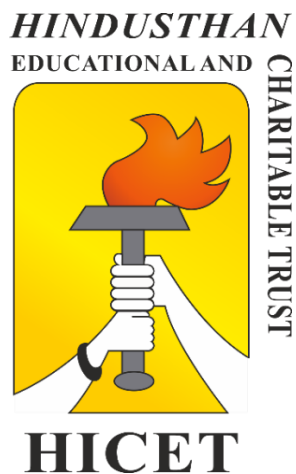


***HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY***  
**(An Autonomous Institution Affiliated to Anna University, Chennai)**  
**(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)**  
**Coimbatore - 641 032.**

**B E. MECHANICAL ENGINEERING**



**CHOICE BASED CREDIT SYSTEM**

**Curriculum and Syllabus**

**Academic year 2023-24**

## **VISION OF THE INSTITUTE**

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

## **MISSION OF THE INSTITUTE**

- To provide academic excellence in technical education through novel teaching methods.
- To empower students with creative skills and leadership qualities.
- To produce dedicated professionals with social responsibility

## **VISION OF THE DEPARTMENT**

To provide quality technical education in Mechanical Engineering and build holistic professionals who can excel in the engineering establishments and serve for the country with ethical values.

## **MISSION OF THE DEPARTMENT**

M1: To prepare graduates with good technical skills and knowledge.

M2: To prepare graduates with life-long learning skills to meet the requirements in the higher education and in society.

M3: To prepare graduates as successful entrepreneur with employment skills, ethics and human values.

## **PROGRAMME EDUCATIONAL OBJECTIVES**

PEO 1: Exhibit their sound theoretical, practical skills and knowledge for successful employments, higher studies, research and entrepreneurial assignments.

PEO 2: Lifelong learning skills, professional ethics and good communication capabilities along with entrepreneur skills and leadership, so that they can succeed in their life.

PEO 3: Become leaders and innovators by devising engineering solutions for social issues and problems, thus caring for the society.

  
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## PROGRAMME OUTCOMES

Engineering graduates will be able to

**PO1. Engineering Knowledge:** Apply the knowledge of Mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct investigations of complex problems:** use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5. Modern tool usage:** create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6. The engineer and society:** apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.


**PO7. Environment and sustainability:** understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and team work:** function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

  
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**PO11. Project management and finance:** demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **PROGRAMME SPECIFIC OUTCOMES**

PSO1. Ability to become a successful entrepreneur caring for the society with ethical approach.

PSO2. Ability to pursue higher education in the field of engineering and management.

  
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# **CURRICULUM**

## **R2019**

**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS  
CBCS PATTERN  
UNDERGRADUATE PROGRAMMES  
B.E. MECHANICAL ENGINEERING REGULATION-2022  
(For the students admitted during the academic year 2022-2023 and onwards)**

**Programme: Mechanical Engineering**

**Branch: Mechanical**

**SEMESTER I**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	40	60	100
3	22PH1151	Physics for Non Circuit Engineering	BSC	2	0	2	3	4	50	50	100
4	22IT1151	Python Programming and practices	ESC	2	0	2	3	4	50	50	100
5	22ME1101	Engineering Drawing	ESC	1	4	0	3	5	50	50	100
<b>EEC COURSES (SE/AE)</b>											
6	22HE1071	Universal Human Values –II	AEC	2	0	0	2	2	40	60	100
7	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
<b>MANDATORY COURSES</b>											
8	22MC1091/ 22MC1092	தமிழரும் தொழில்நுட்பமும்/ Indian Constitution (Common to all branches)	MC	2	0	0	0	2	0	0	0
<b>TOTAL</b>				<b>15</b>	<b>1</b>	<b>10</b>	<b>19</b>	<b>26</b>			

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**SEMESTER II**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22MA2101	Differential Equations and Complex Analysis.	BSC	3	1	0	4	4	40	60	100
2	22CY2101	Environmental Studies	ESC	2	0	0	2	2	40	60	100
3	22PH2101	Basics of Material Science	BSC	2	0	0	2	2	40	60	100
4	22ME2101	Engineering Mechanics	ESC	3	0	0	3	3	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
4	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
5	22CY2152	Applied Chemistry	BSC	2	0	2	3	4	50	50	100
<b>PRACTICAL</b>											
6	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
7	22HE2071	Design Thinking	AEC	1	0	2	2	3	100	0	100
8	22HE2072	Soft Skills -1	SEC	1	0	0	1	1	100	0	100
<b>MANDATORY COURSES</b>											
9	22MC2091/ 22MC2092	தமிழர்மரபு/ Heritage of Tamil	MC	2	0	0	0	2	0	0	0
10	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
<b>TOTAL</b>				<b>18</b>	<b>1</b>	<b>10</b>	<b>22</b>	<b>29</b>			

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**SEMESTER III**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22MA3105	Fourier Series and Transforms	BSC	3	1	0	4	4	40	60	100
2	22ME3201	Engineering Thermodynamics	PCC	3	0	0	3	3	40	60	100
3	22ME3202	Engineering Materials and Metallurgy	PCC	3	0	0	3	3	40	60	100
4	22XXXX	Electrical Drives and Control	PCC	3	0	0	3	3	40	60	100
5	22ME3204	Manufacturing Technology-I	PCC	3	0	0	3	3	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
6	22ME3251	Fluid Mechanics and Machinery	PCC	3	0	2	4	5	50	50	100
<b>PRACTICAL</b>											
7	22ME3001	Manufacturing Technology Laboratory-I	PCC	0	0	4	2	4	60	40	100
8	22ME3002	Computer Aided Modeling Lab	AEC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
9	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100
<b>MANDATORY COURSES</b>											
10	22MC3091	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	0	0	0
<b>TOTAL</b>				<b>15</b>	<b>3</b>	<b>14</b>	<b>25</b>	<b>32</b>			

**SEMESTER IV**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22ME4201	Kinematics of Machinery	PCC	3	0	0	3	3	40	60	100
3	22ME4202	Hydraulic and Pneumatic Systems	PCC	3	0	0	3	3	40	60	100
4	22ME4203	Manufacturing Technology – II	PCC	3	0	0	3	3	40	60	100
5	22ME4204	Thermal Engineering	PCC	3	1	0	3	4	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
6	22ME4251	Strength of Materials	PCC	2	0	2	3	4	50	50	100
<b>PRACTICAL</b>											
7	22ME4001	Manufacturing Technology Laboratory-II	PCC	0	0	4	2	4	60	40	100
8	22ME4002	Thermal Engineering Lab	PCC	0	0	4	2	4	60	40	100
9	22ME4003	Mini Project	PCC	0	0	2	1	2	60	40	100
<b>EEC COURSES (SE/AE)</b>											
10	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
<b>TOTAL</b>				<b>16</b>	<b>1</b>	<b>12</b>	<b>23</b>	<b>29</b>			

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**SEMESTER V**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22ME5201	Design of Machine Elements	PCC	3	1	0	3	4	40	60	100
2	22ME5202	Heat and Mass Transfer	PCC	3	0	0	2	3	40	60	100
3	22MT53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22MT53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22MT53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
7	22ME5251	Dynamics of Machines	PCC	2	0	2	3	4	50	50	100
<b>PRACTICAL</b>											
8	22ME5001	Heat Transfer Lab	PCC	0	0	4	2	4	60	40	100
9	22ME5072	Machine Drawing	ESC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
10	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
<b>TOTAL</b>				<b>18</b>	<b>1</b>	<b>6</b>	<b>22</b>	<b>25</b>			

**SEMESTER VI**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
2	22ME6201	Design of Transmission systems	PCC	3	0	0	2	3	40	60	100
3	22MT63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4	22MT63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
7	22ME6251	Metrology and Quality control	PCC	2	0	2	3	4	50	50	100
<b>PRACTICAL</b>											
8	22ME6001	CAD/CAM Lab	PCC	0	0	4	2	4	60	40	100
<b>EEC COURSES (SE/AE)</b>											
9	22HE6071	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
<b>TOTAL</b>				<b>20</b>	<b>0</b>	<b>8</b>	<b>24</b>	<b>28</b>			

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**SEMESTER VII**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>THEORY</b>											
1	22ME7201	Engineering Economics and Finance Management	PCC	3	0	0	3	3	40	60	100
2	22ME7202	Artificial Intelligence for Mechanical Engineering	PCC	3	1	0	3	4	40	60	100
3	22MT73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
<b>THEORY WITH LAB COMPONENT</b>											
6	22ME7251	Finite Element Analysis	PCC	2	0	2	3	4	50	50	100
<b>EEC COURSES (SE/AE)</b>											
7	22ME7701	Internship	SEC	0	0	0	2	2	100	0	100
<b>TOTAL</b>				<b>15</b>	<b>1</b>	<b>4</b>	<b>20</b>	<b>22</b>			
* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.											

**SEMESTER VIII**

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
<b>EEC COURSES (SE/AE)</b>											
1	22ME8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>	<b>20</b>			

**Note:**

- As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.
- NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
- The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

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## SEMESTER WISE CREDIT DISTRIBUTION

<b>B.E. / B.TECH.PROGRAMMES</b>										
<b>S.No.</b>	<b>Course Area</b>	<b>CreditsperSemester</b>								<b>TotalCredits</b>
		<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>	<b>VII</b>	<b>VIII</b>	
1	HSC	3	3	-	2	-	3	-	-	<b>11</b>
2	BSC	7	9	4	-	-	-	-	-	<b>20</b>
3	ESC	6	7	-	-	2	-	-	-	<b>15</b>
4	PCC	-	-	18	20	10	7	9	-	<b>64</b>
5	PEC	-	-	-	-	9	6	3	-	<b>18</b>
6	OEC	-	-	-	-	-	6	6	-	<b>12</b>
7	EEC	3	3	3	1	1	2	2	10	<b>25</b>
8	MC	✓	✓	-	-	-	-	-	-	-
<b>Total</b>		<b>19</b>	<b>22</b>	<b>25</b>	<b>23</b>	<b>22</b>	<b>24</b>	<b>20</b>	<b>10</b>	<b>165</b>

### **OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)**

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>PERIODS PERWEEK</b>			<b>TOTALCON TACTPERI ODS</b>	<b>CREDITS</b>
				<b>L</b>	<b>T</b>	<b>P</b>		
1	22AI6401	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6401	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6401	Cyber security	OEC	2	0	2	4	3
4	22EC6402	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6401	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6401	Augmented and Virtual Reality	OEC	2	0	2	4	3

  
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## OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS,  
CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGOR Y	PERIODS			TOTAL CONTACT PERIODS	CREDIT S
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

**Note:** Non-Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

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### OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22ME7402	Hybrid and Electric Vehicle Technology	OEC	3	0	0	3	3
2	22MT7401	Project Management (Must in the list)	OEC	3	0	0	3	3
3	22ME7401	Total Quality Management (Must in the list)	OEC	3	0	0	3	3

### OPEN ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

### Service Paper (Chemical Engineering)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22ME3231	Basic Mechanical Engineering	PCC	3	0	0	3	3

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**PROFESSIONAL ELECTIVE COURSES: VERTICALS**

<b>Vertical I General</b>	<b>Vertical II Modern Mobility Systems</b>	<b>Vertical III Product and Process Development</b>	<b>Vertical IV Robotics and Automation</b>	<b>Vertical V Digital and Green Manufacturing</b>	<b>Vertical VI Logistics and Supply Chain Management</b>
<b>22ME5301</b> Automobile Engineering	<b>22ME5304</b> Automotive Materials, Components, Design& Testing	<b>22ME5307</b> Value Engineering	<b>22ME5310</b> Sensors and Instrumentation	<b>22ME5313</b> Digital Manufacturing and IoT	<b>22ME5316</b> Automation in Manufacturing
<b>22ME5302</b> Internet of Things for Mechanical Engineers	<b>22ME5305</b> Conventional and Futuristic Vehicle Technology	<b>22ME5308</b> Quality and Reliability Engineering	<b>22ME5311</b> Electrical Drives and Actuators	<b>22ME5314</b> Lean Manufacturing	<b>22ME5317</b> Warehousing Automation
<b>22ME5303</b> Additive Manufacturing systems	<b>22ME5306</b> Renewable Powered Off Highway Vehicles and Emission Control Technology	<b>22ME5309</b> Production and Operations Management	<b>22ME5312</b> Embedded Systems and Programming	<b>22ME5315</b> Green Manufacturing Design and Practices	<b>22ME5318</b> Material Handling Equipment, Repair and Maintenance
<b>22ME6301</b> Principles of Management	<b>22ME6303</b> Vehicle Health Monitoring, Maintenance and Safety	<b>22ME6305</b> Ergonomics in Design	<b>22ME6307</b> Robotics	<b>22ME6309</b> Environment Sustainability and Impact Assessment	<b>22ME6311</b> Container Logistics
<b>22ME6302</b> CAD/CAM	<b>22ME6304</b> CAE and CFD Approach in Future Mobility	<b>22ME6306</b> New Product Development	<b>22ME6308</b> Smart Mobility and Intelligent Vehicles	<b>22ME6310</b> Energy Saving Machinery and Components	<b>22ME6312</b> Robotics in Logistics
<b>22ME7301</b> Entrepreneurship Development and Business Concepts	<b>22ME7302</b> Thermal Management of Batteries and Fuel Cells	<b>22ME7303</b> Product Life Cycle Management	<b>22ME7304</b> Haptics and Immersive Technologies	<b>22ME7305</b> Green Supply Chain Management	<b>22ME7306</b> Data Science

**Note:**

Students are permitted to choose all professional electives from any of the verticals.

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**Vertical I  
General Core**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5301	Automobile Engineering	PEC	3	0	0	3	3
2	22ME5302	Internet of Things for Mechanical Engineers	PEC	3	0	0	3	3
3	22ME5303	Additive Manufacturing systems	PEC	3	0	0	3	3
4	22ME6301	Design of Transmission systems	PEC	3	0	0	3	3
5	22ME6302	CAD/CAM	PEC	3	0	0	3	3
6	22ME7301	Entrepreneurship Development and Business Concepts	PEC	3	0	0	3	3

**Vertical II  
Modern Mobility Systems**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5304	Automotive Materials, Components, Design & Testing	PEC	3	0	0	3	3
2	22ME5305	Conventional and Futuristic Vehicle Technology	PEC	3	0	0	3	3
3	22ME5306	Additive Manufacturing systems	PEC	3	0	0	3	3
4	22ME6303	Principles of Management	PEC	3	0	0	3	3
5	22ME6304	CAD/CAM	PEC	3	0	0	3	3
6	22ME7302	Entrepreneurship Development and Business Concepts	PEC	3	0	0	3	3

**Vertical III  
Product and Process Development**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5307	Value Engineering	PEC	3	0	0	3	3
2	22ME5308	Quality and Reliability Engineering	PEC	3	0	0	3	3
3	22ME5309	Production and Operations Management	PEC	3	0	0	3	3
4	22ME6305	Ergonomics in Design	PEC	3	0	0	3	3
5	22ME6306	New Product Development	PEC	3	0	0	3	3
6	22ME7303	Product Life Cycle Management	PEC	3	0	0	3	3

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**Vertical IV**  
**Robotics and Automation**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5310	Sensors and Instrumentation	PEC	3	0	0	3	3
2	22ME5311	Electrical Drives and Actuators	PEC	3	0	0	3	3
3	22ME5312	Embedded Systems and Programming	PEC	3	0	0	3	3
4	22ME6307	Robotics	PEC	3	0	0	3	3
5	22ME6308	Smart Mobility and Intelligent Vehicles	PEC	3	0	0	3	3
6	22ME7304	Haptics and Immersive Technologies	PEC	3	0	0	3	3

**Vertical V**  
**Digital and Green Manufacturing**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5313	Digital Manufacturing and IoT	PEC	3	0	0	3	3
2	22ME5314	Lean Manufacturing	PEC	3	0	0	3	3
3	22ME5315	Green Manufacturing Design and Practices	PEC	3	0	0	3	3
4	22ME6309	Environment Sustainability and Impact Assessment	PEC	3	0	0	3	3
5	22ME6310	Energy Saving Machinery and Components	PEC	3	0	0	3	3
6	22ME7305	Green Supply Chain Management	PEC	3	0	0	3	3

**Vertical VI**  
**Logistics and Supply Chain Management**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5316	Automation in Manufacturing	PEC	3	0	0	3	3
2	22ME5317	Warehousing Automation	PEC	3	0	0	3	3
3	22ME5318	Material Handling Equipment, Repair and Maintenance	PEC	3	0	0	3	3
4	22ME6311	Container Logistics	PEC	3	0	0	3	3
5	22ME6312	Robotics in Logistics	PEC	3	0	0	3	3
6	22ME7306	Data Science	PEC	3	0	0	3	3

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## Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

### VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

### MECHANICAL ENGINEERING OFFERING MINOR DEGREE PROGRAM IN ELECTRIC VEHICLES

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5231	Sem 5: EV and Sub Systems.	MDC	3	0	0	3	3
2	22ME6231	Sem 6: E vehicle Dynamics	MDC	3	0	0	3	3
3	22ME6232	Sem 6: Cell and battery management system	MDC	3	0	0	3	3
4	22ME7231	Sem 7: Electric Motor and control system	MDC	3	0	0	3	3
5	22ME7232	Sem 7: EV sensors and actuators	MDC	3	0	0	3	3
6	22ME8231	Sem 8: EV charging station	MDC	3	0	0	3	3

\*MDC – Minor Degree Course

  
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In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

**Vertical I  
Fintech and Block Chain**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5231	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

**Vertical II  
Entrepreneurship**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB72334	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

**Vertical III  
Environment and Sustainability**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

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**B E (HONS) MECHANICAL ENGINEERING**  
**DIGITAL AND GREEN MANUFACTURING**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MEXXX1	Sem 5: Digital Manufacturing and IoT	MDC	3	0	0	3	3
2	22MEXXX2	Sem 6: Lean Manufacturing	MDC	3	0	0	3	3
3	22MEXXX3	Sem 6: Modern Robotics	MDC	3	0	0	3	3
4	22MEXXX4	Sem 7: Green Manufacturing Design and Practices	MDC	3	0	0	3	3
5	22MEXXX5	Sem 7: Environment Sustainability and Impact Assessment	MDC	3	0	0	3	3
6	22MEXXX6	Sem 8: Green Supply Chain Management	MDC	3	0	0	3	3

**RENEWABLE ENERGY TECHNOLOGY**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MEXXX1	Sem 5: Bioenergy Conversion Technologies	MDC	3	0	0	3	3
2	22MEXXX2	Sem 6: Energy Conservation in Industries	MDC	3	0	0	3	3
3	22MEXXX3	Sem 6: Energy Storage Devices	MDC	3	0	0	3	3
4	22MEXXX4	Sem 7: Solar Energy Technology	MDC	3	0	0	3	3
5	22MEXXX5	Sem 7: Renewable Energy Technologies	MDC	3	0	0	3	3
6	22MEXXX6	Sem 8: New and Renewable Sources of Energy	MDC	3	0	0	3	3


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## PRODUCT AND PROCESS DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MEXXX1	Sem 5: New Product Development	MDC	3	0	0	3	3
2	22MEXXX2	Sem 6: Ergonomics in Design	MDC	3	0	0	3	3
3	22MEXXX3	Sem 6: Advances in Composite Materials	MDC	3	0	0	3	3
4	22MEXXX4	Sem 7: Logistics and Supply Chain Management	MDC	3	0	0	3	3
5	22MEXXX5	Sem 7: EV Technologies	MDC	3	0	0	3	3
6	22MEXXX6	Sem 8: Heating, Ventilation and Air Conditioning Systems	MDC	3	0	0	3	3

  
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Programme/s em	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MA1101	<b>MATRICES AND CALCULUS</b> (Common to all Branches)	3	1	0	4

- Course Objective
1. Construct the characteristic polynomial of a matrix and use it to identify eigenvalues and Eigenvectors
  2. To impart the knowledge of sequences and series.
  3. Analyse and discuss the maxima and minima of the functions of several variables.
  4. Evaluate the multiple integrals and apply in solving problems.
  5. Apply vector differential operator for vector function and theorems to solve engineering problems.

Unit	Description	Instructional Hours
	<b>Matrices</b>	12
I	Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	
	<b>Single Variate Calculus</b>	12
II	Rolle's Theorem–Lagrange's Mean Value Theorem–Maxima and Minima–Taylor's and Maclaurin's Series.	
	<b>Functions of Several Variables</b>	12
III	Partial derivatives–Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers.	
	<b>Integral Calculus</b>	12
IV	Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	
	<b>Vector Calculus</b>	12
V	Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.	
	<b>Total Instructional Hours</b>	<b>60</b>

- Course Outcome
- CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.
- CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.
- CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.
- CO4: Evaluate multiple integral and its applications in finding area, volume.
- CO5: Apply the concept of vector calculus in two and three dimensional spaces.

#### TEXTBOOKS:

T1: G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 9<sup>th</sup> Edition Addison Wesley Publishing company, 2016.

T2: Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2019.

T3: K.P. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus)", Pearson Ltd, 2022.

#### REFERENCE BOOKS:

R1- Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W.H. Freeman, 2003

R2- Strauss M.J, G.L. Bradley and K.J. Smith, "Multivariable calculus", Prentice Hall, 2002.

R3- Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016.

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Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/I	22HE1151	ENGLISH FOR ENGINEERS- (Common to all Branches)	2	0	2	3

- Course Objective
- To improve the communicative proficiency of learners
  - To help learners use language effectively in professional writing
  - To advance the skill of maintaining the suitable tone of communication.
  - To introduce the professional life skills.
  - To impart official communication etiquette.

Unit	Description	Instructional Hours
I	<b>Language Proficiency:</b> Types of Sentences, Functional Units, Framing question. <b>Writing:</b> process description, Writing Checklist. <b>Vocabulary</b> – words on environment. <b>Practical Component: Listening-</b> Watching short videos and answer the questions, <b>Speaking-</b> Self introduction, formal & semi-formal	7+2
II	<b>Language Proficiency:</b> Tenses, Adjectives and adverbs. <b>Writing:</b> Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension. <b>Vocabulary</b> – words on entertainment. <b>Practical Component: Listening-</b> Comprehensions based on TED talks <b>Speaking-</b> Narrating a short story or an event happened in their life	7+2
III	<b>Language Proficiency:</b> Prepositions, phrasal verbs. <b>Writing:</b> Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. <b>Vocabulary</b> – words on tools. <b>Practical Component: Listening-</b> Listentosongsandanswerthequestions <b>Speaking-</b> Justaminute	5+4
IV	<b>Language Proficiency:</b> Subject verb concord, Prefixes & suffixes. <b>Writing:</b> Preparing agenda & minutes, writing an event report. <b>Vocabulary</b> – words on engineering process. <b>Practical Component: Listening-</b> Comprehensions based on Talk of orators or interview shows <b>Speaking-</b> Presentation on a general topic with ppt.	5+4
V	<b>Language Proficiency:</b> Modal Auxiliaries, Active & passive voice, <b>Writing:</b> Project report (proposal & progress), sequencing of sentences <b>Vocabulary</b> –words on engineering material <b>Practical Component: Listening-</b> Listening- Comprehensions based on Nat Geo/Discovery channel videos <b>Speaking-</b> Preparing posters and presenting as a team.	6+3
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome
- CO1:To communicate in a professional forum  
CO2:To speak or write a content in the proficient language  
CO3:To maintain and use appropriate tone of the communication.  
CO4:To read, write and present in a professional way.  
CO5:To follow the etiquettes informal communication.

#### TEXTBOOKS:

T1- Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press,2016.T2- Raymond Murphy, “Essential English Grammar”, Cambridge University Press,2019.

#### REFERENCEBOOKS:

R1- Meenakshi Raman and Sangeetha Sharma. “Technical Communication- Principles and Practice”, Oxford University Press, 2009.

R2-RaymondMurphy, “EnglishGrammarinUse”-4<sup>th</sup>editionCambridgeUniversityPress,2004.

R3-KamaleshSadan“AFoundationCoursefortheSpeakersofTamil-Part-I&II”,OrientBlackswan,2010.

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Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech	22PH1151	PHYSICS FOR NON- CIRCUIT ENGINEERING (Common to Non Circuit branches)	2	0	2	3

**The student should be able to**

- Course Objective
1. Gain knowledge about laser, their applications and Conversant with principles of optical fiber, types and applications of optical fiber
  2. Enhance the fundamental knowledge in properties of matter
  3. Extend the knowledge about wave optics
  4. Gain knowledge about magnetic materials.
  5. Acquire fundamental knowledge of nano materials which is related to the engineering program

Unit	Description	Instructional Hours
I	<b>LASER AND FIBRE OPTICS</b> Spontaneous emission and stimulated emission –Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link.	6
	<b>Determination of Wavelength and particle size using Laser</b>	3
II	<b>PROPERTIES OF MATTER</b> Elasticity – Hooke’s law –Poisson’s ratio – Bending moment – Depression of a cantilever – Derivation of Young’s modulus of the material of the beam by Uniform bending theory and experiment. Twisting couple - torsion pendulum: theory and experiment	6
	<b>Determination of Young’s modulus by uniform bending method</b>	3
	<b>Determination of Rigidity modulus – Torsion pendulum</b>	3
	<b>WAVE OPTICS</b>	6
III	Interference of light – air wedge –Thickness of thin paper - Diffraction of light – Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh’s criterion of resolution power - resolving power of grating.	
	<b>Determination of wavelength of mercury spectrum – spectrometer grating</b>	3
	<b>Determination of thickness of a thin wire – Air wedge method</b>	3
IV	<b>QUANTUM PHYSICS</b> Black body radiation –Compton effect: theory and experimental verification – wave particle duality –concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box .	6
	<b>THERMAL PHYSICS</b> Transfer of heat energy –thermal conduction, convection and radiation – thermal conductivity - Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – applications: solar water heaters.	6
<b>Total Instructional Hours</b>		<b>45</b>

**After completion of the course the learner will be able to**

- Course Outcome
- CO1: Understand the advanced technology of LASER and optical communication in the field of Engineering
  - CO2: Illustrate the fundamental properties of matter
  - CO3: Discuss the Oscillatory motions of particles
  - CO4: Understand the advanced technology of magnetic materials in the field of Engineering
  - CO5: Develop the technology of smart materials and Nano materials in engineering field

**TEXT BOOKS:**

- T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.  
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8<sup>th</sup> edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

**REFERENCE BOOKS:**

- R1** - M.N Avadhanulu and PG Kshirsagar “A Text Book of Engineering physics” S. Chand and Company ltd., New Delhi 2016  
**R2** -Dr. G. Senthilkumar “Engineering Physics – I” VRB publishers Pvt Ltd., 2021

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Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E/ I	22IT1151	<b>PYTHON PROGRAMMING AND PRACTICES</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>
Course Objective	<b>The learner should be able to</b>					
	1. To know the basics of algorithmic problem solving 2. To read and write simple Python programs 3. To develop Python programs with conditionals and loops and to define Python functions and call them 4. To use Python data structures — lists, tuples, dictionaries 5. To do input/output with files in Python					

Unit	Description	Instructional Hours
I	<b>ALGORITHMIC PROBLEM SOLVING</b> Algorithms, 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). <b>Illustrative problems: To find the Greatest Common Divisor (GCD) of two numbers, Fahrenheit to Celsius, Perform Matrix addition.</b>	5
II	<b>DATA, STATEMENTS, CONTROL FLOW</b> Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if -elif-else); Iteration: state, while, for, break, continue, pass; <b>Simple algorithms and programs: Area of the circle, check the given year is Leap year or not, Factorial of a Number.</b>	4
III	<b>FUNCTIONS, STRINGS</b> Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module. <b>Illustrative programs: Perform Linear Search, Selection sort, Sum of all elements in a List, Pattern Programs</b>	5
IV	<b>LISTS, TUPLES, DICTIONARIES</b> 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. <b>Illustrative programs: List Manipulation, Finding Maximum in a List, String processing.</b>	4
V	<b>FILES, MODULES, PACKAGES</b> Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages <b>Illustrative programs: Reading writing in a file, word count, Handling Exceptions</b>	9
<b>Total Instructional Hours</b>		<b>45</b>

Course Outcome At the end of the course, the learner will be able to


CO1: Develop algorithmic solutions to simple computational problems  
 CO2: Read, write, execute by hand simple Python programs  
 CO3: Structure simple Python programs for solving problems and Decompose a Python program into functions  
 CO4: Represent compound data using Python lists, tuples, dictionaries  
 CO5: Read and write data from/to files in Python Programs.

**TEXT BOOKS:**

T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.6.2, Shroff Publishers, First edition (2017).  
 T2: S. Annadurai, S. Shankar, I. Jasmine, M. Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

**REFERENCE BOOKS:**

R1: Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.  
 R2: Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015

  
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Programme/sem B.E/ I	Course Code 22ME1201	Name of the Course <b>ENGINEERING DRAWING</b>	L <b>1</b>	T <b>0</b>	P <b>4</b>	C <b>3</b>
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Course Objective

**The learner should be able to**

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	<b>PLANE CURVES</b> Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	<b>PROJECTIONS OF POINTS, LINES AND PLANE SURFACES</b> Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	<b>PROJECTIONS OF SOLIDS</b> Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	<b>SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES</b> Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	<b>ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS</b> Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
<b>Total Instructional Hours</b>		<b>60</b>

Course Outcome

- At the end of the course, the learner will be able to
- CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.
- CO2: Draw the orthogonal projections of straight lines and planes.
- CO3: Interpret the projections of simple solid objects in plan and elevation.
- CO4: Draw the projections of section of solids and development of surfaces of solids.
- CO5: Draw the isometric projections and the perspective views of different objects.

**TEXT BOOK:**

- T1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New delhi 2016.
- T2. K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

**REFERENCES:**

- R1. Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited, New Delhi 2013.
- R2. N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

  
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Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	<b>22HE1071</b>	<b>UNIVERSAL HUMAN VALUES –II</b> (COMMON TO ALL BRANCHES)	2	0	0	2
Course Objective		<ol style="list-style-type: none"> <li>To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.</li> <li>To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.</li> <li>To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.</li> </ol>				

Unit	Description	Instructional Hours
I	<b>Introduction to Value Education</b> Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations	6
II	<b>Harmony in the Human Being and Harmony in the Family</b> Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health	6
III	<b>Harmony in the Family and Society</b> Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	<b>Harmony in the Nature / Existence</b> Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasive space Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
V	<b>Implications of the Holistic Understanding – a Look at Professional Ethics</b> Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
	<b>Total Instructional Hours</b>	<b>30</b>
Course Outcome	CO1: To become more aware of holistic vision of life - themselves and their surroundings. CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions. CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior. CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions. CO5: To develop competence and capabilities for maintaining Health and Hygiene.	

**Reference Books:**

- R1. *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- R2. *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2
- R3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- R4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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Programme /sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/II	22HE1072	ENTREPRENEURSHIP & INNOVATION	1	0	0	1

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
- 5: To make students understand organizational performance and its importance.

Module	Description
--------	-------------

- |    |   |
|----|---|
| 1  | Entrepreneurial Thinking                    |
| 2  | Innovation Management                       |
| 3  | Design Thinking                             |
| 4  | Opportunity Spotting/Opportunity Evaluation |
| 5  | Industry and Market Research                |
| 6  | Innovation Strategy and Business Models     |
| 7  | Financial Forecasting                       |
| 8  | Business Plans/Business Model Canvas        |
| 9  | Entrepreneurial Finance                     |
| 10 | Pitching to Resources Providers/Pitch Deck  |
| 11 | Negotiating Deals                           |
| 12 | New Venture Creation                        |
| 13 | Lean Start-ups                              |
| 14 | Entrepreneurial Ecosystem                   |
| 15 | Velocity Venture                            |

Course Outcome

- CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.  
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.  
CO3: Remember effectively and efficiently the potential of new business opportunities.  
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..  
CO5: Develop a business model for a new venture, including revenue, Margins, operations, Working capital, and investment

#### TEXTBOOKS


- T1: Arya Kumar "Entrepreneurship – Creating and Leading an Entrepreneurial Organization", Pearson, Second Edition (2012).  
T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition (2016).

#### REFERENCEBOOKS

- R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).  
R2: Thomas Lockwood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).  
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

#### WEBRESOURCES

- W1: <https://blof.forgeforward.in/tagged/startup-lessons>  
W2: <https://blof.forgeforward.in/tagged/entrepreneurship>  
W3: <https://blof.forgeforward.in/tagged/minimum-viable-product>  
W4: <https://blof.forgeforward.in/tagged/minimum-viable-product>  
W5: <https://blof.forgeforward.in/tagged/innovation>

  
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Programme	CourseCode	Name of the Course	L	T	P	C
B.E./B.Tech/III.	22MC1091	INDIAN CONSTITUTION	2	0	0	0

**Course Objective**

1. Sensitization of student towards self, family (relationship), society and nature
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals
3. Strengthening of self-reflection
4. Development of commitment and courage to act

Unit	Description	Instructional Hours
<b>BASIC FEATURES AND FUNDAMENTAL PRINCIPLES</b>		
I	Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.	6
<b>FUNDAMENTAL RIGHTS</b>		
II	Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation – Federal structure and distribution Of legislative and financial powers between the union and states.	6
<b>PARLIAMENTARY FORM OF GOVERNMENT</b>		
III	The constitution powers and the status of the president in India. – Amendment of the constitutional Powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions: National emergency, President rule, Financial emergency.	6
<b>LOCAL GOVERNANCE</b>		
IV	Local self-government – Rural Local Government – Panchayath Raj, Elections of Panchayat – State Election Commission – Urban Local Government – Amendment Act, Urban Local Government Structures in India	6
<b>INDIAN SOCIETY</b>		
V	Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	6
<b>Total Instructional Hours</b>		<b>30</b>

**Course Outcome**  
Upon completion of the course, students will be able to  
CO1: Understand the functions of the Indian government.  
CO2: Understand and abide the rules of the Indian constitution

**TEXTBOOKS:**

T1-Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 1997. T2- Agarwal RC., "Indian Political System", S. Chand and Company, New Delhi, 1997. T3-Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi. T4-Sharma KL., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi, 1997.

**REFERENCE BOOKS:**

R1-Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi. R2-Gahai UR., "Indian Political System", New Academic Publishing House, Jalaendhar. R3-Sharma RN., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd.

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Program me/ Sem	Course Code	Name of the Course	L	T	P	C
B.E/ II	22MA21 01	<b>DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS</b> (AERO, AGRI, AUTO, MECH, MECT)	3	1	0	4

**The learner should be able to**

- Course Objective**
1. Describe some methods to solve different types of first order differential equations.
  2. Understand the various approach to find general solution of the ordinary differential equations
  3. Evaluate the various types of Partial differential equations and methods to find solution.
  4. Introduction to analytic functions and its properties.
  5. Understand Cauchy's theorem and its applications in evaluation of integral.

Unit	Description	Instructional Hours
<b>I</b>	<b>ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER</b> Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation.	12
<b>II</b>	<b>LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER</b> Second order linear differential equations with constant with RHS of the form $e^{ax}$ , $x^n$ , $\sin ax$ , $\cos ax$ - Cauchy's linear equations- Method of variation of parameters.	12
<b>III</b>	<b>PARTIAL DIFFERENTIAL EQUATIONS</b> Formation of partial differential equations by eliminating arbitrary constants and functions – Solution of first order partial differential equations of the form $f(p,q)=0$ , Clairaut's equation – Lagrange's equation.	12
<b>IV</b>	<b>COMPLEX DIFFERENTIATION (9)</b> Functions of complex variables – Analytic functions – Cauchy's – Riemann equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping $w = A+iz$ , $Az$ , $1/z$ and bilinear transformations.	12
<b>V</b>	<b>COMPLEX INTEGRATION (9)</b> Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem - Contour Integration with unit circle only.	12
<b>Total Instructional Hours</b>		<b>60</b>

**At the end of the course, the learner will be able to**

- Course Outcome**
- CO1: Apply few methods to solve different types of first order differential equations.  
CO2: Evaluate the solutions of higher order ordinary differential equations and its properties.  
CO3: Compute the solution of first order partial differential equations.  
CO4: Understand the concept of analytic functions and discuss its properties.  
CO5: Evaluate various integrals by using Cauchy's residue theorem and classify singularities and derive Laurent series expansion

**TEXT BOOKS:**

- T1 – Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2019.  
T2 - William E. Boyce, Richard C. DiPrima, Douglas B. Meade, Elementary Differential Equations and Boundary Value Problems, Wiley, 2017.  
T3 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

**REFERENCE BOOKS:**

- R1 - James Ward Brown, Ruel Vance Churchill, Complex Variables and Applications, McGraw-Hill Higher Education, 2004  
R2 - Dennis Zill, Warren S. Wright, Michael R. Cullen, Advanced Engineering Mathematics, Jones &

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E/ II	22CY2101	<b>ENVIRONMENTAL STUDIES</b> (common to all branches except CSE,IT & AIML)	3	0	0	2

- The learner should be able to**
1. Grasp the importance and issues related to ecosystem and biodiversity and their protection.
  2. Acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
  3. Identify the various natural resources, exploitation and its conservation
  4. Gain knowledge on the scientific, technological, economic and political solutions to environmental problems.
  5. Become aware on the national and international concern for environment and its protection

Unit	Description	Instructional Hours
I	<b>ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY</b> Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	9
II	<b>NATURAL RESOURCES</b> Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	9
III	<b>ENVIRONMENTAL POLLUTION</b> Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution- Noise pollution- Nuclear hazards – role of an individual in prevention of pollution.	9
IV	<b>SOCIAL ISSUES AND THE ENVIRONMENT</b> From unsustainable to sustainable development – urban problems related to energy-environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones.	9
V	<b>HUMAN POPULATION AND THE ENVIRONMENT</b> Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health.	9
<b>Total Instructional Hours</b>		<b>45</b>


- At the end of the course, the learner will be able to**
- CO1: Discuss the importance of ecosystem and biodiversity for maintaining ecological balance.  
CO2: Identify the causes of environmental pollution and hazards due to manmade activities.  
CO3: Develop an understanding of different natural resources including renewable resources.  
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.  
CO5: Describe about the importance of women and child education, existing technology to protect environment.

**TEXT BOOKS:**

T1 – S. Annadurai and P.N. Magudeswaran, “Environmental studies”, Cengage Learning India Pvt.Ltd, Delhi, 2020  
T2 - Anubha Kaushik and C. P. Kaushik, “Perspectives in Environmental studies”, Sixth edition, New Age International Publishers, New Delhi, 2019.

**REFERENCE BOOKS:**

R1 - Erach Bharucha, “Textbook of environmental studies” University Press (I) Pvt.Ltd, Hyderabad, 2015  
R2 - G.Tyler Miller, Jr and Scott E. Spoolman “Environmental Science” Thirteenth Edition, Cengage Learning, 2010.  
R3 – Gilbert M. Masters and Wendell P. Ela “Introduction to Environmental Engineering and Science”, 3rd edition, Pearson Education, 2013.

  
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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.Tech II	22PH2101	<b>BASICS OF MATERIAL SCIENCE</b> (Common to all branches except MCT)	2	0	0	2

**Course Objective**

**The student should be able to**

1. Gain knowledge about Crystal systems and crystal structures
2. Understand the knowledge about electrical properties of materials
3. Enhance the fundamental knowledge in semiconducting materials.
4. Gain knowledge about magnetic materials
5. Acquire fundamental knowledge new engineering materials which is related to the engineering program

Unit	Description	Instructional Hours
I	<b>CRYSTAL PHYSICS</b> Crystal systems - Bravais lattice - Lattice planes - Miller indices – Inter planar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
II	<b>ELECTRICAL PROPERTIES OF MATERIALS</b> Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression – Widemann - Franz law – Success and failures – Fermi-Dirac statistics – Density of energy states .	6
III	<b>SEMICONDUCTING MATERIALS</b> Introduction – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Intrinsic semiconductor — electrical conductivity – band gap determination. - Extrinsic semiconductor – n type and p type semiconductor –Light Emitting Diode.	6
IV	<b>MAGNETIC MATERIALS</b> Origin of magnetic moment – Bohr magnetron – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
V	<b>NEW ENGINEERING MATERIALS</b> Metallic glasses: melt spinning process, Preparation and applications - shape memory alloys: phases, shape memory effect - Characteristics of SMA : Pseudoelastic effect, Super elasticity and Hysteresis. Applications of SMA. Nanomaterials preparation (bottom up and top down approaches) – various techniques - pulsed laser deposition - Chemical vapor deposition	6
<b>Total Instructional Hours</b>		<b>30</b>

**After completion of the course the learner will be able to**

CO1: Understand the Crystal systems and crystal structures in the field of Engineering  
CO2: Illustrate the fundamental of electrical properties of materials

**Course Outcome** CO3: Discuss concept of acceptor or donor levels and the band gap of a semiconducting materials  
CO4: Develop the technology of the magnetic materials and its applications in engineering field  
CO5: Understand the advanced technology of new engineering materials in the field of Engineering

**TEXT BOOKS:**

T1 - Rajendran V, “Materials Science”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- M.N Avadhanulu and PG Kshirsagar “A Text Book of Engineering physics” S. Chand and Company Ltd., New

Delhi 2022

**REFERENCE BOOKS:**

R1 – Charles Kittel “Introduction to Solid State Physics”. Wiley., New Delhi 2017

R2 - Dr. M.Arumugam “Materials Science ” Anuradha publications., 2019

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / II	22ME2101	ENGINEERING MECHANICS (AERO, AUTO,CIVIL,MECH)	3	0	0	3

**The student should be able**

**Course Objective**

1. To understand basic concepts and force systems in a real world environment.
2. To understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. To understand the moment of surfaces and solids.
4. To understand the effect of static friction on equilibrium.
5. To understand the dynamic equilibrium equation.

Unit	Description	Instructional Hours
	<b>STATICS OF PARTICLES</b>	
I	Introduction to engineering mechanics - Classifications, force vector, Law of mechanics, System of forces, transmissibility, Force on a particle – resultant of two forces and several concurrent forces – resolution of a force – equilibrium of a particle — forces in space – equilibrium of a particle in space..	9
	<b>EQUILIBRIUM OF RIGID BODIES</b>	
II	Free body diagram, moment of a force – varignon’s theorem – moment of a couple – resolution of a force and a couple. Support reactions of the beam.	9
	<b>CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA</b>	
III	Centroids of simple plane areas, composite areas, determination of moment of inertia of composite plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.	9
	<b>FRICTION</b>	
IV	Laws of dry friction – angles of friction- angle of repose-coefficient of static and kinetic friction — Friction in inclined plane, Ladder friction, Screw friction– rolling resistance – belt friction.	9
	<b>DYNAMICS OF PARTICLES</b>	
V	Rectilinear and Curvilinear motion, -Newton’s II law – D’Alembert’s principle- Energy - potential energy kinetic energy-conservation of energy-work done by a force - work energy method, Impulse momentum method, Impact of bodies, Translation and rotation of the particles.	9
	<b>TOTAL INSTRUCTIONAL HOURS</b>	<b>45</b>

**Course Outcome**

- At the end of the course, the learner will be able to
- CO1: Define and illustrate the basic concepts of force system.  
CO2: Identify the resultant force and couple, support reactions of the beam.  
CO3: Calculate the Centre of gravity and moment of inertia of an object.  
CO4: Examine the friction force of particles and objects for Impending Motion.  
CO5: Determine the Displacement, velocity and acceleration of particles and objects

**TEXT BOOKS:**

- T1. F.P.Beer, and Jr. E.R.Johnston., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 11th Edition, Tata McGraw-Hill Publishing company, New Delhi (2018).  
T2. NH.Dubey, “Engineering Mechanics”, Tata Mcraw Hill, New Delhi, 2016.

**REFERENCE BOOKS:**

1. R.C.Hibbeler, and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11<sup>th</sup> Edition, Pearson Education 2010.
2. S.S.Bhavikatti, and K.G.Rajashekarappa, “Engineering Mechanics”, New Age International (P) Limited Publishers, 2015.
3. P. JagetBabu, “Engineering Mechanics”, Pearson Education, India Ltd, 2016.

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- The learner should be able**
- Course Objective**
1. To improve essential business communication skills.
  2. To enrich employability knowledge.
  3. To acquire the crucial organizing ability in official forum.
  4. To impart important business writings.
  5. To make effective presentation with essential etiquette.

Unit	Description	Instructional Hours
I	Language Proficiency: Types of sentences in English according to structure Writing: writing definitions, Describing product, work place and service (purpose, appearance, function) Vocabulary – words on nature <b>Practical Component: Listening- Watching and interpreting advertisements/short films Speaking- Extempore speech</b>	9
II	Language Proficiency: Direct and Indirect speech. Writing: Formal memos, Job application and resume preparation Vocabulary - words on offense and ethics <b>Practical Component: Listening- Comprehensions based on telephonic conversation Speaking- Vote of thanks &amp; welcome address</b>	9
III	Language Proficiency: Homophones and Homonyms, Writing: Preparing a detail plan for an official visit, schedule and Itinerary, reading comprehension, Vocabulary– words on society <b>Practical Component: Listening- Listening- paraphrasing the listened content Speaking- Group Discussion with preparation</b>	9
IV	Language Proficiency: Idioms Writing: Report writing (marketing, investigating) Vocabulary-words involved in business <b>Practical Component: Listening- Watching technical discussions and preparing MoM Speaking- On the spot Group Discussion</b>	9
V	Language Proficiency: spotting errors Writing: making /interpreting chart, sequencing of sentences Vocabulary- words involved in finance <b>Practical Component: Listening- Comprehensions based on announcements Speaking- Presentation on a technical topic with ppt.</b>	9
<b>Total Instructional Hours</b>		<b>45</b>


- Course Outcome**
- At the end of the course, learners will be able**
- CO1: To the business procedure and promotion skills.  
CO2: To make oral and written presentation in corporate forum.  
CO3: To schedule official events and participate in official discussions without reluctance.  
CO4: To take an effective role and manage in an organizational sector.  
CO5: To prepare and demonstrate a professional presentation

**TEXT BOOKS:**

- T1 - Norman Whitby, “Business Benchmark-Pre-intermediate to Intermediate”, Cambridge University Press, 2016.  
T2- Ian Wood and Anne Willams. “Pass Cambridge BEC Preliminary”, Cengage Learning press 2015.

**REFERENCE BOOKS :**

- R1 -Michael Mc Carthy, “Grammar for Business”, Cambridge University Press, 2009.  
R2- Bill Mascull, “Business Vocabulary in use: Advanced 2<sup>nd</sup> Edition”, Cambridge University Press, 2009.  
R3-Frederick T. Wood, “Remedial English Grammar For Foreign Students”, Macmillan publishers, 2001.

  
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Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E/ II	22CY2152	<b>APPLIED CHEMISTRY</b> (MECH,AERO,CIVIL,AUTO,MCT)	2	0	2	3

**The learner should be able to**

- Course Objective
1. Acquire knowledge on the concepts of chemistry involved in day today life.
  2. Identify the water related problems and water treatment techniques.
  3. Enhance the fundamental knowledge on electro chemistry and the mechanism of corrosion and its control.
  4. Acquire knowledge on various thermo dynamical laws and its importance in engineering applications.
  5. Acquire knowledge on the types of fuels, calorific value calculations, and manufacture of various types of fuels.

Unit	Description	Instructional Hours
I	<b>CHEMISTRY IN EVERYDAY LIFE</b> Chemicals in food – Food colors – Artificial sweeteners – Food preservatives. Soaps and Detergents – Soaps – Types of Soap – Detergents – Types of detergents. Drugs – Classification of drugs - Therapeutic Action of Different Classes of Drugs. Chemicals in Cosmetics – Creams – Talcum powders- Deodorants – Perfumes. Plastics – Thermoplastics- Preparation, properties and uses of PVC, Teflon and Thermosetting plastics - Preparation, properties and uses of Polyester and Polyurethane.	6
II	<b>WATER TECHNOLOGY</b> Impurities in Water, Hardness of Water, Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- -Softening Methods (Zeolite & Ion-Exchange Methods)- Desalination of Brackish Water - Reverse Osmosis, Potable water and treatment. <b>Estimation of total, permanent and temporary hardness of water by EDTA Determination of Dissolved Oxygen in sewage water by Winkler’s method. Estimation of alkalinity of water sample by indicator method.</b>	6
III	<b>ELECTROCHEMISTRY AND CORROSION</b> Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electro chemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods. <b>Conductometric titration of strong acid vs strong base (HCl vs NaOH). Estimation of Ferrous iron by Potentiometry.</b>	6
IV	<b>CHEMICAL THERMODYNAMICS</b> Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs Helmholtz equation- Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore..	6
V	<b>FUELS AND COMBUSTION</b> Fuels : Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas and water gas).Combustion : gross and net calorific value - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).	6
<b>Total Instructional Hours</b>		<b>30</b>
<b>Total Lab Instructional Hours</b>		<b>30</b>

**At the end of the course, the learner will be able to**

- Course Outcome
- CO1: List out the chemicals used in food, soaps and detergents, drugs, cosmetics and plastics
- CO2: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life
- CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design
- CO4: Develop sound knowledge on second law of thermodynamics and second law based derivations and its importance in engineering applications in all disciplines.
- CO5: Classify the various types of fuel and their analysis and other techniques.

**TEXT BOOKS**

- T1 - P. C. Jain & Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2018).  
T2 - O .G. Palanna, “Engineering chemistry” McGraw Hill Education India (2017).

**REFERENCES**

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Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	22ME2001	Engineering Practices (Common to all branches)	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

**Unit Description of the Experiments**  
**GROUP A ( CIVIL AND MECHANICAL)**

- 1 Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
- 2 Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
- 3 Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
- 4 Preparation of arc welding of Butt joints, Lap joints and Tee joints.
- 5 Practice on sheet metal Models– Trays and funnels
- 6 Hands-on-exercise in wood work, joints by sawing, planning and cutting.
- 7 Practice on simple step turning, taper turning and drilling.
- 8 Demonstration on Smithy operation.
- 9 Demonstration on Foundry operation.
- 10 Demonstration on Power tools.


**GROUP B ( ELECTRICAL ENGINEERING)**

- 1 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2 Fluorescent lamp wiring.
- 3 Stair case wiring.
- 4 Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
- 5 Measurement of energy using single phase energy meter.
- 6 Soldering practice using general purpose PCB.
- 7 Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
- 8 Study of Energy Efficient Equipment's and Measuring Instruments.

**Total Instructional Hours 45**

Course Outcome

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.

  
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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TECH II	22HE2071	DESIGN THINKING	2	0	0	2

**The student should be able to**

- Course Objective
1. To expose students to the design process
  2. To develop and test innovative ideas through a rapid iteration cycle.
  3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
I	<b>DESIGN ABILITY</b> Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	6
II	<b>DESIGNING TO WIN</b> Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
III	<b>DESIGN TO PLEASE AND DESIGNING TOGETHER</b> Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
IV	<b>DESIGN EXPERTISE</b> Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	6
V	<b>DESIGN THINKING TOOLS AND METHODS</b> Purposeful Use of Tools and Alignment with Process - Journey Mapping - Value Chain Analysis - Mind Mapping – Brainstorming - Design Thinking Application: Design Thinking Applied to Product Development	7
<b>Total Instructional Hours</b>		<b>30</b>

**After completion of the course the learner will be able to**

- Course Outcome
- CO1: Develop a strong understanding of the Design Process  
CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.  
CO3: Develop teamwork and leadership skills

**TEXT BOOKS:**

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

**REFERENCE BOOKS:**

R1 - Tom Kelley, "Creative Confidence", 2013.

R2 - 3. Tim Brown, "Change by Design", 2009.

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TECH II	22HE2072	SOFT SKILLS AND APPTITUDE I	0	0	0	1

**The student should be able to**

- Course Objective
1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
  2. To enhance the students ability to deal with numerical and quantitative skills.
  3. To identify the core skills associated with critical thinking.
  4. To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
I	<b>Lessons on excellence</b> Skill introspection, Skill acquisition, consistent practice	2
II	<b>Logical Reasoning</b> Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	<b>Quantitative Aptitude</b> Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	<b>Recruitment Essentials</b> Resume Building - Impression Management	4
V	<b>Verbal Ability</b> Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations	4
<b>Total Instructional Hours</b>		<b>30</b>

**After completion of the course the learner will be able to**

- Course Outcome
- CO1: Students will analyze interpersonal communication skills. public speaking skills.  
CO2: Students will exemplify tautology, contradiction and contingency by logical thinking.  
CO3: Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.  
CO4: Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity  
CO5: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar

**REFERENCE BOOKS:**

- R1** - Quantitative Aptitude – Dr. R S Agarwal  
**R2** -Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley  
**R3** -Verbal and Non – Verbal Reasoning – Dr. R S Agarwal  
**R4**- Objective General English – S.P.Bakshi

  
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**அலகு I மொழி மற்றும் இலக்கியம்:**

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:**

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:**

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:**

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:**

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MC2092	<b>HERITAGE OF TAMIL</b>	2	0	0	0

**The learner should be able to**

- Course Objective
1. Introduce students to the great History of Tamil literature.
  2. Establish the heritage of various forms of Rock art and Sculpture art.
  3. To study and understand the various folk and Martial arts of Tamil culture
  4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
  5. To learn about the various influences or impacts of Tamil language in Indian culture.

Unit	Description	Instructional Hours
<b>I Language and Literature</b>	Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
<b>II Heritage _ Rock Art Paintings to Modern Art – Sculpture</b>	Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
<b>III Folk and Martial Arts</b>	Therukoothu, Karagattam, Villupattu, Kaniyan koothu, Oyilattam, Leather puppetry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
<b>IV</b>	<b>Thinai Concept of Tamils</b> Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Export and Import during Sangam age – Overseas conquest of Cholas.	6
<b>V</b>	<b>Contribution of Tamils to Indian National Movement and Indian Culture</b> Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
<b>Total Instructional Hours</b>		<b>30</b>

**At the end of the course, the learner will be able to**

- Course Outcome
- CO1: Learn about the works pertaining to Sangam age  
CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.  
CO3: Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.  
CO4: Appreciate the intricacies of Tamil literature that had existed in the past.  
CO5: Understand the contribution of Tamil Literature to Indian Culture

**TEXTBOOKS:**

T1: Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

T2: Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

T3: Historical Heritage of the Tamils (Dr.S.V.Subatamian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

**REFERENCEBOOKS:**

R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)

R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22MC2093	<b>SOCIAL SERVICES AND COMMUNITY DEVELOPMENT</b>	1	0	0	1

**The student should be able to**

- Course Objectives:**
1. Acquire the knowledge and active participate in social service and community development activities.
  2. Understand the concept of disaster management and role of NCC cadets in disaster management..
  3. Understand the concept thinking and reasoning process..
  4. Understand about maps and use of bearing and service protector
  5. Know about the principles of flight and Aero foil structure and ATC procedures.

Unit	Description	Instructional Hours
	<b>SOCIAL SERVICES AND COMMUNITY DEVELOPMENT</b>	
I	Basics of social services and its need - Rural development programs - Contribution of youth towards social welfare - NGOs in social services Swach bharath Abhiyan - Social evils - Mission Indra danush - Beti bacho Beti pado - Digital awareness - Constitution day.	3
	<b>DISASTER MANAGEMENT</b>	
II	Organization of Disaster management -Types of emergencies - Natural and manmade disasters - fire service and fire fighting - prevention of fire.	3
	<b>PERSONALITY DEVELOPMENT</b>	
III	Introduction to personality development - public speaking Intra and Inter personal skills -self awareness - critical thinking - Decision making and problem solving.	3
	<b>MAP READING</b>	
IV	Types of maps - conventional signs - scales and Grid system - relief and contour gradient - cardinal points - Types of North - types of bearing and use of service protector - Prismatic compass and its uses - setting of map - finding North and own position.	3
	<b>PRINCIPLES OF FLIGHT AND AIRMANSHIP</b>	
V	Introduction to principle of flight - Forces acting on the aircraft - Angle of attack - Angle of incidence - Newton's - law of motion - Bernauli's theorem and Venturi effect - Aerofoil - Airfield layout - ATC (Air Traffic Control) - circuit procedures - Aviation medicine.	3
	<b>Total Instructional Hours</b>	15

**After completion of the course the learner will be able to**


- Course Outcome:**
- CO1:Perform the social services on various occasions for better community and social life  
CO2:Appreciate the need and requirement for disaster management and NCC role in disaster management activities.  
CO3: Define thinking, reasoning, critical thinking and creative thinking  
CO4:Use of bearing and service protector and locate the places and objects on the ground.  
CO5:Understand the principles of flight and Aerofoil structure

**Reference:**

1. UGC and AICTE circulated syllabus.

**Text Books :**

1. NCC cadet Guide (SD/SW) Army
2. NCC cadet Guide (SD/SW) Airforce.
3. ANOs Guide (SD/SW) by DG NCC, Ministry of Defence, New Delhi
4. Digital Forum App 1.0 & 2.0, by DG NCC DG NCC, Ministry of Defence, New Delhi

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22MA3105	FOURIER SERIES AND TRANSFORMS (MECT, MECH)	3	1	0	4

**The learner should be able to**

- Course Objective**
1. Analyze Fourier series which is central to many applications in engineering.
  2. Apply the effective tools for the solutions of one dimensional boundary value problems.
  3. Apply the effective tools for the solutions of two dimensional heat equations.
  4. Apply Fourier transform techniques in various situations.
  5. Analyze Z transform techniques for discrete time systems

Unit	Description	Instructional Hours
<b>I</b>	<b>FOURIER SERIES</b> Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
<b>II</b>	<b>BOUNDARY VALUE PROBLEMS</b> Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
<b>III</b>	<b>TWO DIMENSIONAL HEAT EQUATIONS</b> General and Steady state solution of two dimensional equation of heat conduction in infinite plate and semi circular plate.	12
<b>IV</b>	<b>FOURIER TRANSFORMS</b> Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity (Statement only).	12
<b>V</b>	<b>Z - TRANSFORMS AND DIFFERENCE EQUATIONS</b> Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem( excluding proof)– Solution of difference equations using Z – transform.	12
<b>Total Instructional Hours</b>		<b>60</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
- CO2: Employ Fourier series in solving the boundary value problems.
- CO3: Understand Fourier series in solving the two dimensional heat equations.
- CO4: Apply Fourier transform techniques which extend its applications.
- CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

**TEXT BOOK:**

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018

T2 - Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

**REFERENCES:**

R1 - Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.

R2 - Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.

R3 - Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3201	ENGINEERING THERMODYNAMICS	3	0	0	3

**The learner should be able to**

- Course Objective**
- To learn the fundamentals of thermodynamics and energy conversion.
  - To gain knowledge on energy degradation in thermodynamic systems.
  - To impart knowledge on behavior of pure substances and working principle of steam power cycles.
  - To learn the thermodynamic relations.
  - To study the properties of atmospheric air.

Unit	Description	Instructional Hours
	<b>FIRST LAW OF THERMODYNAMICS</b>	
I	Basic concepts: concept of continuum, microscopic and macroscopic approach, path and point functions, properties, thermodynamic system, equilibrium, state, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer: definition and comparison, sign convention. Zeroth law of thermodynamics: thermal equilibrium. First law of thermodynamics: application to closed and open systems.	9
	<b>SECOND LAW OF THERMODYNAMICS</b>	
II	Heat Reservoirs: source and sink. Heat Engine, Refrigerator, and Heat pump. Statements and its corollaries. Carnot cycle, Clausius inequality. Concept of entropy: T-s diagram, Tds Equations, entropy change of pure substance, ideal gases, different processes, principle of increase in entropy and availability concepts.	9
	<b>PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLES</b>	
III	Steam: formation and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of steam tables and Mollier Chart. Estimation of steam properties and dryness fraction. Steam power cycles: Rankine cycle, Reheat and Regenerative cycles	9
	<b>THERMODYNAMIC RELATIONS AND GASES</b>	
IV	Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule- Thomson Coefficient, Clausius Clapeyron equation. Properties of Ideal and real gases: equations of state, Vander Waals equation for ideal and real gases, reduced properties, compressibility factor, generalised compressibility chart and its usage. Gas mixtures: mole and mass fractions, gas laws, gas constant.	9
	<b>PSYCHROMETRY</b>	
V	Psychrometric properties, Property calculations of air vapour mixtures using psychrometric chart and expressions. Psychrometric process: sensible heating and cooling, humidification, dehumidification, adiabatic saturation, adiabatic mixing of two streams.	9
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Understand the thermodynamic principles and its applications.
  - CO2: Quantify the energy conversion in various thermal systems.
  - CO3: Identify the losses and inefficient components in the thermodynamic system.
  - CO4: Apply the thermodynamic principles for predicting the properties of steam, gas and gas mixtures.
  - CO5: Apply the psychrometric principles for design of air conditioning systems.

**TEXT BOOK:**

- T1 - Nag.P.K, "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill, New Delhi, 2017.  
T2 - Cengel. Y. and Boles.M, "Thermodynamics - An Engineering Approach", 8 th Edition, Tata McGraw Hill, 2010.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3202	ENGINEERING MATERIALS AND METALLURGY	3	0	0	3

**The learner should be able to**

- Course Objective**
- To learn material classification and their atomic structure.
  - To study mechanical behavior of materials, Phase diagrams and its importance.
  - To understand heat treatment and surface treatments of metals.
  - To study the stress-strain behavior of various materials, fracture types.
  - To learn the properties of nonferrous alloys, polymers and ceramics.

Unit	Description	Instructional Hours
	<b>BASIC CONCEPTS</b>	
I	Introduction to Materials Science, Defects-Point, Line, Area, Volume-Slip planes and slip systems, Schmidt's rule, Polymorphism and allotropy -Solidification-Nucleation and Growth mechanism, Cooling curve of pure metal and alloy	9
	<b>PHASE DIAGRAMS AND PHASE TRANSFORMATION</b>	
II	Gibbs's Phase rule, Solubility and Solid Solutions -Isomorphous alloy system - Binary Eutectic alloy system (Lead-Tin System), Eutectoid and Peritectic system, Iron-Iron carbide equilibrium diagram, Phase Transformation-Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation (CCT) Diagrams - Steels, Cast Irons and Stainless steels -types and applications -Effects of alloying elements.	9
	<b>HEAT TREATMENT &amp; SURFACE TREATMENTS</b>	
III	Heat Treatment -Annealing and its types, Normalizing, Aus-tempering, Mar-tempering, Quenching, Hardenability -Surface hardening processes -Flame and induction hardening, Carburizing, Nitriding and Carbonitriding-Basic concepts of wear and corrosion & their types.	9
	<b>MECHANICAL PROPERTIES AND MATERIALS</b>	
IV	Stress-strain behavior of ferrous & non-ferrous metals, polymer and ceramics - Hardness, Fracture of metals -Ductile Fracture, Brittle Fracture, Fatigue - Endurance limit of ferrous and non-ferrous metals - Fatigue, Creep and rupture-mechanism of creep -stages of creep..	9
	<b>NON FERROUS ALLOYS &amp; COMPOSITE MATERIALS</b>	
V	Non Ferrous Alloys of Aluminum, Magnesium, Copper -Microstructure and mechanical property, Composites- Classification, properties and applications, Ceramics -Alumina, Zirconium, Silicon Carbide, Sialons -Processing, properties and applications of ceramics, Glasses -properties and applications.	9
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Understand the atomic structure & classification of engineering materials
- CO2: Predict the alloy components and its composition variation with respect to temperature changes.
- CO3: Select suitable materials and heat treatment methods for various industrial applications.
- CO4: Gain knowledge on testing different types of materials and their applications.
- CO5: Explain the properties of non-ferrous alloys, polymers and ceramics.

**TEXT BOOK:**

T1 - Callister.W.D., Jr., (2010), Materials Science and Engineering: An Introduction, 8th ed., Wiley & Sons.

T2 -William F. Smith and Javad Hashemi (2014), Foundations of Materials Science and Engineering 4th edition.Mc Graw Hill

**REFERENCES:**

R1 - Anderson.C, K.D. Leaver, P. Leavers and R.D. Rawlings, (2013), Materials Science for Engineers, 5th edition, Tata McGraw Hill Publishers.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22XXXX	ELECTRICAL DRIVES AND CONTROLS	3	0	0	3

**The learner should be able to**

- Course Objective**
- To understand the basic concepts of different types of electrical machines and their performance.
  - To study the different methods of starting D.C motors and induction motors.
  - To study the conventional and solid-state drives.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors	8
	<b>DRIVE MOTOR CHARACTERISTICS</b>	
II	Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.	9
	<b>STARTING METHODS</b>	
III	Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors	8
	<b>CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES</b>	
IV	Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers – applications.	10
	<b>CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES</b>	
V	Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.	10
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome** At the end of the course, the learner will be able to  
CO1: Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

**TEXT BOOK:**

- T1 - Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2006  
T2 - Vedam Subrahmaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2010

**REFERENCES:**

- Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 2017
- Pillai.S.K “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
- Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2006.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3204	MANUFACTURING TECHNOLOGY – I	3	0	0	3

**The learner should be able to**


- Course Objective**
- To learn the concepts of some basic manufacturing processes and fabrication techniques
  - To know the manufacturing of metal components in different methods such as metal casting.
  - To gain the metal joining, metal forming techniques.
  - To acquire knowledge in the bulk forming process such as forging and rolling.
  - To learn the manufacturing of plastic components.

Unit	Description	Instructional Hours
I	<b>METAL CASTING PROCESSES</b> Sand Casting: Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces: Blast and Cupola Furnaces; Special casting processes : Shell - investment – Pressure die casting - Centrifugal Casting - Continuous casting process – Stir casting; Casting Defects.	9
II	<b>METAL JOINING PROCESSES</b> Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.	9
III	<b>METAL FORMING PROCESSES</b> Hot working and cold working of metals – Forging processes – Open and closed die forging – forging operations. Rolling of metals– Types of Rolling mills – Flat strip rolling – shape rolling operations – Defects in rolled parts. Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion Principle of rod and wire drawing.	9
IV	<b>SHEET METAL FORMING PROCESS</b> Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal –Special forming processes; Hydro forming – Rubber pad forming – Metal spinning– Explosive forming- Magnetic pulse forming- Peen forming- Super plastic forming – Micro forming.	9
V	<b>MANUFACTURE OF PLASTIC COMPONENTS</b> Types and characteristics of plastics –Thermoplastics and Thermosetting plastics – working principles and typical applications of Injection moulding, Plunger and screw machines – Compression moulding, Transfer Moulding – Blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics -industrial applications of plastics.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Identify the suitable casting process for the given component.
  - CO2: Identify the suitable welding process and integrate the basic knowledge from material science
  - CO3: Compare the functions and applications of metal forming process
  - CO4: Develop basic calculation to fabricate sheet metal components.
  - CO5: Understand plastic component manufacturing.

**TEXT BOOK:**

- T1 - Hajra Choudhary S.K and Hajra Choudhury. AK, "Elements of workshop Technology", volume I and II, Media promoters and Publishers pvt, Mumbai, 2013.
- T2 - Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2nd Ed, TMH-2015.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3251	FLUID MECHANICS AND MACHINERY	3	0	2	4

**The learner should be able to**

- Course Objective**
- To study the fluid laws, properties and measurements.
  - To expose various fluid flow measuring devices and calculate the flow losses in pipes.
  - To learn the concept of dimensional analysis
  - To gain the knowledge on working principles and performance curves of fluid pumps
  - To impart knowledge on various hydraulic turbines and performance curves...

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO FLUID AND FLUID FLOW</b>	
I	Fluid Properties - density, specific weight, specific volume, specific gravity, viscosity, compressibility, capillary, surface tension and buoyancy – pressure measurements- manometers, Continuity equation, theory of various types of flow - laminar, turbulent, unsteady, steady, non-uniform and uniform flows. Stream line, streak line and path.	8
	<b>FLUID DYNAMICS AND FLOW THOROUGH PIPE</b>	
II	Navier Stokes equation – derivation and problems, derivation of Euler's equation and Bernoulli's energy equation, Pipes in series and parallel. Reynolds number, Darcy-Weisbach equation, use of Moody diagram, minor losses-sudden expansion, sudden contraction and losses in pipe fittings.	9
	<b>FLOW MEASUREMENT AND DIMENSIONAL ANALYSIS</b>	
III	Orificemeter, Venturimeter, Pitot tubes, Rotameter, dimensional analysis-Buckingham's theorem, Reynolds, Froude, Weber, Euler and Mach number and their applications. Calculation of discharge using Venturimeter & Orificemeter	9+5
	<b>HYDRAULIC PUMPS</b>	
IV	Classifications of pumps –Centrifugal pumps– work done by the impeller -Head and efficiencies performance curves-velocity triangles – cavitation-priming-Reciprocating pump-slip, Indicator diagram, efficiency. Performance curves- theory of Air vessel. Experimentation on centrifugal pump and reciprocating pump.	9+5
	<b>HYDRAULIC TURBINES</b>	
V	Classification of turbines – heads and efficiencies – velocity triangles. Theory of axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- work done by water on the runner. Specific speed– performance curves. Experimentation on Pelton wheel and Francis turbine.	9+5
	<b>Total Instructional Hours</b>	<b>60</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Apply the properties of fluids and flow characteristics.  
 CO2: Apply the momentum principle and losses in pipes in solving real life problems.  
 CO3: Perform the Dimensional and Model analysis.  
 CO4: Design suitable types of pumps for various applications.  
 CO5: Analyze the performance of various hydraulic turbines.

**TEXT BOOK:**

- T1- Rajput, R.K., "Fluid Mechanics and Hydraulic Machines," S.Chand Publishers 2013.  
 T2 - Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill Education, 2010.

**REFERENCES:**

- R1- Ramamrutham.S and Narayanan.R. "Fluid Hydraulics and Fluid Machines", Dhanpat Rai Publishing House (P) Ltd, New Delhi, 2012.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3001	MANUFACTURING TECHNOLOGY LAB – I	0	0	4	2

**The student should be able**

- Course Objective**
1. To Study and practice the various operations that can be performed on the lathe, drilling and grinding machines etc. and equip with the practical knowledge required in the core industries.

**Description of the Experiments**


**LIST OF EXPERIMENTS**

1. Machining of Step Turning using a Lathe.
2. Machining of Knurling & Grooving using a Lathe.
3. Machining of Taper Turning using a Lathe.
4. Machining of Boring using a Lathe.
5. Machining of Internal Thread Cutting using a Lathe.
6. Machining of External Thread cutting using a Lathe.
7. Machining of Eccentric Turning using a Lathe.
8. Drilling & Tapping in plates using drilling machine.
9. Surface grinding of a plate using surface grinder.

**Total Instructional Hours 45**

**Course Outcome**

The Students will be able to  
CO1 - Upon completion of this course, the students can be able to use various lathe, drilling and grinding machines to fabricate various operations.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3002	COMPUTER AIDED MODELING LAB	0	0	4	2

**The student should be able**

- Course Objective**
1. To develop skills on using software for preparing 2D Drawings and 3D modeling.
  2. To learn the importance of computer aided design and drawing in Engineering society.

**Description of the Experiments**

**LIST OF EXERCISES USING DRAFTING SOFTWARE**


1. Study of drafting software– Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon, conic and special curves.
2. Draw the orthographic projections of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
3. Draw and dimension the orthographic projections of Shaft Support.
4. Draw and dimension the orthographic projections of Machine Component.
5. Draw and dimension the orthographic projections of simple gate valve.
6. Draw the Plan and Elevation of simple Residential Building.

**LIST OF EXERCISES USING MODELLING SOFTWARE**

1. Study of Modeling software-Sketching and Part modeling - Tool familiarizations on Extrude, Revolve, Hole, shell.
2. Creation of Machine Block using 3D Modeling software.
3. Creation of solid journal bearing using 3D Modeling software.
4. Creation of step cone pulley using 3D Modeling software.

**Total Instructional Hours 45**

- Course Outcome**
- The Students will be able to
- CO1: Apply the software package for drafting and modeling.  
CO2: Create 2D Drawing and 3D modeling of Engineering Components. CO3: Apply basic concepts to develop construction drawing techniques

  
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Programme	Course Code	Name of the Course	L	T	P	C
BE/BTECH	19HE6071	Soft Skill-II	1	0	0	1

- Course Objectives**
- To make the students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
  - To learn everything from equations to probability with a completely different approach.
  - To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
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I	<b>Group Discussion &amp; Presentation Skills:</b> GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do’s & Don’ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	<b>Interview Skills and Personality Skills:</b> Interview handling Skills – Self preparation checklist – Grooming tips: do’s & don’ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	<b>Business Etiquette &amp; Ethics:</b> Etiquette – Telephone & E-mail etiquette – Dining etiquette – do’s & Don’ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news	3
IV	<b>Quantitative Aptitude:</b> Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry -	3
V	<b>Logical Reasoning:</b> Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2
	CO1 Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.	
	CO2 Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations	
	CO3 Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment	
	CO4 Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.	
	CO5 Students will excel in complex reasoning.	

**Course Outcome**

**Reference Books:**

- R1: Bridging the Soft Skills Gap: How To Teach The Missing Basics To Today's Young Talent- Bruce Tulgan
- R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
- R3: How to crack test of Reasoning - Jaikishan and Premkishan
- R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj

  
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Programme /sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/IV	22MC3091	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

Course Objective

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyze it and apply It to their day today life.
3. To impart basic principles of thought process, Itihas and Dharma Shastra and Connecting society and nature.
4. To understand the concept to intellectual and intellectual property rights with special Reference.
5. The course focuses on introduction to Indian Knowledge System, Indian perspective of a modern scientific world-view and basic principles of Yoga and Indian philosophy.

Unit	Description	Instructional Hours
I	<b>Introduction to traditional knowledge:</b> Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge	6
II	<b>Protection of traditional knowledge:</b> The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	6
III	<b>Itihas and Dharma-Shastra</b> <b>Itihas:</b> The <a href="#">Mahabharata</a> -The <a href="#">Puranas</a> -The <a href="#">Ramayana</a> <b>Dharma - Shastra:</b> Manu Needhi-The Tirukkural–Thiru Arutpa	6
IV	<b>Traditional knowledge and intellectual property:</b> Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	6
V	<b>Indian philosophy</b> Jain–Buddhist–Charvaka– <a href="#">Samkhya-Yoga-Nyaya-Vaisheshika-Saiva</a> Siddhanta	6
<b>Total Instructional Hours</b>		<b>30</b>

- Course Outcome
- CO1: Identify the concept of Traditional knowledge and its importance.  
CO2: Explain the need and importance of protecting traditional knowledge.  
CO3: Explain the need and importance of Itihas and Dharma Shastra.  
CO4: Interpret the concepts of Intellectual property to protect the traditional knowledge.  
CO5: Interpret the concepts of Indian philosophy to protect the traditional knowledge

#### REFERENCE BOOKS

- R1. Traditional Knowledge System in India, by Amit Jha, 2009.  
R2. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.  
R3. "Knowledge Traditions and Practices of India" Kapil Kapoor 1, Michel Danin  
R4. V. Sivaramakrishna (Ed.), Cultural Heritage of India–Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

  
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**Semester – I**

**Course Code & Name : 22MA1101/ MATRICISS AND CALCULUS**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

**Course Code & Name : 22HE1151/ ENGLISH FOR ENGINEERS**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

**Course Code & Name : 22PH1151/ PHYSICS FOR NON CIRCUIT ENGINEERING**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

**Course Code & Name : 22IT1151/PYTHON PROGRAMMING AND PRACTICES**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

**Course Code & Name : 22ME1101 ENGINEERING DRAWING**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	3	-	1	-	1
CO2	3	2	2	-	-	-	-	-	-	2	-	-	-	1
CO3	3	2	3	-	2	-	-	-	-	2	-	1	-	2
CO4	3	2	3	-	2	-	-	-	-	2	-	-	2	2
CO5	3	2	3	-	2	-	-	-	-	2	-	-	2	2
Avg	3	2	2.6	0	2	0	0	0	0	2.2	0	1	2	1.6

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22MA3105	FOURIER SERIES AND TRANSFORMS (MECT, MECH)	3	1	0	4

**The learner should be able to**

- Course Objective**
1. Analyze Fourier series which is central to many applications in engineering.
  2. Apply the effective tools for the solutions of one dimensional boundary value problems.
  3. Apply the effective tools for the solutions of two dimensional heat equations.
  4. Apply Fourier transform techniques in various situations.
  5. Analyze Z transform techniques for discrete time systems

Unit	Description	Instructional Hours
<b>I</b>	<b>FOURIER SERIES</b> Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	12
<b>II</b>	<b>BOUNDARY VALUE PROBLEMS</b> Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
<b>III</b>	<b>TWO DIMENSIONAL HEAT EQUATIONS</b> General and Steady state solution of two dimensional equation of heat conduction in infinite plate and semi circular plate.	12
<b>IV</b>	<b>FOURIER TRANSFORMS</b> Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity (Statement only).	12
<b>V</b>	<b>Z - TRANSFORMS AND DIFFERENCE EQUATIONS</b> Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem( excluding proof)– Solution of difference equations using Z – transform.	12
<b>Total Instructional Hours</b>		<b>60</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.
- CO2: Employ Fourier series in solving the boundary value problems.
- CO3: Understand Fourier series in solving the two dimensional heat equations.
- CO4: Apply Fourier transform techniques which extend its applications.
- CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

**TEXT BOOK:**

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018

T2 - Bali. N.P and Manish Goyal & Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

**REFERENCES:**

R1 - Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.

R2 - Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2018.

R3 - Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3201	ENGINEERING THERMODYNAMICS	3	0	0	3

**The learner should be able to**

- Course Objective**
- To learn the fundamentals of thermodynamics and energy conversion.
  - To gain knowledge on energy degradation in thermodynamic systems.
  - To impart knowledge on behavior of pure substances and working principle of steam power cycles.
  - To learn the thermodynamic relations.
  - To study the properties of atmospheric air.

Unit	Description	Instructional Hours
	<b>FIRST LAW OF THERMODYNAMICS</b> Basic concepts: concept of continuum, microscopic and macroscopic approach, path and point functions, properties, thermodynamic system, equilibrium, state, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer: definition and comparison, sign convention. Zeroth law of thermodynamics: thermal equilibrium. First law of thermodynamics: application to closed and open systems.	9
I		
	<b>SECOND LAW OF THERMODYNAMICS</b> Heat Reservoirs: source and sink. Heat Engine, Refrigerator, and Heat pump. Statements and its corollaries. Carnot cycle, Clausius inequality. Concept of entropy: T-s diagram, Tds Equations, entropy change of pure substance, ideal gases, different processes, principle of increase in entropy and availability concepts.	9
II		
	<b>PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLES</b> Steam: formation and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of steam tables and Mollier Chart. Estimation of steam properties and dryness fraction. Steam power cycles: Rankine cycle, Reheat and Regenerative cycles	9
III		
	<b>THERMODYNAMIC RELATIONS AND GASES</b> Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule- Thomson Coefficient, Clausius Clapeyron equation.	
IV	Properties of Ideal and real gases: equations of state, Vander Waals equation for ideal and real gases, reduced properties, compressibility factor, generalised compressibility chart and its usage. Gas mixtures: mole and mass fractions, gas laws, gas constant.	9
	<b>PSYCHROMETRY</b> Psychrometric properties, Property calculations of air vapour mixtures using psychrometric chart and expressions. Psychrometric process: sensible heating and cooling, humidification, dehumidification, adiabatic saturation, adiabatic mixing of two streams.	9
V		
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Understand the thermodynamic principles and its applications.
  - CO2: Quantify the energy conversion in various thermal systems.
  - CO3: Identify the losses and inefficient components in the thermodynamic system.
  - CO4: Apply the thermodynamic principles for predicting the properties of steam, gas and gas mixtures.
  - CO5: Apply the psychrometric principles for design of air conditioning systems.

**TEXT BOOK:**

- T1 - Nag.P.K, "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill, New Delhi, 2017.  
T2 - Cengel. Y. and Boles.M, "Thermodynamics - An Engineering Approach", 8 th Edition, Tata McGraw Hill, 2010.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3202	ENGINEERING MATERIALS AND METALLURGY	3	0	0	3

**The learner should be able to**

- Course Objective**
- To learn material classification and their atomic structure.
  - To study mechanical behavior of materials, Phase diagrams and its importance.
  - To understand heat treatment and surface treatments of metals.
  - To study the stress-strain behavior of various materials, fracture types.
  - To learn the properties of nonferrous alloys, polymers and ceramics.

Unit	Description	Instructional Hours
	<b>BASIC CONCEPTS</b>	
I	Introduction to Materials Science, Defects-Point, Line, Area, Volume-Slip planes and slip systems, Schmidt's rule, Polymorphism and allotropy -Solidification-Nucleation and Growth mechanism, Cooling curve of pure metal and alloy	9
	<b>PHASE DIAGRAMS AND PHASE TRANSFORMATION</b>	
II	Gibbs's Phase rule, Solubility and Solid Solutions -Isomorphous alloy system - Binary Eutectic alloy system (Lead-Tin System), Eutectoid and Peritectic system, Iron-Iron carbide equilibrium diagram, Phase Transformation-Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation (CCT) Diagrams - Steels, Cast Irons and Stainless steels -types and applications -Effects of alloying elements.	9
	<b>HEAT TREATMENT &amp; SURFACE TREATMENTS</b>	
III	Heat Treatment -Annealing and its types, Normalizing, Aus-tempering, Mar-tempering, Quenching, Hardenability -Surface hardening processes -Flame and induction hardening, Carburizing, Nitriding and Carbonitriding-Basic concepts of wear and corrosion & their types.	9
	<b>MECHANICAL PROPERTIES AND MATERIALS</b>	
IV	Stress-strain behavior of ferrous & non-ferrous metals, polymer and ceramics - Hardness, Fracture of metals -Ductile Fracture, Brittle Fracture, Fatigue - Endurance limit of ferrous and non-ferrous metals - Fatigue, Creep and rupture-mechanism of creep -stages of creep..	9
	<b>NON FERROUS ALLOYS &amp; COMPOSITE MATERIALS</b>	
V	Non Ferrous Alloys of Aluminum, Magnesium, Copper -Microstructure and mechanical property, Composites- Classification, properties and applications, Ceramics -Alumina, Zirconium, Silicon Carbide, Sialons -Processing, properties and applications of ceramics, Glasses -properties and applications.	9
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Understand the atomic structure & classification of engineering materials
- CO2: Predict the alloy components and its composition variation with respect to temperature changes.
- CO3: Select suitable materials and heat treatment methods for various industrial applications.
- CO4: Gain knowledge on testing different types of materials and their applications.
- CO5: Explain the properties of non-ferrous alloys, polymers and ceramics.

**TEXT BOOK:**

T1 - Callister.W.D., Jr., (2010), Materials Science and Engineering: An Introduction, 8th ed., Wiley & Sons.  
T2 -William F. Smith and Javad Hashemi (2014), Foundations of Materials Science and Engineering 4th edition.Mc Graw Hill

**REFERENCES:**

R1 - Anderson.C, K.D. Leaver, P. Leavers and R.D. Rawlings, (2013), Materials Science for Engineers, 5th edition, Tata McGraw Hill Publishers.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22XXXX	ELECTRICAL DRIVES AND CONTROLS	3	0	0	3

**The learner should be able to**

- Course Objective**
- To understand the basic concepts of different types of electrical machines and their performance.
  - To study the different methods of starting D.C motors and induction motors.
  - To study the conventional and solid-state drives.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors	8
	<b>DRIVE MOTOR CHARACTERISTICS</b>	
II	Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.	9
	<b>STARTING METHODS</b>	
III	Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors	8
	<b>CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES</b>	
IV	Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers – applications.	10
	<b>CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES</b>	
V	Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.	10
<b>Total Instructional Hours</b>		<b>45</b>

**Course Outcome** At the end of the course, the learner will be able to  
CO1: Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

**TEXT BOOK:**

- T1 - Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2006  
T2 - Vedam Subrahmaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2010

**REFERENCES:**

- Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 2017
- Pillai.S.K “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
- Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2006.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3204	MANUFACTURING TECHNOLOGY – I	3	0	0	3

**The learner should be able to**

- Course Objective**
- To learn the concepts of some basic manufacturing processes and fabrication techniques
  - To know the manufacturing of metal components in different methods such as metal casting.
  - To gain the metal joining, metal forming techniques.
  - To acquire knowledge in the bulk forming process such as forging and rolling.
  - To learn the manufacturing of plastic components.

Unit	Description	Instructional Hours
I	<b>METAL CASTING PROCESSES</b> Sand Casting: Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces: Blast and Cupola Furnaces; Special casting processes : Shell - investment – Pressure die casting - Centrifugal Casting - Continuous casting process – Stir casting; Casting Defects.	9
II	<b>METAL JOINING PROCESSES</b> Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.	9
III	<b>METAL FORMING PROCESSES</b> Hot working and cold working of metals – Forging processes – Open and closed die forging – forging operations. Rolling of metals– Types of Rolling mills – Flat strip rolling – shape rolling operations – Defects in rolled parts. Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion Principle of rod and wire drawing.	9
IV	<b>SHEET METAL FORMING PROCESS</b> Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal –Special forming processes; Hydro forming – Rubber pad forming – Metal spinning– Explosive forming- Magnetic pulse forming- Peen forming- Super plastic forming – Micro forming.	9
V	<b>MANUFACTURE OF PLASTIC COMPONENTS</b> Types and characteristics of plastics –Thermoplastics and Thermosetting plastics – working principles and typical applications of Injection moulding, Plunger and screw machines – Compression moulding, Transfer Moulding – Blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics -industrial applications of plastics.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Identify the suitable casting process for the given component.
  - CO2: Identify the suitable welding process and integrate the basic knowledge from material science
  - CO3: Compare the functions and applications of metal forming process
  - CO4: Develop basic calculation to fabricate sheet metal components.
  - CO5: Understand plastic component manufacturing.

**TEXT BOOK:**

T1 - Hajra Choudhary S.K and Hajra Choudhury. AK, "Elements of workshop Technology", volume I and II, Media promoters and Publishers pvt, Mumbai, 2013.

T2 - Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2nd Ed, TMH-2015.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3251	FLUID MECHANICS AND MACHINERY	3	0	2	4

**The learner should be able to**

- Course Objective**
- To study the fluid laws, properties and measurements.
  - To expose various fluid flow measuring devices and calculate the flow losses in pipes.
  - To learn the concept of dimensional analysis
  - To gain the knowledge on working principles and performance curves of fluid pumps
  - To impart knowledge on various hydraulic turbines and performance curves...

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO FLUID AND FLUID FLOW</b>	
I	Fluid Properties - density, specific weight, specific volume, specific gravity, viscosity, compressibility, capillary, surface tension and buoyancy – pressure measurements- manometers, Continuity equation, theory of various types of flow - laminar, turbulent, unsteady, steady, non-uniform and uniform flows. Stream line, streak line and path.	8
	<b>FLUID DYNAMICS AND FLOW THOROUGH PIPE</b>	
II	Navier Stokes equation – derivation and problems, derivation of Euler's equation and Bernoulli's energy equation, Pipes in series and parallel. Reynolds number, Darcy-Weisbach equation, use of Moody diagram, minor losses-sudden expansion, sudden contraction and losses in pipe fittings.	9
	<b>FLOW MEASUREMENT AND DIMENSIONAL ANALYSIS</b>	
III	Orificemeter, Venturimeter, Pitot tubes, Rotameter, dimensional analysis-Buckingham's theorem, Reynolds, Froude, Weber, Euler and Mach number and their applications. Calculation of discharge using Venturimeter & Orificemeter	9+5
	<b>HYDRAULIC PUMPS</b>	
IV	Classifications of pumps –Centrifugal pumps– work done by the impeller -Head and efficiencies performance curves-velocity triangles – cavitation-priming-Reciprocating pump-slip, Indicator diagram, efficiency. Performance curves- theory of Air vessel. Experimentation on centrifugal pump and reciprocating pump.	9+5
	<b>HYDRAULIC TURBINES</b>	
V	Classification of turbines – heads and efficiencies – velocity triangles. Theory of axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- work done by water on the runner. Specific speed– performance curves. Experimentation on Pelton wheel and Francis turbine.	9+5
	<b>Total Instructional Hours</b>	<b>60</b>

- Course Outcome**
- At the end of the course, the learner will be able to
- CO1: Apply the properties of fluids and flow characteristics.  
 CO2: Apply the momentum principle and losses in pipes in solving real life problems.  
 CO3: Perform the Dimensional and Model analysis.  
 CO4: Design suitable types of pumps for various applications.  
 CO5: Analyze the performance of various hydraulic turbines.

**TEXT BOOK:**

- T1- Rajput, R.K., "Fluid Mechanics and Hydraulic Machines," S.Chand Publishers 2013.  
 T2 - Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill Education, 2010.

**REFERENCES:**

- R1- Ramamrutham.S and Narayanan.R. "Fluid Hydraulics and Fluid Machines", Dhanpat Rai Publishing House (P) Ltd, New Delhi, 2012.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3001	MANUFACTURING TECHNOLOGY LAB – I	0	0	4	2

**The student should be able**

- Course Objective**
1. To Study and practice the various operations that can be performed on the lathe, drilling and grinding machines etc. and equip with the practical knowledge required in the core industries.

**Description of the Experiments**


**LIST OF EXPERIMENTS**

1. Machining of Step Turning using a Lathe.
2. Machining of Knurling & Grooving using a Lathe.
3. Machining of Taper Turning using a Lathe.
4. Machining of Boring using a Lathe.
5. Machining of Internal Thread Cutting using a Lathe.
6. Machining of External Thread cutting using a Lathe.
7. Machining of Eccentric Turning using a Lathe.
8. Drilling & Tapping in plates using drilling machine.
9. Surface grinding of a plate using surface grinder.

**Total Instructional Hours 45**

**Course Outcome**

The Students will be able to  
CO1 - Upon completion of this course, the students can be able to use various lathe, drilling and grinding machines to fabricate various operations.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3002	COMPUTER AIDED MODELING LAB	0	0	4	2

**The student should be able**

- Course Objective**
1. To develop skills on using software for preparing 2D Drawings and 3D modeling.
  2. To learn the importance of computer aided design and drawing in Engineering society.

**Description of the Experiments**

**LIST OF EXERCISES USING DRAFTING SOFTWARE**

1. Study of drafting software– Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon, conic and special curves.
2. Draw the orthographic projections of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
3. Draw and dimension the orthographic projections of Shaft Support.
4. Draw and dimension the orthographic projections of Machine Component.
5. Draw and dimension the orthographic projections of simple gate valve.
6. Draw the Plan and Elevation of simple Residential Building.

**LIST OF EXERCISES USING MODELLING SOFTWARE**

1. Study of Modeling software-Sketching and Part modeling - Tool familiarizations on Extrude, Revolve, Hole, shell.
2. Creation of Machine Block using 3D Modeling software.
3. Creation of solid journal bearing using 3D Modeling software.
4. Creation of step cone pulley using 3D Modeling software.

**Total Instructional Hours 45**

- Course Outcome**
- The Students will be able to
- CO1: Apply the software package for drafting and modeling.  
CO2: Create 2D Drawing and 3D modeling of Engineering Components. CO3: Apply basic concepts to develop construction drawing techniques

  
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Programme	Course Code	Name of the Course	L	T	P	C
BE/BTECH	19HE6071	Soft Skill-II	1	0	0	1

- Course Objectives**
- To make the students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
  - To learn everything from equations to probability with a completely different approach.
  - To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	<b>Group Discussion &amp; Presentation Skills:</b> GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do’s & Don’ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	<b>Interview Skills and Personality Skills:</b> Interview handling Skills – Self preparation checklist – Grooming tips: do’s & don’ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	<b>Business Etiquette &amp; Ethics:</b> Etiquette – Telephone & E-mail etiquette – Dining etiquette – do’s & Don’ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news	3
IV	<b>Quantitative Aptitude:</b> Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry -	3
V	<b>Logical Reasoning:</b> Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2
<b>Course Outcome</b>	CO1 Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.	
	CO2 Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations	
	CO3 Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment	
	CO4 Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.	
	CO5 Students will excel in complex reasoning.	

**Reference Books:**

- R1: Bridging the Soft Skills Gap: How To Teach The Missing Basics To Today's Young Talent- Bruce Tulgan
- R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
- R3: How to crack test of Reasoning - Jaikishan and Premkishan
- R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj

  
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Programme /sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/IV	22MC3091	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

Course Objective

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyze it and apply It to their day today life.
3. To impart basic principles of thought process, Itihas and Dharma Shastra and Connecting society and nature.
4. To understand the concept to intellectual and intellectual property rights with special Reference.
5. The course focuses on introduction to Indian Knowledge System, Indian perspective of a modern scientific world-view and basic principles of Yoga and Indian philosophy.


Unit	Description	Instructional Hours
I	<b>Introduction to traditional knowledge:</b> Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge	6
II	<b>Protection of traditional knowledge:</b> The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	6
III	<b>Itihas and Dharma-Shastra</b> <b>Itihas:</b> The <a href="#">Mahabharata</a> -The <a href="#">Puranas</a> -The <a href="#">Ramayana</a> <b>Dharma - Shastra:</b> Manu Needhi-The Tirukkural–Thiru Arutpa	6
IV	<b>Traditional knowledge and intellectual property:</b> Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	6
V	<b>Indian philosophy</b> Jain–Buddhist–Charvaka– <a href="#">Samkhya-Yoga-Nyaya-Vaisheshika-Saiva</a> Siddhanta	6
<b>Total Instructional Hours</b>		<b>30</b>

Course Outcome

CO1: Identify the concept of Traditional knowledge and its importance.  
CO2: Explain the need and importance of protecting traditional knowledge.  
CO3: Explain the need and importance of Itihas and Dharma Shastra.  
CO4: Interpret the concepts of Intellectual property to protect the traditional knowledge.  
CO5: Interpret the concepts of Indian philosophy to protect the traditional knowledge

#### REFERENCE BOOKS

- R1. Traditional Knowledge System in India, by Amit Jha, 2009.
- R2. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
- R3. "Knowledge Traditions and Practices of India" Kapil Kapoor 1, Michel Danin
- R4. V. Sivaramakrishna (Ed.), Cultural Heritage of India–Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

  
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### Semester – III

Course Code & Name: 22MA3105/ Fourier Series and Transforms

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	3
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	-	2	2	3
Avg	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2

Course Code & Name : 22ME3201 Engineering Thermodynamics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1										1	1
CO2	1	2	2	2									2	
CO3	2	2	3	2										
CO4	3	1	1	2										
CO5	2	2	3	2	1					1			2	1
Avg	1.8	1.6	2	1.6	0.2	0	0	0	0	0.2	0	0	1	0.4

Course Code & Name : 22ME3202 Engineering Materials and Metallurgy

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	-	-	-	-	2	2	-	-	1	-	3	1	2
CO2	3	-	-	-	-	2	2	-	-	1	-	3	1	1
CO3	3	-	-	-	-	2	2	-	-	1	-	3	1	1
CO4	3	-	-	-	3	3	3	-	-	1	-	3	2	2
CO5	3	-	-	-	-	2	2	-	-	1	-	3	1	1
Avg	3	0	0	0	0.6	2.2	2.2	0	0	1	0	3	1.2	1.4

Course Code & Name : 22EE3231

Electrical Drives and Control

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1	1	-	1	1	-	2	1	-	1	-	-
CO2	2	2	2	2	-	1	2	-	2	2	1	2	2	1
CO3	1	1	1	1	-	1	1	-	2	1	1	1	1	1
CO4	2	2	1	1	-	1		-	2	1	1	1	2	-
CO5	2	2	2	1	-	2	2	-	2	2	1	2	2	2
Avg	1.6	1.6	1.4	1.2	-	1.2	1.2	-	2	1.4	0.8	1.4	1.4	0.8

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MECH - HICET



Dean - Academics  
Dean (Academics)  
HICET

**Course Code & Name : 21ME3204 Manufacturing Technology-I**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	2	2	1	-	-	1	-	-	-	1	1	1
CO2	3	1	2	2	2	-	-	1	-	-	-	1	1	1
CO3	3	1	2	2	1	-	-	1	-	-	-	1	1	1
CO4	3	1	2	2	1	-	-	1	-	-	-	1	1	1
CO5	3	1	2	2	1	-	-	1	-	-	-	1	1	1
Avg	3	1	2	2	1.2	0	0	1	0	0	0	1	1	1

**Course Code & Name : 22ME3251 Fluid Mechanics and Machinery**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	1.4	1	1.8	1.2	1.2	1.4	1.2	1	1	1.4	1	1	2	1.2

**Course Code & Name : 22ME3001 Manufacturing Technology Lab – I**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
Avg	3	3	3	3	3	-	1	-	2	-	-	-	2	1

**Course Code & Name : 22ME3002 Computer Aided Drawing Lab**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
CO2	3	3	3	3	3		1		2				2	1
CO3	3	3	3	3	3		1		2				2	1
CO4	3	3	3	3	3		1		2				2	1
CO5	3	1	2	2	1								1	1
Avg	3	2.6	2.8	2.8	2.6	0	0	0	0	0	0	0	1.8	1

Chairman, Board of Studies  
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**MECH - HiCET**



Dean – Academics  
**Dean (Academics)**  
**HiCET**

# **CURRICULUM**

## **R2019**



**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS**

**CBCS PATTERN**

**UNDERGRADUATE PROGRAMMES**

**B.E. MECHANICAL ENGINEERING REGULATION-2019 (Revised on July 2021)**

**(For the students admitted during the academic year 2021-2022 and onwards)**

**SEMESTER I – 20 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21HE1101	Technical English	HS	2	1	0	3	25	75	100
2	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
3	21PH1101	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1101	Engineering Chemistry	BS	2	0	2	3	50	50	100
5	21CS1151	Problem Solving and Python Programming	ES	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
<b>PRACTICAL</b>										
7	21HE1001	Language Competency Enhancement Course - I	HS	0	0	1	1	100	0	100
<b>MANDATORY</b>										
8	21MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	21HE1072	Career Guidance –Level I	EEC	1	0	0	0	100	0	100
10	21HE1073	Entrepreneurship & Innovation	EEC	2	0	0	0	100	0	100
Total Credits				15	2	11	20	550	350	900

**SEMESTER II – 22 Credits**

<b>S.No</b>	<b>Course Code</b>	<b>Name of the Course</b>	<b>Course Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>CIA</b>	<b>ESE</b>	<b>TOTAL</b>
<b>THEORY</b>										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
3	21PH2151	Materials Science	BS	2	0	2	3	25	75	100
4	21CY2151	Environmental Sciences	BS	2	0	2	3	25	75	100
5	21EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
6	21ME2101	Engineering Mechanics	ES	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
7	21ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	21HE2071/ 21HE2071R	Language Enhancement Course-II	HS	1	0	0	1	100	0	100
9	21HE2072	<i>Career Guidance – Level II</i>	<i>EEC</i>	2	0	0	0	100	0	100
Total Credits				18	2	8	22	400	500	900

**SEMESTER III – 20 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21MA3101	Fourier Series and Statistics	BS	3	1	0	4	25	75	100
2	21ME3201	Manufacturing Technology-I	PC	3	0	0	3	25	75	100
3	21ME3202	Engineering Thermodynamics	PC	3	0	0	3	25	75	100
4	21ME3203	Engineering Materials and Metallurgy	PC	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
5	21ME3251	Fluid Mechanics and Machinery	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
6	21ME3001	Manufacturing Technology Lab – I	PC	0	0	3	1.5	50	50	100
7	21ME3002	Computer Aided Drawing Lab	PC	0	0	3	1.5	50	50	100
<b>MANDATORY</b>										
8	21AC3191	India Constitution	AC	2	0	0	0	0	0	0
9	21HE3071	Career Guidance Level – III	EEC	2	0	0	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	1	8	20	450	450	900

**SEMESTER IV – 21 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21MA4101	Numerical Methods	BS	3	1	0	4	25	75	100
2	21ME4201	Manufacturing Technology – II	PC	3	0	0	3	25	75	100
3	21ME4202	Thermal Engineering	PC	3	0	0	3	25	75	100
4	21ME4203	Kinematics of Machinery	PC	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
5	21ME4251	Strength of Materials	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
6	21ME4001	Manufacturing Technology Lab–II	PC	0	0	3	1.5	50	50	100
7	21ME4002	Thermal Engineering Lab	PC	0	0	3	1.5	50	50	100

MANDATORY										
8	21AC4191	Value Education - Essence of Indian Traditional Knowledge	AC	2	0	0	0	0	0	0
9	21HE4072	Career Guidance Level – IV	EEC	2	0	0	0	100	0	100
10	21HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	2	8	21	450	450	900

**SEMESTER V – 24 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21ME5201	Dynamics of Machines	PC	3	0	0	3	25	75	100
2	21ME5202	Heat and Mass Transfer	PC	3	1	0	4	25	75	100
3	21ME5203	Design of Machine Elements	PC	3	0	0	3	25	75	100
4	21ME5204	Automobile Engineering	PC	3	0	0	3	25	75	100
5	21ME53XX	<b>Professional Elective – I</b>	PE	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
6	21ME5251	Machine Drawing	PC	2	0	2	3	50	50	100
<b>PRACTICAL</b>										
7	21ME5001	Dynamics Lab	PC	0	0	3	1.5	50	50	100
8	21ME5002	Heat Transfer Lab	PC	0	0	3	1.5	50	50	100
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100		100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100		100
Total Credits				19	1	8	24	350	525	1000

**SEMESTER VI – 24 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21ME6181	Principles of Management	HS	3	0	0	3	25	75	100
2	21ME6201	CAD/CAM	PC	3	0	0	3	25	75	100
3	21ME6202	Metrology and Quality Control	PC	3	0	0	3	25	75	100
4	21ME6203	Design of Transmission Systems	PC	3	0	0	3	25	75	100
5	21ME63XX	<b>Professional Elective - II</b>	PE	3	0	0	3	25	75	100
6	21XX64XX	<b>Open Elective –I</b>	OE	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
7	21ME6001	CAD/CAM Lab	PC	0	0	3	1.5	50	50	100
8	21ME6002	Metrology and Measurements Lab	PC	0	0	3	1.5	50	50	100
9	21HE6071	<i>Soft Skill-II</i>	EEC	1	0	0	1	100		100
10	21HE6072	<i>Intellectual Property Rights (IPR)</i>	EEC	1	0	0	1	100		100
11	21ME6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
<b>Total Credits</b>				20	0	6	24	450	650	1000

**SEMESTER VII – 20 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21ME7201	Finite Element Analysis	PC	3	0	0	3	25	75	100
2	21ME7202	Power Plant Engineering	PC	3	0	0	3	25	75	100
3	21XX74XX	Open Elective -II	OE	3	0	0	3	25	75	100
4	21ME73XX	Professional Elective – III	PE	3	0	0	3	25	75	100
5	21ME73XX	Professional Elective- IV	PE	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
6	21ME7001	Computer Aided Analysis Lab	PC	0	0	3	1.5	50	50	100
7	21ME7002	Comprehension Lab	PC	0	0	3	1.5	50	50	100
8	21ME7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
<b>Total Credits</b>				15	0	10	20	275	525	800

**SEMESTER VIII – 14 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	21ME8201	Engineering Economics and Cost Estimation	PC	3	0	0	3	25	75	100
2	21ME8XXX	Professional Elective- V	PE	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
3	21ME8901	Project Work – Phase II	EEC	0	0	12	8	100	100	200
Total Credits				6	0	12	14	150	250	400

**LIST OF PROFESSIONAL ELECTIVES**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>PROFESSIONAL ELECTIVE I</b>										
1	21ME5301	Advanced Foundry Technology	PE	3	0	0	3	25	75	100
2	21ME5302	Advanced Welding Technology	PE	3	0	0	3	25	75	100
3	21ME5303	CNC Technology	PE	3	0	0	3	25	75	100
4	21ME5304	Unconventional Machining Processes	PE	3	0	0	3	25	75	100
5	21ME5305	Hydraulic and Pneumatic systems	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE II**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME6301	Refrigeration and Air Conditioning	PE	3	0	0	3	25	75	100
2	21ME6302	Advanced I.C. Engines	PE	3	0	0	3	25	75	100
3	21ME6303	Design of Heat Exchangers	PE	3	0	0	3	25	75	100
4	21ME6304	Gas Dynamics and Jet Propulsion	PE	3	0	0	3	25	75	100
5	21ME6305	Energy Conservation and Management	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE III**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME7301	Design of Jigs, Fixtures and Press Tools	PE	3	0	0	3	25	75	100
2	21ME7302	Tool and Die Design	PE	3	0	0	3	25	75	100
3	21ME7303	Mechatronics	PE	3	0	0	3	25	75	100
4	21ME7304	Composite materials	PE	3	0	0	3	25	75	100
5	21ME7305	Industrial Robotics and Expert Systems	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE IV**

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME7306	Operations Research	PE	3	0	0	3	25	75	100
2	21ME7307	Industrial Engineering	PE	3	0	0	3	25	75	100
3	21ME7308	Industrial Safety Engineering	PE	3	0	0	3	25	75	100
4	21ME7309	Maintenance Engineering	PE	3	0	0	3	25	75	100
5	21ME7310	Metrology and Non Destructive Testing	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE V**

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME8181	Total Quality Management	HS	3	0	0	3	25	75	100
2	21ME8182	Entrepreneurship Development and Business Concepts	HS	3	0	0	3	25	75	100
3	21ME8183	Logistics and Supply Chain Management	HS	3	0	0	3	25	75	100
4	21ME8301	Production Planning and Control	PE	3	0	0	3	25	75	100
5	21ME8302	Heating, Ventilation and Air Conditioning Systems	PE	3	0	0	3	25	75	100

### OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME6401	Renewable Energy Sources	OE	3	0	0	3	25	75	100
2	21ME7401	Additive Manufacturing Techniques	OE	3	0	0	3	25	75	100

### List of Life Skill Courses under Open Elective

S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	25	75	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	25	75	100

(Note: Z Stands for semester, students can't choose twice the course)

### ADDITIONAL CREDIT COURSE FOR MECHANICAL ENGINEERING

S. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	IV	21ME4071	Geometric dimensioning and tolerance	2	0	0	1	100	-	100
2	V	21ME5071	Tool and Die Design	2	0	0	1	100	-	100
3	VI	21ME6071	Servicing of Refrigeration and Air Conditioning Equipment's	2	0	0	1	100	-	100
4	VII	21ME7071	Energy Auditing Practices	2	0	0	1	100	-	100

### CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

\* Student can earn extra credit 35 over and above the total credits



## **Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)**

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2019 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

### **VERTICALS FOR MINOR DEGREE**

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

### **MECHANICAL ENGINEERING OFFERING MINOR DEGREE PROGRAM IN ELECTRIC VEHICLES**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21ME5231	Sem 5: EV and Sub Systems.	MDC	3	0	0	3	3
2	21ME6231	Sem 6: E vehicle Dynamics	MDC	3	0	0	3	3
3	21ME6232	Sem6: Cell and battery management system	MDC	3	0	0	3	3
4	21ME7231	Sem 7: Electric Motor and control system	MDC	3	0	0	3	3
5	21ME7232	Sem 7: EV sensors and actuators	MDC	3	0	0	3	3
6	21ME8231	Sem 8: EV charging station	MDC	3	0	0	3	3

\*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

### Vertical I

#### Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MB5231	Financial Management	MDC	3	0	0	3	3
2	21MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	21MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	21MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	21MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	21MB8231	Introduction to Fintech	MDC	3	0	0	3	3

### Vertical II

#### Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	21MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	21MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	21MB7233	Principles of Marketing Management for Business	MDC	3	0	0	3	3
5	21MB72334	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	21MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

### Vertical III

#### Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CE5232	Sustainable Infrastructure Development	MDC	3	0	0	3	3
2	21AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	21BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	21ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	21CE7233	Green Technology	MDC	3	0	0	3	3
6	21CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

**B E (HONS) MECHANICAL ENGINEERING****DIGITAL AND GREEN MANUFACTURING**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MEXXX1	Sem 5: Digital Manufacturing and IoT	MDC	3	0	0	3	3
2	21MEXXX2	Sem 6: Lean Manufacturing	MDC	3	0	0	3	3
3	21MEXXX3	Sem 6: Modern Robotics	MDC	3	0	0	3	3
4	21MEXXX4	Sem 7: Green Manufacturing Design and Practices	MDC	3	0	0	3	3
5	21MEXXX5	Sem 7: Environment Sustainability and Impact Assessment	MDC	3	0	0	3	3
6	21MEXXX6	Sem 8: Green Supply Chain Management	MDC	3	0	0	3	3

**RENEWABLE ENERGY TECHNOLOGY**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MEXXX1	Sem 5: Bioenergy Conversion Technologies	MDC	3	0	0	3	3
2	21MEXXX2	Sem 6: Energy Conservation in Industries	MDC	3	0	0	3	3
3	21MEXXX3	Sem 6: Energy Storage Devices	MDC	3	0	0	3	3
4	21MEXXX4	Sem 7: Solar Energy Technology	MDC	3	0	0	3	3
5	21MEXXX5	Sem 7: Renewable Energy Technologies	MDC	3	0	0	3	3
6	21MEXXX6	Sem 8: New and Renewable Sources of Energy	MDC	3	0	0	3	3

**PRODUCT AND PROCESS DEVELOPMENT**

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MEXXX1	Sem 5: New Product Development	MDC	3	0	0	3	3
2	21MEXXX2	Sem 6: Ergonomics in Design	MDC	3	0	0	3	3
3	21MEXXX3	Sem 6: Advances in Composite Materials	MDC	3	0	0	3	3
4	21MEXXX4	Sem 7: Logistics and Supply Chain Management	MDC	3	0	0	3	3
5	21MEXXX5	Sem 7: EV Technologies	MDC	3	0	0	3	3
6	21MEXXX6	Sem 8: Heating, Ventilation and Air Conditioning Systems	MDC	3	0	0	3	3

  
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# **SYLLABUS**

Programme	Course code	Name of the course	L	T	P	C
B.E.	21MA5201	DYNAMICS OF MACHINES	3	0	0	3

**The student should be able**

- Course Objective**
- To study the method of static force analysis and dynamic force analysis of mechanisms and flywheel.
  - To study the undesirable effects of unbalances in rotors and engines.
  - To learn the concept of natural vibratory systems and their analysis.
  - To learn the concept of forced vibratory systems and their analysis.
  - To know principles of governors and gyroscopes.

Unit	Description	Instructional Hours
I	<b>FORCE ANALYSIS AND FLYWHEELS</b> Static force analysis of mechanisms – D Alembert’s principle - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses - Bearing loads - Crank shaft torque – Engine shaking forces. Turning moment diagrams – Fluctuation of energy, speed - Flywheels of engines and punching press.	9
	<b>BALANCING</b> Static and dynamic balancing – Balancing of rotating masses - Balancing of reciprocating masses in a single cylinder engine – Primary and secondary unbalanced forces - Balancing in multi- cylinder engines – Balancing machines	
III	<b>FREE VIBRATION</b> Basic features of vibratory systems - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - Natural frequency - Whirling of shafts and critical speed - Torsional vibration of two and three rotor systems, torsionally equivalent shaft. Determination of frequency for various elements.	9
IV	<b>DAMPED AND FORCED VIBRATIONS</b> Damped vibration - Types of damping – Logarithmic decrement - Response to periodic forcing - Harmonic Forcing – Forced vibration caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation.	9
V	<b>MECHANISMS FOR CONTROL</b> Governors - Types - Centrifugal governors – Porter & Proell governor, Hartnell, Hartung – Characteristics - Effect of friction - Controlling Force Gyroscopes - Gyroscopic couple – Gyroscopic stabilization - Gyroscopic effects in airplanes and ships.	9
<b>Total Instructional Hours</b>		<b>45</b>

Upon completion of the course Student will be able to:

- Course Outcome**
- CO1: Calculate the inertia forces in reciprocating and rotating masses and turning moments in flywheels.  
CO2: Balance reciprocating and rotating masses.  
CO3: Analyze free vibration systems.  
CO4: Determine the frequency of damped forced vibration systems.  
CO5: Evaluate the gyroscopic couple and sensitivity of governor.

**TEXT BOOK:**

T1 -Rattan S.S., “Theory of Machines”, 3rd edition, TMH, New Delhi, 2009.

T2 -Uicker. J.J, G.R. Pennock, J.E. Shigley, “Theory of Machines and Mechanisms”, 4th Ed, Oxford University Press, New York, 2011.

**REFERENCES:**

R1 -Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 4th Ed, 2010.

R2 -Ghosh A. and Mallick A.K., “Theory of Mechanisms and Machines”, Affiliated East- West Press Pvt. Ltd., New Delhi, 3rd edition, 2004.

R3 -Khurmi, R.S.,”Theory of Machines”, 14th Edition, S Chand Publications, 2005.

R4- F. B. Sayyad, “Dynamics of Machinery”, McMillan Publishers India Ltd., Tech-Max Educational resources, 2011

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<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	21ME5202	HEAT AND MASS TRANSFER	3	0	0	3

**The student should be able**

- Course Objective**
1. To study the various modes of heat transfer and its applications.
  2. To enable the students to understand the free and forced convection concepts.
  3. To learn about phase change heat transfer and heat exchangers.
  4. To acquire knowledge about radiation laws and gas radiation.
  5. To enhance the students for understanding the basic concepts of mass transfer.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>CONDUCTION</b>	
I	Heat Conduction equation – Cartesian and Cylindrical Coordinates-One Dimensional Steady State Heat Conduction: Plain and Composite Systems- Conduction with heat generation. Extended Surfaces- Unsteady State Heat Conduction: Lumped Analysis, Semi Infinite and Infinite Solids –Use of Heisler’s charts.	9
	<b>CONVECTION</b>	
II	Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer- Free and Forced Convection during external flow over Horizontal, Vertical, Inclined Plates, Cylinders and Internal flow through tubes.	9
	<b>PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS</b>	
III	Nusselt’s theory of condensation - Regimes of Pool boiling and Flow boiling- Correlations in boiling and condensation. Heat Exchanger Types: Overall Heat Transfer Coefficient, Fouling Factors –Analysis of heat exchanger: LMTD – NTU method.	9
	<b>RADIATION</b>	
IV	Basic Concepts, Laws of Radiation – Black and Grey body radiation –radiation shield - Shape Factor– Gas radiations (basics study) - Green House Effect.	9
	<b>MASS TRANSFER</b>	
V	Basic Concepts – Diffusion Mass Transfer – Flick’s Law of Diffusion – Steady state Molecular Diffusion– Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.	9
	<b>Total Instructional Hours</b>	<b>45</b>

Upon completion of the course, the students will be able to:

- Course Outcome**
- CO1: Know about the conduction heat transfer concepts in the engineering applications.  
CO2: Understand the convection phenomena.  
CO3: Solve problems on heat exchangers and phase change heat transfer.  
CO4: Gain knowledge about Black Body and Grey body radiation.  
CO5: Understand the basics of mass transfer.

**TEXT BOOK:**

- T1 Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer” New Age International, August 2007, Reprint 2008, 3<sup>rd</sup> edition.  
T2 Yunus Cengel “Heat and Mass Transfer” Tata McGraw Hill, 3<sup>rd</sup> edition, 2008.

**REFERENCES:**

- R1 Kothandaraman C.P “Fundamentals of Heat and Mass Transfer” New Age International, 3<sup>rd</sup> Edition, 2006, Reprint 2008.  
R2 Nag P.K, “Heat Transfer” - Tata McGraw-Hill, New Delhi, 2002 .  
R3 Holman J.P, “Heat Transfer” - Tata McGraw Hill, Ninth edition, 2007.  
R4 S.P. Venkateshan, “Heat Transfer”, Ane Books, New Delhi, 2014

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5203	<b>DESIGN OF MACHINE ELEMENTS</b> (Common to mechanical and Automobile Engineering)	3	0	0	3

**The student should be able**

- Course Objective**
1. To study the design function in mechanical engineering, different steps involved in designing and the relation of design activity with manufacturing activity.
  2. To know the different types of failure modes and criteria.
  3. To learn the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
  4. To gain design knowledge of the different types of elements used in the machine design process, for e.g. Shafts, couplings etc. and will be able to design these elements for each application.
  5. To learn to use catalogues and standard machine components

Unit	Description	Instructional Hours
	<b>STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS</b>	
I	Introduction to the design process - factors influencing machine design – selection of materials based on mechanical properties–preferred numbers, fits and tolerances - calculation of principal stresses for various load combinations, eccentric loading – theories of failure –Variable stresses - Soderberg, Gerber and Goodman methods for combination of stresses and their application in design problems.	10
	<b>DESIGN OF SHAFTS AND COUPLINGS</b>	
II	Design of solid & hollow shaft based on strength and rigidity with steady loading subjected to pure torsion. Design of shafts carrying pulleys & gears (Combined loading), Design and drawing of couplings – Rigid and Flexible.	8
	<b>DESIGN OF TEMPORARY AND PERMANENT JOINTS</b>	
III	Threaded fasteners - Bolted joints, Knuckle joints – Welded joints, riveted joints for structures – theory of bonded joints	9
	<b>DESIGN OF SPRINGS AND FLYWHEEL</b>	
IV	Various types of springs, Design of helical springs and Leaf springs – Design of Flywheel considering stresses in rims and arms for engines and presses.	9
	<b>DESIGN OF BEARINGS</b>	
V	Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfield Number, Raimondi and Boyd graphs- Selection of Rolling Contact bearings.	9
	<b>Total Instructional Hours</b>	<b>45</b>


- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1 - Demonstrate the use of stress analysis, theories of failure and materials in the design of machine components.
- CO2 - Identify proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components.
- CO3 - Design shafts based on strength and rigidity and couplings.
- CO4 - Design springs and considering stresses in flywheel components.
- CO5 - Design Sliding contact and rolling contact bearings.

**TEXT BOOK:**

- T1. Bhandari V.B, “Design of Machine Elements”, 3rd Edition, Tata McGraw-Hill Book Co, 2010.
- T2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill, 2008

**REFERENCES:**

- R1. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4th Ed, Wiley, 2005.
- R2. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010.
- R3. Sundararajamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.
- R4. Ansel C Ugural, “Mechanical Design – An Integral Approach”, 1st Edition, Tata McGraw-Hill Book Co, 2004

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5204	AUTOMOBILE ENGINEERING	3	0	0	3

**The student should be able**

- Course Objective**
1. The anatomy of the automobile in general.
  2. The location and importance of each part.
  3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels.
  4. Suspension, frame, springs and other connections.
  5. Emissions, ignition, controls, electrical systems and ventilation.

Unit	Description	Instructional Hours
I	<b>VEHICLE STRUCTURES AND ENGINE</b> Types of Automobiles - Vehicle Construction, Chassis –Types, Frame and Body – Types. Engine types, Components of Engine – Functions and Materials. Vehicle aerodynamics, Introduction to Electronic Engine Management System.	9
II	<b>FUEL SUPPLY SYSTEM AND ELECTRICAL SYSTEM</b> Carburetion and Simple carburetor - Electronically controlled gasoline fuel injection system – Mono- point and Multi-Point Fuel Injection Systems (MPFI). Diesel engine fuel supply system - Types, Electronically controlled diesel fuel injection system – CRDI. General layout of electrical system – Different sub circuits. Construction and operation of battery - Lighting system – Starting motor and drives.	9
III	<b>TRANSMISSION SYSTEMS</b> Clutch – Types and Construction, Gear Boxes – Types, Manual and Automatic, Selector mechanism - Over Drives – Transfer Box - Fluid flywheel - Torque converter – Propeller shaft – Slip Joint – Universal Joints – Differential unit. Rear Axle – Hotchkiss drive and Torque Tube drive. Turbocharger and supercharger.	9
IV	<b>STEERING, BRAKES AND SUSPENSION SYSTEMS</b> Wheels and Tyres – Wheel alignment parameters, Types of Front axle - Steering geometry and mechanism - Steering gear box and types – Power Steering. Brakes – Types, Hydraulic and Pneumatic braking systems - Construction and working, Antilock Braking System, electronic brake force distribution (EBD) and Traction Control.	9
V	<b>ALTERNATIVE FUELS IN AUTOMOBILES</b> Introduction to MV Act, Pollution Norms, Alternative fuels - Hydrogen- Ethanol – Compressed Natural Gas (CNG) - Liquefied Petroleum Gas (LPG), alternative power plants, Nano flow – Electric - Hybrid Vehicle -Fuel Cells-Solar Cars. Emission Control & Safety: Global Standards, Indian Pollution norms for Petrol & Diesel vehicles, Safety measures in automobiles.	9
<b>Total Instructional Hours</b>		<b>45</b>


- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1 - Understand the function of various automobile components and engine parts.
  - CO2 - Understand the fuel supply systems and electrical systems in automobiles.
  - CO3 - Understand the working of transmission system and its various elements.
  - CO4 - know the working of suspension, steering and braking systems.
  - CO5 - Understand the various alternate fuels that could be used in automobiles.

**TEXT BOOK:**

- T1 Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 2011.  
T2 Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.

**REFERENCES:**

- R1 Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 2006.  
R2 Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart –Will Cox Company Inc, USA ,2002.  
R3 Srinivasan S., "Automotive Mechanics", Tata McGraw Hill, 2nd Edition, 2009.  
R4 Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5251	<b>MACHINE DRAWING</b> (Theory with Lab Component)	2	0	2	3

**The student should be able**

- |                         |   |
|-------------------------|---|
| <b>Course Objective</b> | <ol style="list-style-type: none"> <li>To impart the knowledge of limits, fits and tolerances, orthographic-sectional and assembly drawing procedures.</li> <li>To provide the practice to draw assembly orthographic views of various machine parts.</li> <li>To provide the practice and develop the detailed part drawing.</li> <li>To impart the knowledge of shape and structure of different types of screws, keys and Couplings.</li> <li>To provide the practice and develop the detailed mechanical components drawing.</li> </ol> |
|-------------------------|---|

Unit	Description	Instructional Hours
	<b>LIMITS, FITS AND TOLERANCES</b>	
I	Limit System- Tolerance, Limits, Deviation, Actual Deviation, Upper Deviation, Lower Deviation, Allowance, Basic Size, Design Size, Actual Size. Fits-Types, Tolerances of Form and Position-Form and Position Variation, Geometrical Tolerance, Tolerance Zone, Indicating Geometrical Tolerances. Indication of Surface Roughness, Standard Abbreviations and Symbols used in industries.	7
	<b>SECTIONAL VIEWS</b>	
II	Sections- Hatching of Sections, Cutting Planes, Revolved or Removed Section, Sectional Views- Full Section, Half Sections and Auxiliary Sections.	7
	<b>STANDARD PART DRAWINGS</b>	
III	Drawing standards and Designation of Bolts, nuts, screws, keys, pins, Rivets, Welded Joints- Dimensioning of Welds	7
	<b>DRAWINGS OF VARIOUS VIEWS</b>	
IV	Shaft joints: Cotter joint and Knuckle joint. Keys & Shaft coupling: Flanged coupling, Flexible coupling and Universal coupling. Shaft bearing: Solid and bush bearing, Plummer block. Pulley: Belt pulley, V belt pulley.	12
	<b>ASSEMBLY DRAWING OF MECHANICAL COMPONENTS</b>	
V	Lathe Tail stock, Machine Vice, Pipe Vice, Simple Eccentric, Screw jack, Stuffing Box, Plummer Block.	12
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1 Use limits, fits and tolerances, orthographic-sectional and assembly drawing procedures in real world problems.
  - CO2 Apply sectional view, assembly and orthographic concepts to draw various machine parts.
  - CO3 Understand the Concept of fasteners and different joints.
  - CO4 Draw and demonstrate the projections and sectional views of various mechanical elements.
  - CO5 Construct assembly drawings of mechanical components.

**TEXT BOOK:**

- T1. Narayana K.L. and Kannaiah P., —Machine Drawing, 4th Edition, New Age International Publishers Ltd., New Delhi, 2010.
- T2. Gopalakrishna K.R., —Machine Drawing, 22nd Edition, Subhas Publications, New Delhi, 2013.

**REFERENCES:**

- R1. Bhatt N.D. and Panchal V.M., —Machine Drawing, 45th Edition, Charotar Publishing House Pvt. Ltd., Gujarat, 2010.
- R2. Sidheswar N., Kannaiah P., Sastry V.V., —Machine Drawing, 27th Reprint, Tata-McGraw Hill Education, Chennai, 2004.
- R3. Faculty of Mechanical Engineering —Design Data, Revised Edition 1978, Reprint on October 2011, Kalaikathir Achchagam, 2011.
- R4. Junnarkar, N.D., “Machine Drawing”, 1st Edition, Pearson Education, 2004.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5001	DYNAMICS LABORATORY	0	0	3	1.5

**The student should be able**

- Course Objective**
- To learn the concepts of generalized forces and the Principle of Virtual Work.
  - To acquire concepts of static and dynamic mass balancing and flywheels.
  - To be aware of the approaches and mathematical models used dynamical analysis of machinery.
  - To learn the applications of measuring devices used for dynamic testing.

**Description of the Experiments**

- Experimental study of velocity ratio for various types of gear trains – simple and Compound.
- To draw the profile of CAM and to determine the jump speed of cam.
- To perform static balancing on static balancing machine.
- To perform dynamic balancing on dynamic balancing machine.
- To determine Moment of Inertia of Round bar by Bifilar Suspension and Compound Pendulum.
- To determine the Natural Frequency of Torsional Vibrations.
- To determine the following:
  - Natural Frequency of Longitudinal Vibrations of helical spring.
  - Transverse Vibrations.
- To determine the critical speed of Shaft.
- To perform experiment on Watt and Porter Governors and draw the performance characteristic Curves, find stability and sensitivity
- To perform experiment on Proell Governor and draw performance characteristic Curves, find stability & sensitivity.
- To determine the gyroscopic couple on Motorized Gyroscope.

**Total Instructional Hours 45**

The Students will be able to

- Course Outcome**
- Understand the velocity ratio for various types of gear trains – simple and Compound.
  - Conduct experiments on vibrating bodies for predicting natural frequency.
  - Draw the cam profiles.
  - Perform experiments on balancing of masses and determine unbalanced force.
  - Draw characteristic curves for governors and effect of gyroscopic couple.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5002	HEAT TRANSFER LAB	0	0	3	1.5

**The student should be able**

**Course Objective**

1. Determination of thermal conductivity of conduction apparatus.
2. Determination of the heat transfer coefficient of convection apparatus.
3. Calculation of effectiveness of heat exchangers.
4. Determination of emissivity of a grey surface.
5. Performance of air conditioning and refrigeration systems.

**Description of the Experiments**

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus.
8. Determination of Stefan – Boltzmann constant.
9. Determination of Emissivity of a grey surface.
10. Effectiveness of Parallel / Counter flow heat exchanger.
11. Performance test on refrigeration system.
12. Performance test on air-conditioning system.

**Total Instructional Hours 45**

**Course Outcome**

The Students will be able to  
 CO1: Apply the various modes of heat transfer in thermal systems.  
 CO2: Understand the working principle of refrigeration and air conditioning systems.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21HE5071	SOFT SKILLS - I	1	0	0	1

**The student should be able**

- Course Objective**
1. To employ soft skills to enhance employability and ensure workplace and career success.
  2. To enrich students' numerical ability of an individual and is available in technical flavor.
  3. To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.


Unit	Description	Instructional Hours
	<b>INTRODUCTION TO SOFT SKILLS</b>	
I	Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management- Critical Thinking-Reflective thinking and writing- p2p Interaction	3
	<b>ART OF COMMUNICATION</b>	
II	Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
	<b>WORLD OF TEAMS</b>	
III	Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
	<b>QUANTITATIVE APTITUDE</b>	
IV	Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
	<b>LOGICAL REASONING</b>	
V	Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	4
	<b>Total Instructional Hours</b>	<b>15</b>

Upon completion of the course, the students will be able to:

- Course Outcome**
- CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.
- CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
- CO3: Students will understand how teamwork can support leadership skills
- CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
- CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.

**REFERENCES:**

- R1 Frederick H. Wentz , Soft Skills Training: A Workbook to Develop Skills for Employment
- R2 Arun Sharma, How to prepare for data interpretation for CAT.
- R3 Jaikishan and Premkishan, How to Crack TEST OF REASONING in all competitive examinations.
- R4 B.S. Sijwali, A New Approach To Reasoning Verbal & Non-Verbal
- R5 Dr. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations - S. Chand

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5072	DESIGN THINKING	1	0	0	1

**The student should be able**

- Course Objective**
1. To expose students to the design process
  2. To develop and test innovative ideas through a rapid iteration cycle.
  3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
	<b>DESIGN ABILITY</b>	
I	Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	4
	<b>DESIGNING TO WIN</b>	
II	Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
	<b>DESIGN TO PLEASE AND DESIGNING TOGETHER</b>	
III	Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
	<b>DESIGN EXPERTISE</b>	
IV	Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert.	3
<b>Total Instructional Hours</b>		<b>15</b>

Upon completion of the course, the students will be able to:


- Course Outcome**
- CO1: Develop a strong understanding of the Design Process
- CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
- CO3: Develop teamwork and leadership skills

**TEXT BOOK:**

T1 Nigel Cross, “Design Thinking”, Kindle Edition

**REFERENCES:**

- R1 Tom Kelley, “Creative Confidence”, 2013
- R2 Tim Brown, “Change by Design”, 2009.

  
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**PROFESSIONAL ELECTIVE – I**

<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	21ME5301	ADVANCED FOUNDRY TECHNOLOGY	3	0	0	3

**The student should be able**

- Course Objective**
- To provide problem solving skills among students in various foundry technologies.
  - To learn the understanding of basic facts and concepts in foundry process while retaining the excitement of foundry industry.
  - To know the foundry technology in academic and Industrial courses.
  - To provide practical knowledge in the fields of foundry concepts like investment castings, shell moulding, die castings, etc.
  - To learn about testing and quality assurance in foundry.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
<b>I</b>	<b>INTRODUCTION TO FOUNDRY AND PATTERN</b> Introduction foundry as a manufacturing centre and types of foundries. Types of patterns Pattern materials-Pattern allowances-Pattern layout, Pattern making	<b>9</b>
<b>II</b>	<b>GATING AND RISERING SYSTEM</b> Gates and risers -their functions - Types - Design principles, design of gating and risering for steels and cast irons	<b>9</b>
<b>III</b>	<b>MOULDING AND CORE MAKING</b> Materials: Ingredients, properties, Moulding methods:- Green sand moulding, dry sand moulding, CO2moulding, no bake moulding, shell moulding, Investment casting, permanent moulding, die casting and centrifugal casting, Cold box and Hot box. No bake processes.	<b>9</b>
<b>IV</b>	<b>MELTING AND POURING PRACTICE</b> Classification of melting furnaces used in Foundry, Selection of melting furnaces, essential features of a melting furnace, Refractory materials – types, properties and application. Cupola melting - Cupola furnace: types of cupola- divided blast, hot blast, oil fired, coke less etc., Furnaces heated by electricity - Resistance, Arc and Induction furnaces various types, brief description and application and merits of each. Influence of melting and pouring practice on casting quality, shop floor tests for quality assurance.	<b>9</b>
<b>V</b>	<b>PRODUCTION PRACTICE FOR FERROUS AND NON-FERROUS METALS</b> Important aspects of foundry practice for castings of Cast irons – grey, malleable and ductile irons, modularizing treatment. Steel foundry practice, practice and quality control in moulding, melting and pouring for production of carbon and alloy steel castings, High –manganese and Stainless steel castings, finishing operations and safety aspects. Foundry practice for copper and aluminum alloys, melting and pouring practice, degassing and dross removal, precautions required. Cleaning of castings: knockout, fettling, shot blasting and grinding of casting components. Hardness tests and Tensile tests of castings, Non-destructive tests of castings. Casting defects: Causes and remedial measures	<b>9</b>
<b>Total Instructional Hours</b>		<b>45</b>

Upon completion of the course, the students will be able to:

CO1: Understand the use of foundry in manufacturing sector and design of patterns for steel and cast Iron components.

CO2: Understand the concepts of Gates and risers for steel and cast iron components.


**Course Outcome** CO3: Analyze moulding materials and methods such as green sand ,dry sand, carbon dioxide, Investment casting, Die casting and permanent moulding for steel and cast iron Weighing upto 25kg.

CO4: Gain the knowledge about different types of furnaces.

CO5: Understand theoretical knowledge in testing and determine the composition, temperature, sand reclamation, moulding machines for foundry and cast iron components.

**TEXT BOOK:**

- T1. Heine R W., Loper,C.R.Rosenthal,P.C., “Principles of Metal Casting”, Tata-McGraw Hill,New Delhi 2017.  
T2. Jain P.L,”Principles of Foundry Technology”, Tata-McGraw Hill, New Delhi,2004.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5302	ADVANCED WELDING TECHNOLOGY	3	0	0	3

**The student should be able**

- Course Objective**
- To learn the basic skill in welding technologies.
  - To learn the special processes which require competency & certification to perform the job activity.
  - To learn some common hazards in welding.
  - To learn about proper personal protection used in welding.
  - To learn safety techniques for storing and handling cylinders.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Welding as compared with other fabrication processes, Importance and application of welding, classification of welding processes, Health & safety measures in welding. <b>Welding Power Sources:</b> Physics of welding Arc, Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.	
I	<b>Physics of Welding Arc:</b> Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow, Electrode Polarity, Flux Covering. <b>Metal Transfer:</b> Mechanism and types of metal transfer in various arc welding processes. Case studies and applications -automotive and aerospace.	9
II	<b>WELDING PROCESSES</b> Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electro gas and Electro slag, Flux Cored Arc Welding, Resistance welding, Friction welding, Friction Stir welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding & Microwave welding. Robotic welding.	9
III	<b>HEAT FLOW WELDING</b> Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates, weld thermal cycles, residual stresses and their measurement, weld distortion and its prevention.	9
IV	<b>REPAIR &amp; MAINTENANCE WELDING</b> Hard facing, Cladding, Surfacing, Metalizing processes and Reclamation welding Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, Cast Iron and aluminum. Micro & Macro structures in welding.	9
V	<b>WELD DESIGN</b> Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testing of welds, Introduction to Welding Procedure Specification & Procedure Qualification Record. Life Assessment of Weldment	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

Upon completion of the course, the students will be able to

CO1: Gain the Knowledge in advanced welding technology.  
CO2: Select and operate tools and equipment to support welding and related activities.  
CO3: Choose and interpret basic blueprints and welding symbols to fabricate components.  
CO4: Develop skills in Gas Metal Arc Welding to industry standards.  
CO5: Apply Gas Tungsten Arc Welding to industry standards and pass the AWS Aluminum Aerospace Certification.

**TEXT BOOK:**

- T1: Welding Engineering and Technology – R. S. Parmar, M/s. Khanna Publishers, 2-B Nath Market, NaiSarak, Delhi – 6.  
T2: Welding Handbook, American Welding Society, Section-II: Gas Arc and Resistance.

**REFERENCES:**

- R1: Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.  
R2: Welding Principles and Practices, by- Edwards R. Bohnart, McGraw Hill Education.  
R3: Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishers.  
R4 Hull., 'Non-Destructive Testing', ELBS Edition, 1991

  
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<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	21ME5303	CNC TECHNOLOGY	3	0	0	3

**The student should be able**

- Course Objective**
1. To impart knowledge in CNC machine tool building.
  2. To construct Tooling and work holding devices.
  3. To generate CNC codes using CAM software.
  4. To develop part programming skills.
  5. To illustrate numerical control techniques and functions.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
<b>I</b>	<b>CNC MACHINE TOOLS</b> CNC Systems-machine control-Interpolations and components. Machining and Turning centres, CNC drilling, milling and grinding machines. Maintenance of CNC machines	9
<b>II</b>	<b>CNC CONSTRUCTIONAL FEATURES</b> Spindle drives-Transmission belting-Axes feed drives-Sideways-Accessories of Machining and Turning centres. Tools-Tool holders-Tool planning-work holding-fixtures. Feedback devices in CNC machine tools.	9
<b>III</b>	<b>MANUAL PART PROGRAMMING</b> Nomenclature - CNC machines, block format-preparatory functions - fixed canned cycles - miscellaneous function - tool offset- tool nose radius compensation - Datum setting - Programs on Turning and Milling	9
<b>IV</b>	<b>COMPUTER AIDED PART PROGRAMMING</b> Languages for computer aided part programming-Geometric statements in APT - Point to Point Programming-Programming a tool path-Post processor statements.	9
<b>V</b>	<b>MANUFACTURING AUTOMATION</b> Direct numerical control-Flexible manufacturing cells and systems-Integration of manufacturing systems-Tools for manufacturing-Functions of a computer integrated manufacturing. Co-ordinate measuring machine. Robot applications in automation.	9
<b>Total Instructional Hours</b>		<b>45</b>

Upon completion of the course, the students will be able to:

- Course Outcome**
- CO1: Illustrate the parameters of metal cutting and understand the components of CNC system.  
CO2: Select the appropriate drives and controls for CNC machines.  
CO3: Construct part programming for various machining process.  
CO4: Compute operation and maintenance cost of CNC machines.  
CO5: Develop Flexible manufacturing cells and systems.

**TEXT BOOK:**

T1 -Kalpakjian S. and Schmid S.R., "Manufacturing Engineering and Technology", 5th Edition, Pearson Education India, New Delhi, 2014.

T2 - Radhakrishnan P., "Computer Numerical Control Machines" , New Central Book Agency, 2013.


**REFERENCES:**

R1 -Narang J.S. and Narang V.D.S., - "CNC Machines and Automation", Dhanpat Rai and Co. Pvt. Ltd., 2014.

R2 - HMT Limited, "Mechatronics", Tata McGraw-Hill, New Delhi, 2001.

R3 -Thyer G.E., "Computer Numeric Control of Machine Tools", 2nd Edition, Butterworth- Heinemann, Burlington, 1996.

R4 -Radhakrishnan P, SubramanyanS.andRaju V., "CAD/CAM/CIM", 2nd Edition, New AgeInternational (P) Ltd, New Delhi,2000.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5304	UNCONVENTIONAL MACHINING PROCESSES	3	0	0	3

**The student should be able**

- Course Objective**
- To learn about various unconventional machining processes.
  - To know the various mechanical energy based process parameters and their influence on performance and their applications.
  - To understand the electrical energy based machining processes.
  - To know the chemical energy based metal removal processes.
  - To learn about thermal energy used in machining processes.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Traditional machining process - Need for non-traditional machining – Classification of modern machining process	6
	<b>MECHANICAL ENERGY BASED PROCESSES</b>	
II	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.	9
	<b>ELECTRICAL ENERGY BASED PROCESSES</b>	
III	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.	9
	<b>CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES</b>	
IV	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.	11
	<b>THERMAL ENERGY BASED PROCESSES</b>	
V	Laser Beam machining and drilling (LBM), Oxyfuel cutting, (Plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques- Applications.	10
	<b>VISUAL STUDY:</b>	
	Basics of thermal cutting process-Sample product manufacturing process	
	<b>Total Instructional Hours</b>	<b>45</b>

- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1: Upon completion of this course Demonstrate different unconventional machining processes.
- CO2: Identify the influence of difference process parameters and their applications.
- CO3: know the mechanical energy based process.
- CO4: Gain knowledge about chemical energy processes.
- CO5: Understand thermal energy based manufacturing processes

**TEXT BOOK:**

- T1 -Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
- T2- Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

**REFERENCES:**

- R1 - Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.
- R2 -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.
- R3 - Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
- R4 -Adithan. M., “Unconventional Machining Processes”, Atlantic, New Delhi, India, 2009. ISBN13: 9788126910458.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5305	HYDRAULICS AND PNEUMATICS SYSTEMS	3	0	0	3

**The student should be able**

1. To know the physical properties to the hydraulic systems and basic laws of hydrostatics and hydrodynamics.
2. To know the theory of operation and the structure and know the symbols of pumps, cylinders, hydraulic motors and the directional control valves and the control valves of pressure and flowrate.
3. To know of the basic properties of the compressed air as medium used in energy transmission for the purposes of control and the other necessary specific properties of the compressed air.
4. To know the principles that should awarded in preparing the compressed air, the devices that are used in pneumatic energy conversion also the control devices in the pneumatic energy.
5. To provide exposure to various problems and maintenance of Hydraulic and Pneumatic circuits for various engineering applications.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO FLUID POWER AND HYDRAULIC PUMPS</b>	
I	Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – Fluid power symbols. Basics of Hydraulics - Applications of Pascal’s Law. Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps.	9
	<b>HYDRAULIC ACTUATORS AND CONTROL VALVES</b>	
II	Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder. Control Valves: Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable	9
	<b>DESIGN OF HYDRAULIC SYSTEMS AND INDUSTRIAL APPLICATIONS</b>	
III	Reciprocating circuit, Synchronizing circuit, Regenerative circuit, Pump unloading circuit, Counterbalance valve circuit. Types of accumulators – Accumulators circuits, sizing of accumulators- Intensifier, Fail-safe circuits - Speed control circuits	9
	<b>PNEUMATIC SYSTEMS AND COMPONENTS</b>	
IV	Properties of air – Compressors – Filter, Regulator, Lubricator, and Muffler – Air control valves, Quick exhaust valves, pneumatic actuators. Sequential circuit design for simple applications using cascade method.	9
	<b>SERVO SYSTEMS AND MAINTENANCE</b>	
V	Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits. Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting. Internet of things in automation.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

Upon completion of the course, the students will be able to:

CO 1: Choose hydraulic and pneumatic elements and demonstrate the applicability of fluid power systems for engineering applications.

CO 2: Design customized circuits in hydraulics, pneumatics and servo systems for various industrial needs.

CO 3: Draw and explain the working of various types of pumps and hydraulic motors and cylinders.

CO 4: Explain the fundamentals of pneumatic systems and working of pneumatic components.

CO 5: Draw ladder logic diagrams and explain about low cost automation.

**TEXT BOOK:**

- T1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education 2000.  
T2. Peter Rohner, “Industrial Hydraulic Control” 4th Revised Edition 2005

**REFERENCES:**

- R1. Majumdar S.R., “Pneumatic systems – Principles and maintenance”, Tata McGraw Hill, 1995.

  
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**Semester – V**

**Course Code & Name : 21ME5201 Dynamics of Machines**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	-	-	1	-	-	-	-	1	1	2	2
CO2	2	1	-	2	-	-	1	-	-	-	2	1	2	1
CO3	3	1	1	1	1	2	-	-	-	-	1	2	3	1
CO4	2	1	1	1	1	2	-	-	-	-	1	2	2	1
CO5	1	1	1	1	-	1	-	-	-	-	-	-	1	1
Avg	2	1.2	1	1	0.4	1.2	0.2	0	0	0	1	1.2	2	1.2

**Course Code & Name : 21ME5202 Heat and Mass Transfer**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	1		1						1	1	1
CO2	3	1	1	1		2	2		1		1	1	1	1
CO3	3	1	1	1								1	1	1
CO4	3	1	1	1								1	1	1
CO5	3	1	1	1		2	1		1		1	1	1	1
Avg	3	1	1	1		1	0.6		0.4		0.4	1	1	1

**Course Code & Name : 21ME5203 Design of Machine Elements**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	2	2	-	-	-	-	-	2	2	3	2
CO2	3	3	1	2	2	-	-	-	-	-	-	1	3	3
CO3	3	3	1	2	1	-	-	-	-	-	1	1	3	3
CO4	3	3	2	2	2	-	-	-	-	-	1	1	3	3
CO5	3	3	3	2	2	-	-	-	-	-	1	1	3	3
Avg	3	2.8	1.6	2	1.8	0	0	0	0	0	1	1.2	3	2.8

**Course Code & Name : 21ME5204 Automobile Engineering**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	1.4	1	1.8	1.2	1.2	1.4	1.2	1	1	1.4	1	1	2	1.2

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**Course Code & Name : 21ME5251 Machine Drawing**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	1	-	-	-	-	-	2	-	1
CO2	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO3	2	3	3	1	1	-	-	-	-	-	-	1	-	1
CO4	3	2	2	2	1	-	-	-	-	-	-	2	1	1
CO5	3	2	2	2	1	-	-	-	-	-	-	2	1	1
Avg	3	2	2	1	-	1	-	-	-	-	-	2	-	1

**Course Code & Name : 21ME5303 - CNC Technology**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	1	1	2	-	2
CO2	-	-	-	-	3	-	-	-	-	1	1	3	1	1
CO3	-	-	-	-	3	1	-	-	3	2	1	3	1	2
CO4	-	-	1	2	-	-	-	-	1	3	1	2	2	2
CO5	-	-	1	2	-	1	-	-	1	2	1	3	2	1
Avg	-	-	1	2	3	1	-	-	1.3	1.8	1	2.6	1.5	1.6

**Course Code & Name : 21ME5305 Hydraulic and Pneumatic Systems**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	1.4	1	1.8	1.2	1.2	1.4	1.2	1	1	1.4	1	1	2	1.2

**Course Code & Name: 21ME5001 Dynamics Lab**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	2	-	-	-	-	1	2	3	1
CO2	3	-	-	-	-	2	-	-	-	-	2	2	3	1
CO3	3	-	-	-	-	2	-	-	-	-	2	2	3	1
CO4	3	-	-	-	-	2	-	-	-	-	2	2	3	1
CO5	3	-	-	-	-	2	-	-	-	-	2	3	3	1
Avg	3	0	0	0	0	2	0	0	0	0	1.8	2.2	3	1


  
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**Course Code & Name: 21ME5002 Heat Transfer Lab**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	1	1	1	1	-	-	1	-	1	-	-	-
CO2	2	2	1	2	-	-	-	-	1	1	1	1	2	2
CO3	2	2	2	2	-	2	-	-	1	1	1	1	2	2
CO4	2	2	2	1	-	2	2	-	1	2	1	1	2	2
CO5	2	2	2	2	-	2	2	-	-	2	1	-	2	2
Avg	2	1.8	1.6	1.6	0.2	1.4	0.8	-	0.8	1.2	1	0.6	1.6	1.6

  
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# **CURRICULUM**

## **R2019**

**DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS**

**CBCS PATTERN**

**UNDERGRADUATE PROGRAMMES**

**B.E. MECHANICAL ENGINEERING REGULATION-2019 (Revised on July 2021)**

**(For the students admitted during the academic year 2020-2021 and onwards)**

**SEMESTER I – 20 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
3	19PH1101	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1101	Engineering Chemistry	BS	2	0	2	3	50	50	100
5	19CS1151	Problem Solving and Python Programming	ES	2	0	2	3	50	50	100
6	19ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
<b>PRACTICAL</b>										
7	19HE1001	Language Competency Enhancement Course - I	HS	0	0	1	1	100	0	100
<b>MANDATORY</b>										
8	19MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	19HE1072	Career Guidance –Level I	EEC	1	0	0	0	100	0	100
10	19HE1073	Entrepreneurship & Innovation	EEC	2	0	0	0	100	0	100
<b>Total Credits</b>				15	2	11	20	550	350	900



**SEMESTER II – 22 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
3	19PH2151	Materials Science	BS	2	0	2	3	25	75	100
4	19CY2151	Environmental Sciences	BS	2	0	2	3	25	75	100
5	19EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
6	19ME2101	Engineering Mechanics	ES	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2071/ 19HE2071R	Language Enhancement Course-II	HS	1	0	0	1	100	0	100
9	19HE2072	<i>Career Guidance – Level II</i>	<i>EEC</i>	2	0	0	0	100	0	100
Total Credits				18	2	8	22	400	500	900

**SEMESTER III – 20 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19MA3101	Fourier Series and Statistics	BS	3	1	0	4	25	75	100
2	19ME3201	Manufacturing Technology-I	PC	3	0	0	3	25	75	100
3	19ME3202	Engineering Thermodynamics	PC	3	0	0	3	25	75	100
4	19ME3203	Engineering Materials and Metallurgy	PC	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
5	19ME3251	Fluid Mechanics and Machinery	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
6	19ME3001	Manufacturing Technology Lab – I	PC	0	0	3	1.5	50	50	100
7	19ME3002	Computer Aided Drawing Lab	PC	0	0	3	1.5	50	50	100
<b>MANDATORY</b>										
8	19AC3191	India Constitution	AC	2	0	0	0	0	0	0
9	19HE3071	Career Guidance Level – III	EEC	2	0	0	0	100	0	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	1	8	20	450	450	900

**SEMESTER IV – 21 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19MA4101	Numerical Methods	BS	3	1	0	4	25	75	100
2	19ME4201	Manufacturing Technology – II	PC	3	0	0	3	25	75	100
3	19ME4202	Thermal Engineering	PC	3	0	0	3	25	75	100
4	19ME4203	Kinematics of Machinery	PC	3	1	0	4	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
5	19ME4251	Strength of Materials	PC	3	0	2	4	50	50	100
<b>PRACTICAL</b>										
6	19ME4001	Manufacturing Technology Lab-II	PC	0	0	3	1.5	50	50	100
7	19ME4002	Thermal Engineering Lab	PC	0	0	3	1.5	50	50	100

MANDATORY										
8	19AC4191	Value Education - Essence of Indian Traditional Knowledge	AC	2	0	0	0	0	0	0
9	19HE4072	Career Guidance Level – IV	EEC	2	0	0	0	100	0	100
10	19HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
Total Credits				20	2	8	21	450	450	900

**SEMESTER V – 24 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19ME5201	Dynamics of Machines	PC	3	0	0	3	25	75	100
2	19ME5202	Heat and Mass Transfer	PC	3	1	0	4	25	75	100
3	19ME5203	Design of Machine Elements	PC	3	0	0	3	25	75	100
4	19ME5204	Automobile Engineering	PC	3	0	0	3	25	75	100
5	19ME53XX	<b>Professional Elective – I</b>	PE	3	0	0	3	25	75	100
<b>THEORY &amp; LAB COMPONENT</b>										
6	19ME5251	Machine Drawing	PC	2	0	2	3	50	50	100
<b>PRACTICAL</b>										
7	19ME5001	Dynamics Lab	PC	0	0	3	1.5	50	50	100
8	19ME5002	Heat Transfer Lab	PC	0	0	3	1.5	50	50	100
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	100		100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100		100
Total Credits				19	1	8	24	350	525	1000

**SEMESTER VI – 24 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19ME6181	Principles of Management	HS	3	0	0	3	25	75	100
2	19ME6201	CAD/CAM	PC	3	0	0	3	25	75	100
3	19ME6202	Metrology and Quality Control	PC	3	0	0	3	25	75	100
4	19ME6203	Design of Transmission Systems	PC	3	0	0	3	25	75	100
5	19ME63XX	<b>Professional Elective - II</b>	PE	3	0	0	3	25	75	100
6	19XX64XX	<b>Open Elective –I</b>	OE	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
7	19ME6001	CAD/CAM Lab	PC	0	0	3	1.5	50	50	100
8	19ME6002	Metrology and Measurements Lab	PC	0	0	3	1.5	50	50	100
9	19HE6071	<i>Soft Skill-II</i>	EEC	1	0	0	1	100		100
10	19HE6072	<i>Intellectual Property Rights (IPR)</i>	EEC	1	0	0	1	100		100
11	19ME6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				20	0	6	24	450	650	1000

**SEMESTER VII – 20 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19ME7201	Finite Element Analysis	PC	3	0	0	3	25	75	100
2	19ME7202	Power Plant Engineering	PC	3	0	0	3	25	75	100
3	19XX74XX	Open Elective -II	OE	3	0	0	3	25	75	100
4	19ME73XX	Professional Elective – III	PE	3	0	0	3	25	75	100
5	19ME73XX	Professional Elective- IV	PE	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
6	19ME7001	Computer Aided Analysis Lab	PC	0	0	3	1.5	50	50	100
7	19ME7002	Comprehension Lab	PC	0	0	3	1.5	50	50	100
8	19ME7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total Credits				15	0	10	20	275	525	800

**SEMESTER VIII – 14 Credits**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>THEORY</b>										
1	19ME8201	Engineering Economics and Cost Estimation	PC	3	0	0	3	25	75	100
2	19ME8XXX	Professional Elective- V	PE	3	0	0	3	25	75	100
<b>PRACTICAL</b>										
3	19ME8901	Project Work – Phase II	EEC	0	0	12	8	100	100	200
Total Credits				6	0	12	14	150	250	400

**LIST OF PROFESSIONAL ELECTIVES**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
<b>PROFESSIONAL ELECTIVE I</b>										
1	19ME5301	Advanced Foundry Technology	PE	3	0	0	3	25	75	100
2	19ME5302	Advanced Welding Technology	PE	3	0	0	3	25	75	100
3	19ME5303	CNC Technology	PE	3	0	0	3	25	75	100
4	19ME5304	Unconventional Machining Processes	PE	3	0	0	3	25	75	100
5	19ME5305	Hydraulic and Pneumatic systems	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE II**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME6301	Refrigeration and Air Conditioning	PE	3	0	0	3	25	75	100
2	19ME6302	Advanced I.C. Engines	PE	3	0	0	3	25	75	100
3	19ME6303	Design of Heat Exchangers	PE	3	0	0	3	25	75	100
4	19ME6304	Gas Dynamics and Jet Propulsion	PE	3	0	0	3	25	75	100
5	19ME6305	Energy Conservation and Management	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE III**

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME7301	Design of Jigs, Fixtures and Press Tools	PE	3	0	0	3	25	75	100
2	19ME7302	Tool and Die Design	PE	3	0	0	3	25	75	100
3	19ME7303	Mechatronics	PE	3	0	0	3	25	75	100
4	19ME7304	Composite materials	PE	3	0	0	3	25	75	100
5	19ME7305	Industrial Robotics and Expert Systems	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE IV**

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME7306	Operations Research	PE	3	0	0	3	25	75	100
2	19ME7307	Industrial Engineering	PE	3	0	0	3	25	75	100
3	19ME7308	Industrial Safety Engineering	PE	3	0	0	3	25	75	100
4	19ME7309	Maintenance Engineering	PE	3	0	0	3	25	75	100
5	19ME7310	Metrology and Non Destructive Testing	PE	3	0	0	3	25	75	100

**PROFESSIONAL ELECTIVE V**

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME8181	Total Quality Management	HS	3	0	0	3	25	75	100
2	19ME8182	Entrepreneurship Development and Business Concepts	HS	3	0	0	3	25	75	100
3	19ME8183	Logistics and Supply Chain Management	HS	3	0	0	3	25	75	100
4	19ME8301	Production Planning and Control	PE	3	0	0	3	25	75	100
5	19ME8302	Heating, Ventilation and Air Conditioning Systems	PE	3	0	0	3	25	75	100

**OPEN ELECTIVES**

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME6401	Renewable Energy Sources	OE	3	0	0	3	25	75	100
2	19ME7401	Additive Manufacturing Techniques	OE	3	0	0	3	25	75	100

**List of Life Skill Courses under Open Elective**

S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	19LSZ401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	19LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	25	75	100
3	19LSZ403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	19LSZ404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	19LSZ405	Yoga for Human Excellence	3	0	0	3	25	75	100


(Note: Z Stands for semester, students can't choose twice the course)

**ADDITIONAL CREDIT COURSE FOR MECHANICAL ENGINEERING**

S. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	IV	19ME4071	Geometric dimensioning and tolerance	2	0	0	1	100	-	100
2	V	19ME5071	Tool and Die Design	2	0	0	1	100	-	100
3	VI	19ME6071	Servicing of Refrigeration and Air Conditioning Equipment's	2	0	0	1	100	-	100
4	VII	19ME7071	Energy Auditing Practices	2	0	0	1	100	-	100

**CREDIT DISTRIBUTION**

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

  
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# **SYLLABUS**



Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7201	<b>FINITE ELEMENT ANALYSIS</b> (Common to mechanical and Automobile Engineering)	3	0	0	3

**The student should be able**

- Course Objective**
1. To equip the students with the finite element analysis fundamentals
  2. To enable the students to formulate the design problems using Finite Element Analysis
  3. To acquire knowledge on solving 2-D structural and thermal problems.
  4. To develop proficiency in the application of FEM to realistic axisymmetric engineering problems.
  5. To enable the students to solve Isoparametric elements

Unit	Description	Instructional Hours
<b>I</b>	<b>INTRODUCTION</b> Historical background – Matrix approach – Application to the continuum – Discretization – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM– Weighted residual method – Ritz method.	9
<b>II</b>	<b>ONE DIMENSIONAL PROBLEMS</b> Finite element modeling –shape functions- Potential energy approach – Galerkin approach –Assembly of stiffness matrix and load vector – General form of finite element equations –linear bar element– Quadratic shape function- Applications to plane trusses - Beam elements - one dimensional steady state conduction and convective heat transfer problems.	9
<b>III</b>	<b>TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS</b> Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Triangular elements – Element stiffness matrix – Force vector – Galerkin approach - Stress calculation – Temperature effects-Heat transfer problems.	9
<b>IV</b>	<b>TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS</b> Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures.	9
<b>V</b>	<b>ISOPARAMETRIC FORMULATION</b> Natural coordinate systems - Isoparametric elements-The four-node quadrilateral element– Shape functions for isoparametric elements – Element stiffness matrix and force vector – Lagrangean and serendipity elements – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- Upon completion of the course Student will be able to:
- CO1: Develop the mathematical model for solution of engineering design problems  
CO2: Determine the solution for real time 1D structural problems and heat transfer problems.  
CO3: Solve heat transfer and structural problems using 2D elements  
CO4: Explain the stages in solving engineering problems under axisymmetric condition  
CO5: Analyse and solve the real time problems using iso-parametric elements

**TEXT BOOK:**

- T1 Seshu P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2012.  
T2 Hutton D.V., “Fundamentals of Finite Element Analysis”, McGraw Hill, International Edition, 2017.

**REFERENCES:**

- R1 Rao S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butterworth Heinemann, 2011  
R2 Logan D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002

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<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	19ME7202	POWER PLANT ENGINEERING	3	0	0	3

**The student should be able**

- Course Objective**
1. To learn the working principle of steam power plants.
  2. To study the need of captive power generation system.
  3. To gain knowledge about the environmental benefits of nuclear power plant.
  4. To learn the benefits of various renewable energy sources.
  5. To evaluate cost of energy.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>STEAM POWER PLANTS</b>	
I	Review of basic vapour power cycles. Layout of steam power plant: components- types of boilers, turbines, condensers and cooling towers. Coal and ash handling of steam power plant, draught system and ash disposal in coal power plants. Feed water treatment. Cogeneration systems.	9
	<b>DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS</b>	
II	Components of diesel and gas Turbine Power plants. Combined gas turbine cycle power plants. Integrated gasifier based combined cycle systems. Cycle analysis.	9
	<b>NUCLEAR POWER PLANTS</b>	
III	Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canadian deuterium uranium reactor (CANDU), Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants and disposal of nuclear waste.	9
	<b>RENEWABLE ENERGY POWER PLANTS</b>	
IV	Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas, Fuel Cell power systems, MHD Power plants.	9
	<b>ENERGY ECONOMICS</b>	
V	Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants.	9
	<b>Total Instructional Hours</b>	<b>45</b>

Upon completion of the course, the students will be able to:

- Course Outcome**
- CO1: Understand the operation and maintenance of steam power plants.  
CO2: Identify the environmental impacts of captive power plants.  
CO3: Understand the working principle of nuclear power plants.  
CO4: Understand the environmental benefits of renewable energy power plants.  
CO5: Analyze the energy utilization and energy demand forecasting.

**TEXT BOOK:**

- T1 - Nag. P.K., “Power Plant Engineering”, Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.  
T2 - Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, “Power Plant Engineering”, Second Edition, Standard Handbook of McGraw – Hill, 1998.

**REFERENCES:**

- R1 - El-Wakil. M.M., “Power Plant Technology”, Tata McGraw – Hill Publishing Company Ltd., 2010. R2 - Black & Veatch, Springer, “Power Plant Engineering”, 1996.  
R3 - Godfrey Boyle, “Renewable energy”, Open University, Oxford University Press in association with the Open University, 2004.  
R4 -N.K. Bansal, Non-Conventional Energy Resources, Vikas Publishing House, 2014.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7001	COMPUTER AIDED ANALYSIS LABORATORY	0	0	3	1.5

**The student should be able**

**Course Objective**

1. To develop the student's skills in proper modeling, meshing, and setting up material properties, loads, and constraints for computer simulation and analysis.
2. To expose the student's to different applications of simulation and analysis tools and then solves the problem using software packages.
3. To provide the student's with some knowledge in multi-physics analysis –interaction between structure and thermal.

**Description of the Experiments**

- A Analysis (Using Software)
1. Stress analysis of beams.
  2. Stress analysis of a plate with a circular hole.
  3. Stress analysis of rectangular L – bracket.
  4. Stress analysis of an Axi-symmetric component.
  5. Modal analysis of beams.
  6. Modal analysis of a 2D component.
  7. Harmonic analysis of a 2D component.
  8. Thermal stress analysis of a 2D component.
  9. Conductive heat transfer analysis of a 2Dcomponent.
  10. Convective heat transfer analysis of a 2Dcomponent.

**Total Instructional Hours 45**

**Course Outcome**

The Students will be able to

CO1: Determine engineering design problem that involves interaction between heat and stress, generate the model using a proper element type, and then solve the problem.

CO2: Solve linear and non-linear structural, thermal, and flow problems using software packages.

CO3: Analyze and display the results such as von-Mises stress, displacement, temperature, pressure, and velocity etc. obtained from computer analysis.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7002	COMPREHENSION LAB	0	0	3	1.5

**The student should be able**

**Course Objective** To provide opportunity and encourage the student to apply the knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer through periodic exercise.


**METHOD OF EVALUATION**

- The problems given to the students should be of real, like industrial problems selected by the faculty members of the concerned course.
- While learning as how to solve the real time problems, student will receive guidance from the faculty and also review various courses learnt earlier.
- The students work individually and as a group to solve a variety of problems given to them.
- Further this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including design, materials, manufacturing, process, product and process control, computer integrated manufacture and quality.
- The evaluation is based on continuous assessment by the Faculty Member constituted by the professor in-charge of the course.
- The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics.

**Total Instructional Hours 45**

**Course Outcome**

The Students will be able to  
 CO1: Understand and comprehend any given problem related to mechanical engineering field.  
 CO2: Apply knowledge to real time industrial solutions.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7901	PROJECT PHASE - I	0	0	4	2

**The student should be able**

**Course Objective**

1. To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
2. To develop the methodology to solve the identified problem.
3. To train the students in preparing project reports and to face reviews and viva-voce examination.

**Project work assignment**

- Enable the students to form a convenient group with not more than four students.
- The project groups are assigned with a supervisor who is the faculty member of the respective department.
- In the case of industrial projects, one additional supervisor may be assigned as external supervisor.
- The students have to identify a technical problem related to the Mechanical Engineering based on the technical knowledge gained during the period of study.
- Four hours per week have been allotted in the time table.
- During project works, students can get the guidance from the supervisor(s), visiting library for literature review, conducting experiments related to the project work, computer simulation studies, field work, visiting industries (in the case of industry sponsored project works), case studies or basic research and development work assigned by the supervisor.
- The student has to make two presentations based on their project works.
- The solutions provided by the students should be technically, economically and environment friendly feasible.
- The project evaluation committee (constituted by the Head of Department) has evaluated the problem identification.
- The students has to consolidate the work as project report, which includes Introduction, Literature review, Modeling or simulation details, Experimental details, Results and discussions and Conclusions.
- The student should follow the guidelines for preparing the project work.

**Course Outcome**

The Students will be able to

- At the end of the course the students will have a clear idea of their area of work and they will be in a position to carry out the remaining phase II work in a systematic way.

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**PROFESSIONAL ELECTIVE – III**

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7301	<b>DESIGN OF JIGS, FIXTURES AND PRESS TOOLS</b> (Common to mechanical and AutomobileEngineering)	3	0	0	3

**The student should be able**

**Course Objective**

1. To understand the functions and design principles of Jigs, fixtures and press tools  
Study important methods of analysis of in chromatography.
2. To gain proficiency in the development of required views of the final design.
3. To impart knowledge in Jigs and fixtures, and various kinds of locating devices.
4. To understand the Principles of jigs and fixtures.
5. To know the important considerations while designing Jigs and Fixtures.

Unit	Description	Instructional Hours
	<b>PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES</b>	
I	Tool design objectives - Production devices–inspection devices, Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical, pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis, Poka Yoke.	9
II	<b>JIGS</b> Drill bushes–different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jig components. Design and development of Jigs for given components.	9
III	<b>FIXTURES</b> General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given components.	9
IV	<b>PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT</b> Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block-die shoe. Bolster plate-punch plate- punch holder-guide pins and bushes – strippers – knockouts-stops –pilots- Selection of standard die sets strip layout-strip lay out calculations.	9
V	<b>DESIGN AND DEVELOPMENT OF DIES</b> Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

- Upon completion of the course Student will be able to:
- CO1: demonstrate and analyze the types and functions of jigs and fixtures.
  - CO2: design, specify and analyze the jigs for various applications.
  - CO3: demonstrate and design the fixtures for various applications.
  - CO4: demonstrate and analyze the press working terminologies of die and strip layout.
  - CO5: design and development of dies for different applications.

**TEXT BOOK:**

**TEXT BOOKS:**

- T1 - Edward G. Hoffman, —Jigs & Fixture Design, 6th Edition, Thomson-Delmar Learning, Singapore, 2014.  
T2 - Donaldson C, —Tool Design, 5th Edition, Tata McGraw-Hill, 2010.

**REFERENCES:**

- R1 - Joshi P.H., —Jigs & Fixtures, 5nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2014.

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<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	19ME7302	TOOL AND DIE DESIGN	3	0	0	3

**The student should be able**

- Course Objective**
1. To understand the fundamentals of work holding devices.
  2. To impart knowledge in design tools, dies, jigs and fixtures.
  3. To analyze and optimize an existing jig and fixture.
  4. To gain proficiency when design of dies for press work and forging.
  5. To design tools to maintain precision accuracy of the component produced.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
<b>I</b>	<b>DESIGN OF CUTTING TOOLS</b> Metal cutting process - Selection of tool materials - Design of single point and multipoint cutting tool - Form tools, Drills, Milling cutters, broaches and chip breakers – Problems on design of single point cutting tools only.	9
<b>II</b>	<b>LOCATING AND CLAMPING METHODS</b> Basic Principles of Location - Locating methods and devices - Principles of clamping - Mechanical, Pneumatic and Hydraulic actuation - Clamping force analysis – Design problems.	9
<b>III</b>	<b>DESIGN OF JIGS AND FIXTURES</b> Types of drill jigs - General considerations in the design of drill jigs - Drill bushings - Types, methods of construction - Simple designs of Plate, Channel, Boxes, Post, Angle plate, Turnovers and Pot Jigs. Types of fixtures - Fixtures for machine tools: Lathe, Milling, Boring, Broaching and grinding - Assembly fixtures - Inspection and Welding fixtures.	9
<b>IV</b>	<b>DESIGN OF DIES</b> Press tools - Fundamentals of die-cutting operations - Cutting action in punch and die operations - Die clearance - Blanking and Piercing Die construction – Pilots - Strippers and Pressure Pads.	9
<b>V</b>	<b>PRESS WORK MATERIALS AND MOULD DESIGN</b> Strip layout - Design of simple progressive and compound die sets - Forging Die – Flow lines, V parting lines, open and close die forging; Materials for die block. General mould construction. Design of ejection, feed and cooling systems. Parting surface design. Side cores and side cavities. Product design for die casting and injection molding.	9
<b>Total Instructional Hours</b>		<b>45</b>

- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1: Identify the importance of work holding device.  
CO2: Design jigs and fixtures.  
CO3: Calculate the required specifications of a press for required operations.  
CO4: Design tools and dies for required operations.  
CO5: Design, specify and analyze the dies for different application

**TEXT BOOK:**

T1 - Donaldson C., Lecain G.H. and Goold V.C. (2007), Tool Design, 3rd edition, Tata McGraw- Hill Publishing Company Ltd., New Delhi.

T2 - Jeff Lantrip, David A. Smith and John G. Nee, (2003) Fundamentals of Tool Design, 5th Edition, Society of Manufacturing Engineers.

**REFERENCES:**

R1 - Joshi P. H., “Jigs and Fixtures”, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

R2 - Edward G. Hoffman, “Jigs and Fixtures Design”, Thomson - Delmar Learning Series, Singapore, 2004.

R3 – Nagpal G. R., “Metal Forming Processes”, Khanna Pub., New Delhi, 2000.

R4 – Sadhu Singh, “Theory of plasticity and Metal Forming Processes”, Khanna Publishers, 2005.

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<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	19ME7303	MECHATRONICS	3	0	0	3

**The student should be able**

- Course Objective**
1. To learn interdisciplinary applications.
  2. To impart knowledge of Microprocessor and Microcontroller.
  3. To Study the Programmable Peripheral Interface and Architecture.
  4. To learn PLC architecture, programming and applications.
  5. To impart knowledge in various Actuators and Mechatronics system design.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>INTRODUCTION</b>	
I	Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors.	9
	<b>MICROPROCESSOR AND MICROCONTROLLER</b>	
II	Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes – Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.	9
	<b>PROGRAMMABLE PERIPHERAL INTERFACE</b>	
III	Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.	9
	<b>PROGRAMMABLE LOGIC CONTROLLER</b>	
IV	Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.	9
	<b>ACTUATORS AND MECHATRONIC SYSTEM DESIGN</b>	
V	Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

Upon completion of the course, the students will be able to:

CO1- Understand interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.

CO2- Gain knowledge in architecture of Microprocessor and Microcontroller.

CO3- Understand the Programmable Peripheral Interface and Architecture

CO4- Gain knowledge in programming and application of programmable logic controllers.

CO5- Know the various Actuators and Mechatronics system design

**TEXT BOOK:**

- T1. Bolton, "Mechatronics", Prentice Hall, 2008
- T2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008

**REFERENCES:**

- R1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
- R2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
- R3. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
- R4. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7304	COMPOSITE MATERIALS FOR ENGINEERING	3	0	0	3

**The student should be able**

- Course Objective**
1. To understand the fundamentals of composite material strength and its mechanical behavior.
  2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
  3. Study of residual stresses in Laminates during processing.

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b> Definition, Need, General characteristics, Applications, Fibers-Glass, Carbon, Ceramic and Aramid fibers, Polymer Matrix Composite (PMC), Ceramic Matrix Composite (CMC), Metal Matrix Composite (MMC), Characteristics of fibers and matrices, Smart materials, types and Characteristics.	
I		9
	<b>MECHANICS AND PERFORMANCE</b> Characteristics of fiber reinforced Lamina, Laminates, Inter-laminar stresses, Static Mechanical Properties, Fatigue and Impact properties, Environmental effects, Fracture Behavior and Damage Tolerance.	
II		9
	<b>MANUFACTURING</b> Bag Moulding, Compression moulding, Filament winding, Other Manufacturing Processes, Quality Inspection method.	
III		9
	<b>ANALYSIS</b> Analysis of an orthographic lamina, Hooke's law, stiffness and compliance matrices, Strengths of orthographic lamina, Stress analysis of laminated composite Beams, plates, shells and etc, Free vibration	
IV		9
	<b>DESIGN</b> Failure predictions in a Unidirectional Lamina, Failure predictions for Un-notched Laminates, Laminated Design Consideration, Bolted and Bonded Joints, Design examples.	
V		9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

Upon completion of the course, the students will be able to


CO1: Demonstrate the knowledge on the fundamentals of fibers, matrices and composites.  
CO2: Understand the various manufacturing processes involved in the fabrication of composite material.  
CO3: Demonstrate knowledge on the performance of composite materials.  
CO4: Understand and solve problems concerning the mechanics of composite materials.  
CO5: Understand the design calculations for the development of fiber reinforced matrices.

**TEXT BOOK:**


- T1 Mallick P.K., —Fiber Reinforced Composites: Materials, Manufacturing and Design, 3rd Edition, Taylor and Francis, 2008.  
T2 Autar K. Kaw, —Mechanics of Composite Materials, 2nd Edition, CRC Press, 2006.

**REFERENCES:**

- R1 Bhagwan D. Agarwal, Lawrence J. Broutman, Chandrashekhar K., —Analysis and Performance of Fiber Composites, 3rd Edition, John Wiley & Sons, New York, 2006.  
R2 Gibson R.F., —Principles of Composite Material Mechanics", 3rd Edition, CRC Press, 2011.  
R3 Chawla K.K., —Composite Materials, 3rd Edition, Springer Verlag, Boston, 2012.  
R4 Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw Hill, 1998.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7305	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	3	0	0	3

**The student should be able**

- Course Objective**
1. To learn the functions of the basic components of a Robot.
  2. To study the use of various types of End Effectors and Sensors.
  3. To impart knowledge in Robot Kinematics and Programming.
  4. To learn Robot safety issues and economics.
  5. To impart knowledge in Robot cell design.

Unit	Description	Instructional Hours
I	<b>INTRODUCTION AND ROBOT KINEMATICS</b> Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.	10
II	<b>ROBOT DRIVES AND CONTROL</b> Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.	9
III	<b>ROBOT SENSORS</b> Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing – Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.	9
IV	<b>ROBOT CELL DESIGN AND APPLICATION</b> Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	9
V	<b>ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b> Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.	8
<b>Total Instructional Hours</b>		<b>45</b>


- Course Outcome**
- Upon completion of the course, the students will be able to:
- CO1: Understand the functions of the basic components of a Robot.  
CO2: Know the use of various Robot drives and End Effectors.  
CO3: Gain knowledge of Robot sensors.  
CO4: Understand the Robot cell design and applications.  
CO5: Understand the robot programming and AI.

**TEXT BOOK:**


- T1 – Fu.K.S., R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill, 1987.  
T2 - YoramKoren,” Robotics for Engineers’ Mc Graw-Hill, 1987.

**REFERENCES:**

- R1 - Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,” Industrial Robotics Technology, Programming and Applications”, Mc Graw-Hill, Int. 1986.  
R2 - Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering - An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.  
R3 - Deb, S.R.” Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7306	OPERATIONS RESEARCH	3	0	0	3

**The student should be able**

- Course Objective**
- To provide students the knowledge of optimization techniques and approaches.
  - To enable the students, apply mathematical and computational skills needed for the practical utility of Operations Research.
  - To explore the industrial applications of Transportation and Assignment models.
  - To teach students about networking, Inventory, decision, replacement models and queuing theory
  - To introduce students to research methods and current trends in Operations Research.

Unit	Description	Instructional Hours
	<b>LINEAR PROGRAMMING</b>	
I	The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex.	9
	<b>SEQUENCING AND NETWORKS MODEL</b>	
II	Sequencing –Problem with N jobs and 2 machines - 3 machines and „M“ machines. Network models – Basic Concepts – Construction of Networks – Project Network – CPM and PERT - Critical Path Scheduling – Crashing of Network.	9
	<b>TRANSPORTATION AND ASSIGNMENT PROBLEM</b>	
III	Transportation model – Initial solution by North West corner method – least Cost method – VAM. Optimality test – MODI method and stepping stone method. Assignment model – formulation – balanced and unbalanced assignment problems.	9
	<b>INVENTORY MODELS</b>	
IV	Inventory models – Various Costs and Concepts–EOQ–Deterministic inventory models – Production models – Stochastic Inventory models – Buffer stock.	9
	<b>REPLACEMENT MODEL AND QUEING THEORY</b>	
V	Replacement models – Items that deteriorate with time - When money value changes – Items that fail completely – Individual replacement and Group replacement. Queuing models – Poisson arrivals and Exponential service times – Single channel models and Multi-channel models.	9
	<b>Total Instructional Hours</b>	<b>45</b>

Upon completion of the course, the students will be able to:

- Course Outcome**
- CO1: Apply operations research techniques like Linear Programming problems in industrial optimization problems.
- CO2: Apply the concepts of PERT and CPM for decision making and optimally managing projects.
- CO3: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results.
- CO4: Analyze and apply appropriate inventory techniques in domain specific situations.
- CO5: Analyze the replacement model techniques and to apply appropriate queuing theories in domain specific situations.

**TEXT BOOK:**

T1- Mittal, K. V. and Mohan, C. "Optimization Methods in Operations Research and Systems Analysis", 4th Edition, New Age, 2016.

T2- Taha, H. A, "Operations Research - An Introduction", Pearson, 9th Edition, 2014.

**REFERENCES:**

R1- Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2015.

R2 Ravindran, A , Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2014.

R3-Hadley G - 'Linear Programming' - Narosa Book Distributors Private Ltd. – 2006.

R4-Wagner,"Operations Research", Prentice Hall of India, 2000.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7307	INDUSTRIAL ENGINEERING	3	0	0	3

**The student should be able**

**Course Objective**

1. To introduce the concepts, principles and framework of contents of Industrial Engineering.
2. To introduce the principles of work study and Method study.
3. To introduce the concepts and frame work of work measurements.
4. To introduce the concepts of various facility design, material handlings & Ergonomic work design.
5. To introduce concepts of various cost accounting and financial management & acquaint the students with different aspects of Industrial Safety rules.

Unit	Description	Instructional Hours
	<b>INTRODUCTION TO INDUSTRIAL ENGINEERING AND PRODUCTIVITY</b>	
I	Introduction - Definition and Role of Industrial Engineering, Contribution of Taylor and Gilbreth, Organization, organizational structure, organization charts; Types of organization. - Formal line, military organization, functional organization, line & staff organization, Productivity: Definition of productivity, Productivity of materials, land, building, machine and power. Measurement of productivity: factors affecting the productivity.	9
	<b>METHOD STUDY</b>	
II	Work Study: Definition, objectives and scope of work-study. Human factors in work-study. Method Study: Definition, objective and scope of method study, SIMO chart, and micro motion study. Definition and installation of the improved method, brief concept about synthetic motion studies. (Numerical); Introduction to Value Engineering and Value Analysis.	9
	<b>WORK MEASUREMENTS</b>	
III	Work Measurements: Definition, objectives and uses; Work measurement techniques. Work sampling - need, confidence levels, sample size determinations, random observation conducting study with the simple problems. Time study: Definition, time study equipment, selection of job, steps in time study. scales of rating, factors affecting rate of working, allowances and standard time determination; Introduction to PMTS and MTM. (Numerical), Introduction to MOST.	9
	<b>FACILITY DESIGN &amp; ERGONOMICS</b>	
IV	Facility location Factors and Evaluation of Alternate Locations; Types of Plant Layout; Computer Aided Layout Design Techniques; Assembly Line Balancing (Numerical); Material Handling: Principles, Types of Material Handling Devices; Ergonomic Design Standards- Study of development of stress in human body and their consequences. Case Studies.	9
	<b>ENGINEERING ECONOMY AND INDUSTRIAL SAFETY</b>	
V	Engineering Economy and Costing: Elementary Cost Accounting and Methods of Depreciation; Break-Even Analysis (Numerical); Introduction to Debit and Credit Note, Financial Statements (Profit and Loss Account and Balance Sheet), Techniques for Evaluation of Capital Investments. Industrial Safety: Safety Organization, Safety Programme, General Safety Rules.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

- Upon completion of the course, the students will be able to:
- CO1: Apply the Industrial Engineering concepts in the industrial environment.
  - CO2: Manage and implement different concepts involved in methods study and understanding of work content in different situations. Undertake project work based on the course content.
  - CO3: Describe different aspects of work measurement system design and standards.
  - CO4: Identify various facilities design pertinent to manufacturing industries & working comfortability in industries.
  - CO5: Identify various cost accounting and financial management practices widely applied in industries and different safety rules followed in industries.

**TEXT BOOK:**

- T1 - MartendTelsang, Industrial Engineering, S. Chand Publication.  
T2 - Banga and Sharma, Industrial Organization & Engineering Economics, Khanna publication.

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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7308	INDUSTRIAL SAFETY ENGINEERING AND ENVIRONMENT	3	0	0	3

**The student should be able**

**Course Objective**

1. To provide in depth knowledge in Principles of safety and Prevention of accident in various fields.
2. To understand the basics on safety organization.
3. To expose the students to the basics in Human safety and hazard management.
4. To learn about human safety.
5. To study about Industrial Hygiene and Hazards.

Unit	Description	Instructional Hours
I	<b>ACCIDENT PREVENTION</b> Definitions and theories of accident, injury, unsafe act, unsafe condition and dangerous occurrence - Theories and principles of accident causation - Cost of accidents, Accident reporting and investigations, Safety committees and their need, types and advantages - Safety education and training and their importance - Various training methods - Accident prevention and Motivating factors of safety - suggestion schemes, Safety performance - Definitions connected with measuring safety performance as per Indian and International standards.	9
II	<b>SAFETY IN MATERIAL HANDLING</b> General safety consideration in material handling, Ropes, Chains, Sling, Hoops, Clamps, Arresting gears and Prime movers - Ergonomic consideration in material handling, Design, installation, operation and maintenance of conveying equipments, Hoisting, traveling and slewing mechanisms, Selection, operation and maintenance of industrial trucks, Mobile cranes and Tower crane.	9
III	<b>SAFETY IN CHEMICAL INDUSTRIES</b> Safety in the design process of chemical plants - Safety in operational and maintenance of chemical plants Exposure of personnel - Operational activities and hazards, Safety in storage and handling of chemicals and gases, Hazards during transportation and Pipeline transport - Safety in chemical laboratories Specific safety consideration for cement, paper and pharmaceutical, Specific safety consideration for petroleum, petro - chemical, rubber, fertilizer and distilleries.	9
IV	<b>ENVIRONMENTAL IMPACT ASSESSMENT</b> Evolution, Concepts, Methodologies, Screening, Scoping and Checklist of EIA Rapid and Comprehensive EIA Legislative and environmental clearance procedure in India - Prediction tools for EIA Assessment of Impact of air, water, soil, noise, biological and Socio cultural environment Public participation Resettlement and Rehabilitation Documentation of EIA.	9
V	<b>REGULATIONS FOR HEALTH, SAFETY AND ENVIRONMENT</b> Factories act and rules - Indian explosive act - Gas cylinder rules, Environmental pollution act, Indian petroleum act and rules, Oil industry safety directorate (OISD), Indian Electricity act and rules, Mines act and rules, Indian motor vehicles act and rules.	9
<b>Total Instructional Hours</b>		<b>45</b>

**Course Outcome**

- Upon completion of the course, the students will be able to:
- CO1: Apply the philosophies behind industrial accidents  
CO2: Apply the hierarchical levels in a safety organization  
CO3: Understand the concept of industrial process safety  
CO4: Understand the safety procedures for human and apply Industries.  
CO5: Apply the types of industrial hazards and preventive measures.

**TEXT BOOK:**

- T1- Handlin. W, "Industrial Hand Book", McGraw-Hill, 2000.  
T2 - Anton. T.J, "Occupational Safety and Health Management", 2nd Edition, New York, McGraw Hill, 1989.

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<b>Programme</b>	<b>Course code</b>	<b>Name of the course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
B.E.	19ME7309	MAINTENANCE ENGINEERING	3	0	0	3

**The student should be able**

- Course Objective**
1. To study the principles and functions of maintenance planning.
  2. To learn the types of maintenance.
  3. Gain knowledge about condition monitoring.
  4. Understand the repair methods for machine elements.
  5. Understand the repair methods for material handling equipments.

<b>Unit</b>	<b>Description</b>	<b>Instructional Hours</b>
	<b>PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING</b>	
I	Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.	9
	<b>MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE</b>	
II	Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.	9
	<b>CONDITION MONITORING</b>	
III	Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear- debris analysis.	9
	<b>REPAIR METHODS FOR BASIC MACHINE ELEMENTS</b>	
IV	Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.	9
	<b>REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT</b>	
V	Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance	9
	<b>Total Instructional Hours</b>	<b>45</b>

Upon completion of the course, the students will be able to:


- Course Outcome**
- CO1: Understand the maintenance planning functions.  
CO2: Identify maintenance policies and types.  
CO3: Gain knowledge about methods and instruments for CM.  
CO4: To analyze failure of machine parts.  
CO5: Implement failure analysis in material handling equipments

**TEXT BOOK:**


- T1 - Srivastava S.K., “Industrial Maintenance Management”, S. Chand and Co., 1981.  
T2 - Venkataraman .K “Maintenance Engineering and Management”, PHI Learning, Pvt. Ltd., 2007.

**REFERENCES:**

- R1 - Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995.  
R2 - White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.  
R3 - Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.  
R4 - L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005.

  
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Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7310	METROLOGY AND NON DESTRUCTIVE TESTING	3	0	0	3

**The student should be able**

**Course Objective**

1. To impart the knowledge of quality assurance and inspection techniques.
2. To familiarize with the various inspection and measurement techniques like contact and non-contact measurement by adapting Computer Aided Inspection.
3. To impart the knowledge of working principles and calibration of various Systems.
4. To study and understand the various non-destructive evaluation and testing methods, theory and their industrial applications.
5. To provide exposure to the students on various advanced measuring methods and nondestructive testing techniques.

Unit	Description	Instructional Hours
	<b>MEASURING MACHINES</b>	
I	Tool Maker's microscope - Co-ordinate measuring machines - Universal measuring machine – Image shearing microscope -Laser viewers for production profile checks - Use of computers in metrology- Machine vision technology - Microprocessors in metrology.	9
	<b>STATISTICAL QUALITY CONTROL</b>	
II	Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits - Control charts for variables and for fraction defectives - Theory of probability - Sampling – ABC standard, Reliability and life testing	9
	<b>LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS</b>	
III	Non destructive testing: Visual inspection, principles and operation of Liquid penetration inspection, Characteristics of liquid Penetrants - Different washable systems - Developers - Applications – Methods of production of magnetic fields - Principles of operation of Magnetic particle test - Applications - Advantages and Limitations.	9
	<b>RADIO GRAPHY</b>	
IV	Sources of x-ray production - properties of x rays - film characteristics – Exposure charts - contrasts - operational characteristics of x ray equipment - Applications.	9
	<b>ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES</b>	
V	Production of ultrasonic waves - Types, characteristics of ultrasonic waves - pulse echo method - A, B, C scans - Principles of Acoustic emission techniques – Advantages and limitations –Instrumentation - Applications.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

- Upon completion of the course, the students will be able to:
- CO1: Understand the concept of Laser Metrology and Computer Integrated Machining Machine.
- CO2: Understand the techniques used in statistical quality control.
- CO3: Analyse the materials characteristics through various non-destructive tests.
- CO4: Understand the knowledge various radiography characteristics and operations.
- CO5: Understand the knowledge of ultrasonic and Acoustic emission techniques.

**TEXT BOOK:**

- T1. Jain, R.K. "Engineering Metrology ", Khanna Publishers, 1997.
- T2. Barry Hull and Vernon John, "Non Destructive Testing ", MacMillan, 1988.

**REFERENCES:**

- R1. American Society for Metals, "Metals Hand Book ", Vol.II, 1976.
- R2. Progress in Acoustic Emission, "Proceedings of 10th International Acoustic Emission Symposium ", Japanese Society for NDI, 1990.
- R3. Halmshaw, "Non-destructive testing", 2nd edition, Edward Arnold, 1991.
- R4. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

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**OPEN ELECTIVE**

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7401	ADDITIVE MANUFACTURING TECHNIQUES	3	0	0	3

**The student should be able**

- |                         |  |
|-------------------------|--|
| <b>Course Objective</b> | <ol style="list-style-type: none"> <li>To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Rapid Prototyping technologies.</li> <li>To acquire knowledge of solid and liquid based Rapid prototyping system.</li> <li>To provide information about Power based prototyping system.</li> <li>To be familiar with the characteristics of the different materials those are used in lean Manufacturing.</li> <li>To impart knowledge of characteristics and issues of Just in time.</li> </ol> |
|-------------------------|--|

Unit	Description	Instructional Hours
	<b>INTRODUCTION</b>	
I	Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping – Virtual prototyping.	7
	<b>REVERSE ENGINEERING AND CAD MODELING</b>	
II	Basic concept - Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – Data formats - Data interfacing - Part orientation and support generation - Support structure design - Model Slicing and contour data organization - Direct and adaptive slicing - Tool path generation	10
	<b>SOLID AND LIQUID BASED ADDITIVE MANUFACTURING SYSTEMS</b>	
III	Stereo lithography Apparatus (SLA), Fused deposition Modeling (FDM), Laminated object manufacturing (LOM), three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.	9
	<b>POWDER BASED ADDITIVE MANUFACTURING SYSTEMS</b>	
IV	Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Three-Dimensional Printing, Laser Engineered Net Shaping (LENS), Processes, materials, products, advantages, applications and limitations – Case Studies.	9
	<b>OTHER ADDITIVE MANUFACTURING SYSTEMS</b>	
V	Introduction - basic process of Shape Deposition Manufacturing (SDM) and its applications. Selective Laser Melting (SLM), Electron Beam Melting (EBM) – Rapid Manufacturing.	9
	<b>Total Instructional Hours</b>	<b>45</b>

**Course Outcome**

Upon completion of the course, the students will be able to:


CO1: Understand the basics of additive manufacturing techniques in manufacturing.  
 CO2: Understand the concepts of modeling, data processing and reverse engineering in additive Manufacturing.  
 CO3: Apply the liquid and solid based additive manufacturing system in suitable applications.  
 CO4: Apply powder based additive manufacturing system in suitable applications.  
 CO5: Apply the new technologies in additive manufacturing for various applications.

**TEXT BOOK:**


- T1 Ian Gibson, David W. Rosen, Brent Stucker, Springer (2010). Additive Manufacturing Technologies Rapid prototyping: Direct Digital Manufacturing.  
 T2 Hopkinson, N., R. Hague and P. Dickens, (2006) Rapid Manufacturing: An Industrial Revolution for the Digital Age, John Wiley, New York.

**REFERENCES:**

- R1 Chua C.K, Leong K.F and Lim C.S, “Rapid Prototyping: Principles and Applications”, World Scientific, 2003.  
 R2 RafiqI.Noorani, “Rapid Prototyping: Principles and Applications”, Wiley & Sons, 2006.

  
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**Semester – VII**

**Course Code & Name : 19ME7201 Finite Element Analysis**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO2	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO3	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO4	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO5	3	2	2	2	-	1	2	-	-	2	1	2	1	1
Avg	3	2.2	2.2	2	0	1	2	0	0	2.2	1	2	1	1

**Course Code & Name : 19ME7202 Power Plant Engineering**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	2	2	1	2	2	2	1	2	2	3	2	1
CO2	3	1	2	2	1	2	2	2	1	1	1	3	2	1
CO3	3	1	2	2	1	2	3	2	2	2	1	2	2	3
CO4	3	1	2	2	1	2	3	2	2	1	1	3	1	3
CO5	2	1	2	2	1	3	2	2	2	3	1	3	1	3
Avg	2.8	1	2	2	1	2.2	2.4	2	1.6	1.8	1.2	2.8	1.6	2.2

**Course Code & Name : 19ME7302 Tool and Die Design**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	1.4	1	1.8	1.2	1.2	1.4	1.2	1	1	1.4	1	1	2	1.2

**Course Code & Name : 19ME7305-Industrial Robotics and Expert Systems**

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO2	3	3	2	-	1	-	-	-	-	-	-	-	1	1
CO3	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO4	3	2	3	-	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	-	1	-	-	-	-	-	-	-	1	1
Avg	3	2.2	2.4	-	1	-	-	-	-	-	-	-	1	1

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**Course Code & Name : 19ME7306 Operations Research**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	1	3				2		2			2	1
CO2	3	1	2	1				1		1			2	
CO3	3	1	1	1				1		1			2	1
CO4	2	1	1										1	
CO5	3	2	1										2	
Avg	3	3	1	3				2		2			2	1

**Course Code & Name : 19ME7308 Industrial Safety Engineering**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	2	2	3	3			1			1		2	1
CO2	2	2	2	3	2	1		1					3	1
CO3	2	3	3	3	2								2	1
CO4	2	2	3	3	3		1	1					2	1
CO5	3	3	3	3	3					1			1	2
Avg	2.2	2.4	2.6	3	2.6	1	1	1		1	1		2	1.2

**Course Code & Name : 19ME7310 Metrology And Nondestructive Testing**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	1	1	1	-	-	-	-	1	-	1	-	1
CO2	3	1	1	2	1	-	-	-	-	1	-	1	-	1
CO3	3	2	2	2	1	-	-	-	-	1	-	1	-	1
CO4	3	1	1	1	2	-	-	-	-	2	-	1	3	1
CO5	3	1	2	1	2	-	-	-	-	2	-	1	3	1
Avg	3	1.2	1.4	1.4	1.4	0	0	0	0	1.4	0	1	3	1

**Course Code & Name : 19ME7401 Additive Manufacturing Techniques (OE)**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO2	3	3	2	-	1	-	-	-	-	-	-	-	1	1
CO3	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO4	3	2	3	-	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	-	1	-	-	-	-	-	-	-	1	1
Avg	3	2.2	2.4	-	1	-	-	-	-	-	-	-	1	1

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**Course Code & Name : 19ME7001 Computer Aided Analysis Lab**


PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	-	-	-	3	-	-	-	-	2	-	2	3	1
CO2	2	-	-	-	3	-	-	-	-	2	-	2	3	1
CO3	2	-	-	-	3	-	-	-	-	2	-	2	3	1
CO4	2				3					2		2	3	1
CO5	2				3					2		2	3	1
Avg	2	-	-	-	3	-	-	-	-	2	-	2	3	1

**Course Code & Name : 19ME7002 Comprehension Lab**


PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
Avg	3	3	3	3	3	-	1	-	2	-	-	-	2	1

**Course Code & Name : 19ME7901 Project Work – Phase I**

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	-	-	-	-	-	-	-	1	3	2	2
Avg	3	2.3	2.6	-	-	-	-	-	-	-	1.3	3	2	2

  
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