid Mechanics and Heat Transfer”,Hemishpere Publishing Corporation, New York, USA, 1984.
4. Flectcher, C.A.J., "Computational Techniques for Different Flow Categories, Springer-Verlage 1987.

YRE207 MINI PROJECT

0 0 1 2

Syllabus contents:-

Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

Semester	Course name	Course Code	L	T	P	C
II	Constitution of India	YPSOE1	-	-	-	0

Course content

1. Meaning of the constitution law andconstitutionalism
2. Historical perspective of the Constitution ofIndia
3. SalientfeaturesandcharacteristicsoftheConstitutionofIndia
4. Scheme of the fundamentalrights
5. The scheme of the Fundamental Duties and its legalstatus
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers

- and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
 10. The historical perspectives of the constitutional amendments in India
 11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
 12. Local Self Government – Constitutional Scheme in India
 13. Scheme of the Fundamental Right to Equality
 14. Scheme of the Fundamental Right to certain Freedom under Article 19
Scope of the Right to Life and Personal Liberty under Article 21

YRE301 Project phase - I 0 0 10 10

Guidelines:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

YRE401 Project Phase - II 0 0 16 16

Guidelines:

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of

the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

SYLLABUS FOR
M.Tech Renewable Energy (PT) – 2020-21-ACADEMIC YEAR

PYRE 102 - WIND ENERGY, TIDAL ENERGY AND OTEC **3 0 0 3**

UNIT - I MEASUREMENT TECHNIQUES **12**
(Use of approved data book permitted in the examination)

Introduction-measurement and instrumentation-Beau fort number Guest parameters-wind type-power law index betz constant Terrain value.Wind speed characterization-site survey and site analysis -Energy in wind-Highest, lowest wind speeds-wind speed for return periods-study of wind applicable Indian standards-steel Tables, Structural Engineering.

UNIT – II WINDMILL AND WIND TURBINE **10**

Wind mill characteristics – types of wind mills- performance analysis -Merits and limitation-variables in wind energy conversion system-wind power density-power in a wind stream-wind turbine efficiency-power of a wind turbine for given in-coming wind velocity - forces on the blades of a propeller-examples of wind farm site-mean wind velocity-wind velocity duration curve-energy pattern factor-wind power duration characteristics - Tip speed ratios - Solidity curves.

Terms-study of all types of turbines (HAWT, VAWT)-typical large capacity wind turbines-sizing-tower design-power duration curves-wind rows diagrams –study of characteristics-actuator theory –analysis of Hourly, daily, monthly, annual, wind behavior-control and instrumentations. syncln& power stabilization synchronization & power stabilization.

UNIT - III POWER GENERATION AND HYBRIDISATION **10**

Types of wind energy system-alternatives-Grid-combination of diesel generator, Battery storage-wind turbine circuits-wind map of India-Wind farm-indefinitely developed wind turbine-study of various wind turbines manufactured indigenously - kilowatt rating-retrofits-R&M-OP & FC-speed limitation-fatigue stress.

UNIT - IV WAVE AND TIDAL ENERGY **7**

Wave energy -Tidal changes – Ecological changes – Types Tidal Power – Energy from Sea – Tidal Turbines – Tidal Power Generation – Recent Trends and Developments – Problems and solutions – Case Studies.

UNIT - V OTEC **6**

The concepts- construction and operational problems – history of OTEC development Alternative energy technology – Ocean thermal energy conversion – Techniques – Problems and solutions – Case Studies-ecological and environmental aspects.

A compulsory seminar / assignment on design / case study/analysis /application in any one of the Wind energy,Tidal and OTEC

L:45; Total:45

TEXT BOOKS;

- 1.E.LWakil "Power plant technology", McGrawGillPublishers,New York
- 2.G. D Rai "Non Conventional Energy sources" Khanna publishers. New Delhi

REFERENCES:

- 1.S.Rao& B.B.Parulekar,"Energy Technology", 3rd edition,Khanna publishers,1995.
- 2.Anna Mani & Dr.Nooley,"wind Energy Data for India", 1983.

PYRE202 – Research Methodology and IPR

2 0 0 2

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

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4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. Mayall , "Industrial Design", McGraw Hill, 1992.
- 5.. Niebel , "Product Design", McGraw Hill, 1974.
6. Model Curriculum of Engineering & Technology PG Courses [Volume -II] 125 Asimov, "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
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