

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR  
(AUTONOMOUS)**



**Bachelor of Technology  
DEPARTMENT OF MECHANICAL ENGINEERING  
R20 CURRICULUM**

<b>INDUCTION PROGRAM (MANDATORY)</b>	<b>3 WEEKS DURATION</b>
<b>Induction program for students to be offered right at the start of the first year.</b>	<ul style="list-style-type: none"> <li>• Physical activity</li> <li>• Creative Arts</li> <li>• Universal Human Values</li> <li>• Literary</li> <li>• Proficiency Modules</li> <li>• Lectures by Eminent People</li> <li>• Visits to local Areas</li> <li>• Familiarization to Dept./Branch &amp; Innovations</li> </ul>

**I B. Tech. – I Semester (ME)**

S. No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	20HS0830	Algebra and Calculus	3	-	-	3
2.	20HS0804	Engineering Chemistry	3	-	-	3
3.	20HS0810	Communicative English	3	-	-	3
4.	20EE0251	Basic Electrical & Electronics Engineering	3	-	-	3
5.	20ME0301	Engineering Graphics	1	-	4	3
6.	20HS0805	Engineering Chemistry Lab	-	-	3	1.5
7.	20HS0811	Communicative English Lab	-	-	3	1.5
8.	20EE0252	Basic Electrical & Electronics Engineering lab	-	-	3	1.5
Contact Periods / Week			13	-	13	19.5
			Total/Week 26			

**I B. Tech. – II Semester (ME)**

S. No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	20HS0831	Differential Equations and Complex Analysis	3	-	-	3
2.	20HS0848	Engineering Physics	3	-	-	3
3.	20CS0501	C Programming and Data Structures	3	-	-	3
4.	20ME0303	Basic Thermodynamics	3	-	-	3
5.	20CE0163	Basics of Engineering Mechanics	3	-	-	3
6.	20HS0850	Engineering Physics Lab	-	-	3	1.5
7.	20CS0502	C Programming and Data Structures Lab	-	-	3	1.5
8.	20ME0302	Workshop Practice Lab	-	-	3	1.5
<b>Mandatory Courses</b>						
9.	20HS0816	Indian Constitution	2	-	-	-
Contact Periods / Week			17	-	9	19.5
			Total/Week 26			

## II B. Tech. – I Semester (ME)

S. No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	20HS0833	Numerical Methods, Probability & Statistics	3	-	-	3
2.	20CE0160	Fluid Mechanics & Hydraulic Machinery	3	-	-	3
3.	20CE0164	Mechanics of Solids	3	-	-	3
4.	20ME0304	Kinematics of Machinery	3	-	-	3
5	20ME0305	Thermal Engineering	3	-	-	3
6.	20CE0112	Fluid Mechanics & Hydraulic Machinery Lab	-	-	3	1.5
7.	20CE0106	Strength of Materials Lab	-	-	3	1.5
8.	20ME0306	Thermal Engineering Lab	-	-	3	1.5
<b>Skill oriented course</b>						
9	20ME0365	Automobile Engineering Lab- I	1	-	2	2
<b>Mandatory Course</b>						
9.	20HS0801	Environmental Science	2	-	-	-
Contact Periods / Week			18	-	11	21.5
			Total/Week 29			

## II B. Tech. – II Semester (ME)

S. No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	20HS0815	Entrepreneurship Development	3	-	-	3
2.	20ME0307	CAD/CAM	3	-	-	3
3.	20ME0308	Manufacturing Processes	3	-	-	3
4.	20ME0309	Materials Science	3	-	-	3
5.	20ME0310	Theory of Machines	3	-	-	3
6.	20ME0311	Computer Aided Machine Drawing lab	-	-	3	1.5
7.	20ME0312	Manufacturing Processes Lab	-	-	3	1.5
8.	20ME0313	Materials Science Lab	-	-	3	1.5
<b>Skill Oriented Course</b>						
9.	20ME0366	Computer Aided Modelling Lab- I	1	-	2	2
<b>Internship-1 of 60 hours (Mandatory) during summer vacation</b>						
Contact Periods / Week			16	-	11	21.5
			Total/Week 27			

## III B.Tech– I Semester (ME)

S.No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	20ME0314	Design of Machine Elements-I	3	-	-	3
2.	20ME0315	Heat and Mass Transfer	3	-	-	3
3.	20ME0316	Metal Cutting and Machine Tools	3	-	-	3
<b>Professional Elective Course (PEC) –I</b>						
4.	20ME0329	Industrial Engineering and Management	3	-	-	3
	20ME0330	Production and Operations Management				
	20ME0331	Total Quality Management				
<b>Open Elective (OE)-I</b>						
.5	20CE0170	Fundamental of Civil Engineering	3	-	-	3
	20EE0227	Generation of Energy From Waste				
	20EC0451	Introduction to Communication Systems				
	20CS0550	Relational Database Management System				
	20HS0813	Management Science				
6.	20ME0317	Heat Transfer Lab	-	-	3	1.5
7.	20ME0318	Machine Tools lab	-	-	3	1.5
<b>Skill advanced course/ Soft Skill Course</b>						
	20HS0859	English for Corporate Communication Skills	1	-	2	2
<b>Mandatory Course</b>						
9.	20HS0817	Essence of Indian Traditional Knowledge	2	-	-	-
10	20ME0319	<b>Internship-1 of 60 hours (Mandatory) after second year (to be evaluated during V semester)</b>	-	-	-	1.5
Contact Periods / Week			18	-	8	21.5
			Total/Week 26			

## III B. Tech – II Semester (ME)

S.No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	20ME0320	Design of Machine Elements-II	3	-	-	3
2.	20ME0321	Metrology and Measurements	3	-	-	3
3.	20ME0322	Non-Conventional Energy Resources	3	-	-	3
<b>Professional Elective Course (PEC) –II</b>						
4.	20ME0332	Automotive Electrical and Electronic systems	3	-	-	3
	20ME0333	Automobile Engineering				
	20ME0334	Theory of Combustion and Emission				
<b>Open Elective (OE)-II</b>						
5.	20CE0147	Fundamentals of Urban Planning	3	-	-	3
	20EE0235	Industrial Instrumentation				
	20EC0452	Elements of Embedded systems				
	20CS0551	JAVA Programming				
	20HS0814	Intellectual Property Rights				
6.	20ME0323	Computer Aided Modeling Lab-II	-	-	3	1.5
7.	20ME0324	Instrumentation & Control Systems Lab	-	-	3	1.5
8.	20ME0325	Metrology Lab	-	-	3	1.5
<b>Skill advanced course/ Soft skill course</b>						
9.	20ME0367	Automobile Engineering Lab- II	1	-	2	2
<b>Mandatory Course</b>						
10.	20HS0864	Human Values & Professional Ethics	3	-	-	3*
<b>Internship-2 of 120 hours (Mandatory) during summer vacation</b>						
Contact Periods / Week			19	-	11	21.5/
			Total/Week		30	24.5*

\*Applicable from 2021-22 admitted batches onwards.

## IV B.Tech – I Semester

S. No	Course Code	Name of the Subject	L	T	P/Drg	C
1	20HS0812	Managerial Economics and Financial Analysis	3	-	-	3
<b>Professional Elective Course (PEC) –III</b>						
2	20ME0335	Finite Element Analysis	3	-	-	3
	20ME0336	Operation Research				
	20ME0337	Mechatronics & Robotics				
<b>Professional Elective Course (PEC) –IV</b>						
3	20ME0338	Gas Dynamics and Jet Propulsion	3	-	-	3
	20ME0339	Power Plant Engineering				
	20ME0340	Refrigeration & Air Conditioning				
<b>Professional Elective Course (PEC) –V</b>						
4	20ME0341	Advanced Welding processes	3	-	-	3
	20ME0342	Modern Machining Methods				
	20ME0343	Quality Control & Reliability Engineering				
<b>Open Elective (OE)-III</b>						
5	20CE0148	Elements of Road Traffic Safety	3	-	-	3
	20EE0237	Electrical Energy Conservation and Auditing				
	20EC0453	Introduction to IOT				
	20CS0511	Python Programming				
	20HS0861	Business Ethics				
<b>Open Elective (OE)-IV</b>						
6	20CE0171	Project Planning and Control	3	-	-	3
	20EE0239	Neural Networks and Fuzzy Logic				
	20EC0454	MATLAB Programming				
	20CS0552	Artificial Intelligence & Machine Learning				
	20HS0862	Strategic Management				
<b>Skill advanced course/ soft skill course</b>						
7	20ME0368	Computer Simulation lab	1	-	2	2
8	20ME0326	<b>Internship-2 of 120 hours (Mandatory) after third year (To be evaluated during VII semester)</b>	-	-	-	3
Contact Periods / Week			19	-	2	23
			Total/Week 21			

## IV B.Tech – II Semester

S. No	Course Code	Name of the Subject	L	T	P/Drg	C
1.		MOOCS	3	-	-	3
2.	20ME0327	Project Work	-	-	18	9
Total Credits						12

Year	I Year		II Year		III Year		IV Year		Total
	I Sem	II Sem	I Sem	II Sem	I Sem	II Sem	I Sem	II Sem	
Credits	19.5	19.5	21.5	21.5	21.5	21.5/24.5*	23	12	160/163*

Note: L – Lecture, T- Tutorial, P- Practical's, C – Credits

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**I B.Tech- I Sem**

L	T	P	C
3	-	-	3

**(20HS0830) ALGEBRA AND CALCULUS  
(Common to All Branches)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Illuminate the students in the concepts of calculus and linear algebra.*
2. *Equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.*
3. *Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Develop the use of matrix algebra techniques that is needed by engineers for practical applications.*
2. *Utilize mean value theorems to real life problems.*
3. *Familiarize with functions of several variables which is useful in optimization.*
4. *Learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems*
5. *Interpret the physical meaning of different operators such as gradient, curl and divergence.*
6. *Apply Fundamental Theorem of Line Integrals, Green's Theorem, Stokes' Theorem, or Divergence Theorem to evaluate integrals.*

**UNIT I**

**Matrices:** Rank of a matrix by echelon form, solutions of system of homogeneous and non-homogeneous linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem.

**UNIT II**

**Mean value theorems:** Rolle's theorem-Lagrange's Mean value theorem-Taylor's and Maclaurin's theorems (without proof);

**Partial Differentiation:** Chain rule, Total derivatives, Jacobians, functional dependence, Maxima and Minima of functions of two variables, method of Lagrange multipliers with three variables only.

**UNIT III**

**Integral Calculus:** Evaluation of definite and improper integrals (single variable), Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Evaluation of Triple integrals (Cartesian).

**UNIT IV**

**Vector differentiation:** Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

**UNIT V**

**Vector integration:** Line integral-circulation-work done, surface and volume integrals.

**Integral theorems:** Green's theorem in the plane (without proof), Stoke's theorem (without proof), Divergence theorem (without proof) and applications of these theorems.

**TEXT BOOKS**

1. Grewal B S, *Higher Engineering Mathematics*, Khanna Publishers, 2017.
2. Ramana B V, *Higher Engineering Mathematics*, Mc Graw Hill Education, 2010.

**REFERENCES**

1. Rukmangadachari. E & Keshava Reddy E, *Engineering Mathematics*, Volume-I,II&III, Pearson Publishers, 2010.
2. Satyanarayana Bh, Pradeep Kumar T.V & Srinivasulu D, *Linear Algebra and Vector Calculus*, Studera Press, New Delhi, 2017, ISBN: 978-81-930333-8-8.
3. Iyengar T.K.V, Krishna Gandhi B, Ranganatham S & Prasad M.V.S.S.N, *Engineering Mathematics*, Volume-I,II&III, 12<sup>th</sup>Edition, S.Chand publication, 2014.

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**I B.Tech- I Sem**

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3	-	-	3

**(20HS0804) ENGINEERING CHEMISTRY**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Familiarize engineering chemistry and its applications.
2. Train the students on the principles and applications of electrochemistry.
3. Understand the physical and mechanical properties of polymers helps in selecting Suitable materials for different purpose.
4. Understand about the materials which are used in major industries like steel and metallurgical manufacturing industries
5. Know the importance of nano and engineering materials used in their daily life and Industry.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Explain the principles of reverse osmosis and electro dialysis.
2. Apply Nernst equation for calculating electrode and cell potentials.
3. Differentiate between thermoplastics and thermosetting plastics.
4. Elucidate the setting and hardening of cement and concrete phase.
5. Explicate the synthesis of colloids with examples.
6. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry and daily life.

**UNIT I**

**Water Technology:** Introduction, Soft Water and Hardness of water, Estimation of hardness by EDTA Method. determination of dissolved oxygen by Winkler's method . Boiler troubles.- priming ,foaming, scale and sludge, boiler corrosion Municipal Water Treatment,. Specifications for drinking water - Bureau of Indian Standards (BIS) and World Health Organization (WHO)

standards. Softening of water by Zeolite and Ion-exchange Processes; Desalination of Brackish water by Reverse osmosis (RO) and Electrodialysis.

**UNIT II**

**Electrochemistry and Applications:** Introduction to Electrochemical cell, Nernst equation, Cell potential calculations. Primary cells - Zn-Air Battery. Secondary cells – Lead acid Battery and Lithium Ion cell (Rechargeable) - working of the batteries including cell reactions. Fuel cells: Hydrogen-Oxygen, Methanol-Oxygen Fuel cell– basic principle, working and application of of the cells

**Corrosion:** Introduction to corrosion, Types of corrosion - Chemical corrosion, Electrochemical corrosion and Differential aeration cell corrosion. Factors affecting the corrosion. Cathodic protection and Anodic protection, Electroplating (Nickel and Copper) and Electro less plating.

**UNIT III**

**Polymers and Fuel Chemistry:** Introduction to Polymers, Functionality of Monomers, Nomenclature of Polymers, Types of Polymerization, Mechanism of Addition Polymerization. Thermoplastics and Thermosetting plastics - Preparation, Properties and Applications of PVC and Bakelite. Elastomers: Preparation, Properties and Applications of Buna-S, Buna-N and Thikol Rubber.

**Fuels:** Types of Fuels, Calorific value, Analysis of Coal. Liquid fuels: Refining of Petroleum, fractional distillation, Fuels for IC-Engines, Knocking and Anti-knocking agents, Octane and Cetane number, Alternative Fuels- Propane, Ethanol and Bio - Fuels.

**UNIT IV****Basic Engineering Materials:**

**Composites:** Constituents, Classification- Particle, Fibre and Structural reinforced composites - properties and Engineering applications of Composites. Refractories: Classification, Properties of Refractories.

**Lubricants:** Classification, Mechanism, Properties of Lubricating Oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, pour point and its Applications. Building Materials - Manufacture of Portland cement, Constituents, Phases and reactivity of clinkers, Setting and Hardening of Cement.

**UNIT V**

**Surface Chemistry and Applications:** Introduction to Surface Chemistry, Colloids, Micelle formation, Characteristics of Colloids, Synthesis of Colloids – Condensation Method, Dispersion Method. Stabilization of Colloids - Solid-Gas Interface, Solid-Liquid Interface, Adsorption Isotherm, BET equation (no derivation), Applications of Colloids.

**Nano Chemistry:** Introduction, Chemical and Electrochemical methods of preparation of Nano-Metals and Metal oxides, Nanomaterials characterization of surface by physicochemical methods: SEM, TEM, X-ray diffraction. Fullerenes and carbon nanotubes, applications of Nanomaterials.

**TEXT BOOKS**

1. Jain and Jain, *Engineering Chemistry*, 16 Ed., Dhanpat Rai Publishers, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, *Atkins' Physical Chemistry*, 10 Ed., Oxford University Press, 2010

**REFERENCES**

1. G V Subba Reddy, K N Jayaveera and C. Ramachandraiah, *Engineering Chemistry*, McGraw Hill Higher Education,, New Delhi 2019.
2. K Sessa Maheswaramma and Mridula Chugh, *Engineering Chemistry*, 1 Ed., Pearson India Education Services Pvt. Ltd, 2016.
3. Dr. S.S. Dara and Dr S.S Umare, *A Text book of Engineering Chemistry*, 1 Ed., Chand & Company Ltd., 2000.
4. D. J. Shaw, *Introduction to Colloids and Surface Chemistry*, 4 Ed., Butterworth-Heineman, 2013.

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**I B.Tech- I Sem**

L	T	P	C
3	-	-	3

**(20HS0810) COMMUNICATIVE ENGLISH  
(Common EEE, ME & ECE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.
2. Ask and answer general questions on familiar topics and introduce oneself / others.
3. Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information.
4. Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs.
5. Form sentences using proper grammatical structures and correct word forms.
6. Write various letters with correct letter format

**UNIT – I**

**Part 1**

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts.

**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

**Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing:** Beginnings and endings of paragraphs - introducing the topic; Letter writing.

**Grammar and Vocabulary:** Parts of speech, Function words, Content words; Tenses.

**Soft Skills:** Attitude is Everything; Positive attitude Positive thinking- thought provoking ideas – creative thinking.

**Part 2**

Half a Rupee Worth by R K Narayan from Engage with English.

**UNIT – II**

**Part 1**

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts.

**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks.

**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Writing:** Mechanics of writing –punctuations.

**Grammar and Vocabulary:** Voice; Cohesive devices; Articles. Type of sentences – Simple, Complex, and Compound.

**Soft skills:** The factors of human mindset; self-confidence- self-belief, self-learning – self motivation.

### Part 2

The Thakur's Well by Prem chand from Paths to Skills in English

## UNIT – III

### Part 1

**Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing Report Writing. **Grammar and Vocabulary:** Subject-verb agreement; If- clauses; Direct and Indirect speech. wh-questions.

**Soft skills:** Emotional intelligence; Work efficiency- peace of mind- Broad nature in ideas- having patience in multiple ways.

### Part 2

I am not that Woman by Kishwar Naheed.

## UNIT – IV

### Part 1

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

**Speaking:** conversational English in academic contexts (formal and informal).

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

**Writing:** Information transfer

**Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of synonyms and antonyms.

**Soft skills:** Time management; the priority of the task – the task you take- Urgent and importance- not urgent, important- not important, urgent- Not important, not urgent.

### Part 2

What is my name? By Sathyavathi from Paths to Skills in English.

## UNIT – V

### Part 1

**Listening:** Identifying key terms.

**Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides.

**Reading:** Reading for comprehension.

**Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement).

**Soft skills:** Goal setting; Immediate goal – Short goal- midterm goal – Life goal.

### Part 2

The Power of Prayer by A P J Abdul Kalam from Paths to Skills in English.

**TEXT BOOKS**

1. PushpaRelia .P & Sanjay Mihhra .K *English All Round: Communication Skills for Undergraduation Learners* Vol. I, Orient Black Swan Publishers, First Edition, 2019.
2. Prof.Sundaravalli.G et al.*Paths to Skills in English*, Orient Blackswan ,Publishers, First Edition2015

**REFERENCES**

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver.*Pathways: Listening, Speaking and Critical Thinking*. HeinleyELT;2nd Edition, 2018.
3. Hewings, Martin. *Cambridge Academic English (B2)*.CUP, 2012.
4. Eric H. Glendinning et al *Study Reading: A Course in Reading Skills for Academic Purposes*,Cambridge University Press; 2 edition, 14 October 2004.
5. Pattabiram, B.V, *Soft Skills*, Sonmez Publication, 2011(2nd Edition).
- 6.VirendranathYandamuri, *Soft Skills for Engineer*, Yaswin Publication, 2nd Edition, 2009.

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**I B.Tech- I Sem**

L	T	P	C
3	-	-	3

**(20EE0251) BASIC ELECTRICAL & ELECTRONICS ENGINEERING**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the nature of different circuit elements, fundamental laws and network Theorems.*
2. *Know the operation of DC machines and single phase transformers.*
3. *Identify the applications of DC motors and DC generators.*
4. *Explain the characteristics of the p-n junction diode.*
5. *Describe the characteristics of BJT, FET, MOSFET and characteristics of special purpose electronic devices.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Determine the equivalent impedance of a given network by using network reduction techniques.*
2. *Calculate the voltage and current for a given particular network by using KCL&KVL.*
3. *Analyze the working operation & characteristics of DC generators.*
4. *Understand the construction of DC motors and transformer.*
5. *Explain the operating principles of major electronic devices, its characteristics and application*
6. *Design and analyze the DC bias circuitry of BJT and FET.*

**PART-A**

**UNIT- I**

**Introduction to Electrical Engineering:** Ohm's Law – Basic Circuit Components -Kirchhoff's Laws –Types of Sources –Resistive Networks, Inductive Networks, Capacitive Networks –Series Parallel Circuits, Star Delta and Delta Star Transformation - Principle of AC Voltages, Root Mean Square and Average Values of Alternating Currents and Voltage –Form Factor and Peak Factor.

**UNIT- II**

**Network Theorems:** Thevenin's, Norton's, Maximum Power Transfer, Reciprocity and Superposition Theorems for DC Excitations.

**DC Generator:** Construction details of DC Machine, principle and operation of DC generator, EMF equation, Types of generators and applications.

**UNIT- III**

**DC Motors:** Principle of Operation of DC Motors, Types of DC Motors, Torque Equation, Losses and Efficiency calculation in DC Motor - Applications.

**Transformers:** Principles of Operation, EMF equation, Losses and Efficiency, Regulation of Transformer.

**PART B****UNIT I**

**Semiconductor Devices:** Intrinsic Semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison

of N-Type and P-Type Semiconductors. The p-n Junction –Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode-Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

**UNIT II**

**BJT:** Bi polar Junction Transistor (BJT)–Types of Transistors, Operation of n-p-n and p-n-p Transistors, Input-Output Characteristics of BJT-CB,CE and CC Configurations, Relation Between  $I_C$ ,  $I_B$  and  $I_E$  –Transistor Biasing-Fixed Bias – Transistor Applications- Transistor as an Amplifier, Transistor as a Switch.

**UNIT III**

**JFET & MOSFET:** Junction Field Effect Transistor (JFET)-Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET-CD,CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET, MOSFET-Static Characteristics of MOSFET, Applications of MOSFET.

**TEXTBOOKS**

1. M.S. Naidu and S. Kamakshiah, *Basic Electrical Engineering*, TMH, 2011.
2. T.K. Nagasarkar and M.S. Sukhija, *Basic Electrical Engineering*, Oxford University Press, 2005.

**REFERENCES**

1. D.P. Kothari & I.J. Nagrath, *Theory and Problems of Basic Electrical Engineering*, PHI,2009
2. V. K Mehta, *Principles of Electrical Engineering*, S. Chand Publications,2011
3. T. Thyagarajan, *Fundamentals of Electrical Electronics Engineering*, SCITECH Publications 5th Edition, 2007.
4. Hughes, *Electrical and Electronic Technology*, Pearson Education, 2012

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1	-	4	3

**(20ME0301) ENGINEERING GRAPHICS  
(Common to All Branches)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Draw simple curves like ellipse, cycloid and Involutes.
2. Describe the Orthographic projections of points, lines and planes.
3. Construct the projection of solids like cylinders, cones, prisms and pyramids.
4. Sketch the development of the surfaces for practical cut sections of cylinders, cones, prisms and pyramids.
5. Depict the isometric and Orthographic Projections of simple objects.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Interpret the engineering drawing fundamentals to draw the curves like ellipse, cycloid and Involutes.
2. Know the projection of points and implement the same in the construction of projection of lines and planes.
3. Recognize the basic solids like cylinders, cones, prisms and pyramids and sketch the projections of them.
4. Explain the sectional views of Right regular Solids and Apply visualization skills in developing new products.
5. Understand the basic principles of isometric and Orthographic Projections.
6. Construct the isometric and orthographic projections of simple objects.

**UNIT – I**

**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections – Eccentricity method, Rectangle Method, Parallelogram Method, Cycloids- Epi & Hypo-Cycloids and Involutes.

**UNIT – II**

**Projections of Points:** Principles of Orthographic Projections-Conventions - Projections of Points.

**Projections of straight lines:** Inclined to both the planes (Trapezoidal Method & Rotating line method) - simple problems only, Traces

**UNIT – III**

**Introduction to plane surfaces:** Surface Inclined to one plane - Surface inclined to both reference planes

**Projections of Solids:** Introduction– Projections of right regular solids-Prisms, Pyramids in different positions (Inclined to one plane only).

**UNIT – IV**

**Section of solids -** Sectional Views of Right regular Solids - Prisms, Pyramids

**Development of surfaces -** Development of surfaces of Right Regular Solids - Prisms, Pyramids.

**UNIT – V**

**Orthographic Projections** - Principles of Orthographic projection, Conversion of objects from 3D to 2D

**Isometric Projections** - Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids, Conversion of 2D to 3D.

**TEXT BOOKS**

1. K. L. Narayana, P.Kannaiah , *A text Book of Engineering Drawing*, Scitech Publishers, 23<sup>rd</sup> Reprint Edition, 2010.
2. N. D. Bhatt, *Engineering Drawing*, Charotar Publishers, 49<sup>th</sup> Edition, 2008.

**REFERENCES**

1. K. Venugopal, *A text Book of Engineering Drawing and Graphic*, New Age Publishing, 5<sup>th</sup> Edition, 2008.
2. Warren J. Luzadder & Jon M, *Fundamentals of Engineering Drawing*, Peach Pit Press, 11<sup>th</sup> Edition, 1992.
3. Dhananjay A Jolhe, *Engineering Drawing with An introduction to AutoCAD*, McGraw Hill Education; 1<sup>st</sup> Edition, 2017.

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**(20HS0805) ENGINEERING CHEMISTRY LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chlorine, etc.*
2. *Understand and experience the formation of inorganic complex and analytical technique for trace metal determination.*
3. *Be trained to use the instruments to practically understand the concepts of electrochemistry.*
4. *Bridge theoretical concepts and their practical engineering applications, thus highlighting the role of chemistry in engineering.*
5. *Learn and understand the practical implementation of fundamental concepts*

**COURSE OUTCOMES**

On successful completion of this course, student will be able to

1. *Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.*
2. *Prepare advanced polymer materials*
3. *Estimate the Iron in cement*
4. *Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation and redox titrations respectively.*
5. *Think innovatively and improve the creative skills that are essential for solving engineering problems*
6. *Learn the alkalinity, acidity and viscosity of the any solutions.*

**List of Experiments**

1. Conductometric Titration of Strong acid vs Strong base
2. Conductometric Titration of Weak acid vs. Strong base
3. Determination of Hardness of a Groundwater sample.
4. pH metric titration of Strong acid vs. Strong base,
5. Potentiometry - Determination of Redox potentials and emfs
6. Determination of Strength of an Acid in Pb-Acid battery
7. Preparation of a Polymer
8. Determination of viscosity of an oil by Redwood viscometer .
9. Determination of percentage of Iron in Cement sample by Colorimetry
10. Determination of acidity of water sample.
11. Determination of Alkalinity of water sample.
12. Determination of Percentage Moisture content in a Coal sample

**TEXT BOOKS**

1. J. Mendham et al, *Vogel's Text book of Quantitative Chemical Analysis*, Pearson Education, Sixth Edition, 2002.
2. G.V. Subba Reddy, Chandra Sekhar and Jayaveera, *Chemistry Practical – Lab Manual*, McGraw Hill Higher Education, 2015.

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**(20HS0811) COMMUNICATIVE ENGLISH LAB  
(Common to EEE, ME & ECE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Expose the students to a variety of self-instructional, learner friendly modes of language learning.*
2. *Cultivate the habit of reading passages in the students from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.*
3. *Learn better pronunciation through stress, intonation and rhythm.*
4. *Train to use language effectively to face interviews, group discussions, public speaking.*
5. *Initiated into greater use of the computer in resume preparation, report writing, format making etc.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills.*
2. *Apply communication skills through various language learning activities.*
3. *Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.*
4. *Evaluate and exhibit acceptable etiquette essential in social and professional Settings.*
5. *Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.*
6. *Use effective communicative approaches by preparing job application, report and other kinds of writing correspondences.*

**LIST OF EXPERIMENTS**

**1.1. Phonetics**

Definition - Articulation - Phonetic Chart - Pure Vowels and Diphthongs.

**1.2 . Minimal Pairs**

Definition - Minimal Pairs 1 -Minimal Pairs 2

**2.1 .Clusters and Markers**

Consonant Clusters - Initial Consonant Cluster -Final Consonant Clusters -  
Past Tense Markers - Plural Markers.

**2. 2. ICE Breaking Activity**

Ice Breakers Overview - Ice Breakers Activity - Why Ice Breaker.

**3. 1.Syllable**

Syllable Overview -Syllable Types.

**3.2. Stress**

Syllable Stress - Stress Pattern -Stress and Rhythm - Word Stress - Sentence Stress.

**4.0 Accent & Intonation**

Intonation overview- Intonation making lists – Intonation questions – Intonation – yes or no questions – notes.

**5.0 JAM**

Jam tips - Sample topics.

**6.0 Listening skills**

Listening skills - Effective listening - Listening importance - Barriers to listening.

**7.1.Role Play 1**

Greetings - Giving compliments - Making requests – Hobbies - Asking permission – Thanking.

**7.2.Role Play 2**

Comparing and contrasting - Agreeing and disagreeing - Expressing opinions - Likes and dislikes - Formal and informal – Suggestions - Polite requests - Meeting people.

**7.3.Role Play 3**

Phone calls – Directions.

**8.0 Description**

Describing a person- Adjectives to describe – Giving direction – Asking giving direction – describing a product – Describing products – Personal narrative – narrative writing Notes.

**9.0 Book review**

Introduction – Book review overview- Book review tips – Book review notes.

**10.0 Information Transfer**

Information writings –Text to Diagram- Diagram to Text.

**Minimum requirements for Communicative English Lab**

1. Computer Assisted Language Learning (CALL) Lab: The Computer Assisted Language Lab for 60 Students with 60 systems one Master Console, LAN facility and English Language Software for self-study by learners.
2. Communicative English Lab with movable chairs and audio visual aids with a P. A. system, Projector, a Digital stereo audio & video system and Camcorder etc.

**System Requirement (Hardware component)**

Computer network, LAN with minimum 60 multimedia systems with the following:

**Specifications**

- i)
  - a) Intel(R) core (TM) i3
  - b) Speed 3.10 GHZ
  - c) RAM – 4 GB
  - d) Hard Disk – 320 GB
- ii) Headphones with High quality

**SOFTWARE**

Walden Info Tech Software

**REFERENCES:**

1. T. Balasubramanian, *A Textbook of English Phonetics for Indian Students*, second edition (McMillan) 2012.
2. DhamijaSethi, *A Course in Phonetics and spoken English*, Prentice-hall of India Pvt. Ltd, 2000.
3. Krishna Mohan & NP Singh, *Speaking English Effectively*, second Edition (McMillan), 2011
4. E.Sureshkumar ,P.Sreehari, *A Hand Book of English Laboratories*, Foundation books, 2011.
5. M Ashraf Rizvi, *Effective Technical Communication*, , Director, Jaipuria Institute of Management, Lucknow. McGraw Hill Education; Second edition, 2017.
6. *Chemistry Practical – Lab Manual*, McGraw Hill Higher Education, 2015.

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**(20EE0252) BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Enhance the student with knowledge on electrical and electronic equipment's.*
2. *Students can gain practical knowledge about network theorems.*
3. *Enhance the student with practical knowledge about characteristics of BJT.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Understand all the fundamental components about electrical Engineering and Electronics Engineering.*
2. *Make electrical connections by wires of appropriate ratings.*
3. *Know the usage of common electrical and electronic measuring instruments.*
4. *Explain the basic characteristics of transformers and electrical machines.*
5. *Describe the characteristics of DC shunt generator*
6. *Perform the brake test on DC shunt motor.*

**PART – A ELECTRICAL LAB**

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Open circuit characteristics of DC shunt generator.
4. Swinburne's Test on DC Shunt Machine
5. Brake Test on DC Shunt Motor.
6. OC & SC Tests on Single-Phase Transformer

**PART –B ELECTRONICS LAB**

1. P-N Junction Diode and Zener Diode Volt-Ampere Characteristics.
2. Bipolar Junction Transistor in CB Configuration-Input and Output Characteristics, Computation of  $\alpha$ .
3. Half-Wave Rectifier- a) Without Filter b) With Capacitor Filter.
4. Full-Wave Rectifier- a) Without Filter b) With Capacitor Filter.
5. Bipolar Junction Transistor in CE Configuration-Input and Output Characteristics, Computation of  $\beta$ .
6. Verification of Logic Gates- AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

**Note:** Any 5 experiments from each part are to be performed

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**(20HS0831) DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS  
(Common to CE, EEE, ECE, ME & AGE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Enlighten the learners in the concept of differential equations and multivariable calculus.*
2. *Furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.*
3. *Provide a setting that prepares students to read and learn mathematics on their own.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Classify the differential equations with respect to their order and linearity.*
2. *Solve the differential equations related to various engineering fields.*
3. *Identify solution methods for partial differential equations that model physical processes.*
4. *Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions.*
5. *Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.*
6. *Recognize and apply the Cauchy's integral formula and the generalized Cauchy's integral formula (relationship between the derivative and the contour integral of a function.*

**UNIT I**

**First and Higher Order Ordinary Differential Equations:** Exact, linear and Bernoulli's equations - Second and higher order linear differential equations with constant coefficients with R.H.S term of the types  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ ,  $e^{ax} V(x)$ .

**UNIT II**

**Equations Reducible to Linear Differential Equations:** Method of variation of parameters - Cauchy's and Legendre's linear equations- simultaneous linear equations with constant coefficients - Applications to L-C-R Circuit problems.

**UNIT-III**

**Partial Differential Equations:** Formation of P.D.E by elimination of arbitrary constants and arbitrary functions-Method of Separation of variables-Solutions of one dimensional Wave equation, Heat equation and two dimensional Laplace's equation under initial and boundary conditions.

**UNIT-IV**

**Complex Variable – Differentiation:** Differentiation, analytic functions, Cauchy-Riemann equations in Cartesian and polar co-ordinates (without proof), harmonic functions, conjugate harmonic functions, Milne Thompson's method-Conformal mappings, Transformation by  $e^z$ ,  $\ln z$ ,  $z^2$ ,  $\sin z$  and  $\cos z$ -Möbius transformations and their properties.

**UNIT-V**

**Complex Variable – Integration:** Line integral, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof)- Taylor's series, zeros of analytic functions, singularities, Laurent's series- Residues, Cauchy Residue theorem (without proofs), Evaluation of definite integral involving sine and cosine.

**TEXT BOOKS**

1. Grewal B. S, *Higher Engineering Mathematics*, Khanna Publishers, 2017.
2. Ramana B.V, *Higher Engineering Mathematics*, Mc Graw Hill Education, 2010.

**REFERENCES**

1. Rukmangadachari. E & Keshava Reddy E, *Engineering Mathematics*, Volume-I,II&III, Pearson Publishers, 2010.
2. Iyengar T.K.V, Krishna Gandhi B, Ranganatham S & Prasad M.V.S.S.N, *Engineering Mathematics*, Volume-I,II&III, 12<sup>th</sup>Edition, S.Chand publication, 2014.
3. Garg Nishu Gupta R.L, *Engineering Mathematics*, Volumes-I &II, Pearson Education, 2014.

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**(20HS0848) ENGINEERING PHYSICS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Identify the importance of optical phenomenon i.e. interference and diffraction related to its engineering applications.*
2. *Enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes and crystal structure determination by X-rays .*
3. *Familiarize the basic concepts of acoustics and ultrasonics with their Engineering applications.*
4. *Recognize the various basic terms related to Mechanics of Solids.*
5. *Understand the fundamentals of Superconductivity and Nano Science & Technology.*

**COURSE OUTCOMES**

On successful completion of this course, student will be able to

1. *Analyze the differences between interference and diffraction with applications.*
2. *Apply the Bragg's Law for crystal structure determination by X-rays.*
3. *Explain applications of acoustics and Ultrasonics in various engineering fields.*
4. *Elucidate the importance of various mechanical properties of solids.*
5. *Describe the basic properties and applications of superconductors in various Fields.*
6. *Illustrate methods for synthesis and characterization of nanomaterials and apply basic principles of nanomaterials in various engineering applications.*

**UNIT – I**

**Wave Optics**

**Interference** - Principle of Superposition-Interference of light- Conditions for sustained Interference - Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength of light-Engineering Applications of interference.

**Diffraction** – Introduction- Fraunhofer Diffraction-Single Slit – Double Slit -Diffraction Grating – Grating Spectrum -Determination of Wavelength of Light - Engineering Applications of diffraction.

**UNIT – II**

**Crystallography:** Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC

**X-Ray Diffraction** - Directions and planes in crystals – Miller indices – Inter planar spacing in cubic crystals – X-ray diffraction - Bragg's law – Powder Method

**UNIT – III**

**Acoustics:** Intensity – Loudness Absorption coefficient and its determination –Reverberation – Reverberation time (qualitative treatment) – Factors affecting acoustics of buildings and their remedies.

**Ultrasonics:** Introduction – Production of ultrasonics by piezoelectric method – Properties and detection – Applications in non-destructive testing.

**UNIT – IV**

**Mechanics of Solids**

Elasticity and isotropic materials- Stress, Strain and Hooke's Law- Types of Stresses- Types of strains: longitudinal strain, volume strain and shearing strain- Internal energy due to strain – Behavior of wire

under the load- Elastic constants of Isotropic solids- Young's modulus, rigidity modulus and bulk modulus, Poisson's ratio of materials - Beams- classification-Types of support -problems.

## UNIT – V

### Superconductivity and Physics of Nanomaterials

**Superconductivity:** Introduction – Meissner effect - Properties of superconductors Type I and type II superconductors- ac and dc Josephson effects -BCS theory (qualitative) –Applications of superconductors.

**Physics of Nanomaterials:** Introduction, Nanoscience and Nanotechnology – Surface area to volume ratio and Quantum confinement- Classifications of Nanomaterials – Advantages of nanotechnology, Synthesis of nanomaterials- Top Down Process- Ball Milling; Bottom Up Process: Sol-Gel method– Applications of nanomaterials.

## TEXT BOOKS

1. M.N.Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, *A Text book of Engineering Physics*, S.Chand Publications, 11<sup>th</sup> Edition, 2019.
2. K. Thyagarajan , *Engineering Physics* , Mc Graw Hill Education Private Ltd, New Delhi, 2012
3. D.K. Bhattacharya and A. Bhaskaran, *Engineering Physics*, Oxford Publications, 2015.

## REFERENCES

1. MK Harbola , *Engineering Mechanics*, Cengage Learning Publications, 2<sup>nd</sup> Edition 2012.
2. JL Meriam, LG.Kraige and JN.Bolton, *Engineering Mechanics – Dynamics*, Wiley Publications, 7<sup>th</sup> Edition 2018.
3. SH Crandall, NC Dahl & TJ Lardner , *An Introduction to the Mechanics of Solids*, Tata Mc Graw Hill Education. 3<sup>rd</sup> Edition 2017 (with SI Units).
4. M K Varma, *Introduction to Mechanics*, Taylor & Francis Group, 4<sup>th</sup> Edition 2019.

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**(20CS0501) C PROGRAMMING AND DATA STRUCTURES  
(Common to EEE, ME and ECE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Teach the syntax and semantics of a C Programming language*
2. *Demonstrate the use of Control structures of C Programming language*
3. *Illustrate the methodology for solving Computational problems*
4. *Explain the approach to algorithm analysis*
5. *Introduce different data structures for solving the problems*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Recognize the programming elements of C language*
2. *Select the control structure for solving the problem*
3. *Apply modular approach for solving the problem*
4. *Solve mathematical problems using C Programming language*
5. *Develop the applications using stacks and queues*
6. *Construct the linked lists for various applications and perform sorting techniques*

**UNIT- I**

**Introduction to C Language:** C Language Elements, Variable Declarations and Data Types, General Form of a C Program, Input and Output Statements, Operators, Expressions, Precedence and Associativity, Type Conversions.

**Statements:** Decision Statements, Loop Control Statements, break, continue, goto statement.

**UNIT- II**

**Arrays:** Declaring and Referencing Arrays, Array Subscripts, Multidimensional Arrays.

**Functions:** Library Functions, Communications among Functions, Using Array Elements as Function Arguments, Scope, Storage Classes ,Type Qualifiers, Recursion , Preprocessor Commands.

**Strings:** String Basics, String Library Functions

**UNIT- III**

**Pointers:** Pointer Declaration, Pointers and Arrays, Array of Pointers, Pointers to Pointers, Void Pointers, Memory Allocation Functions, Pointer to Functions, Pointers and Strings.

**Structure and Union:** Declaration and Initialization of Structures, Structure within Structure, Array of Structures, Pointer to Structure, Structure and Functions, typedef, Bit Fields, Enumerated Data Type, Union, Union of Structures.

**UNIT- IV**

**Data Structures:** Overview of Data Structure, Types of data structures, Stacks: Introduction- Definition-Representation of Stack-Operations on Stacks- Applications of Stacks. Queues: Introduction, Definition- Representations of Queues- Various Queue Structures- Applications of Queues.

**Linked List:** Single linked list, Circular linked list, Double linked list, Circular Double linked list, Applications of linked lists.

**UNIT- V****Searching & Sorting:**

Linear Search, Binary Search, Exchange Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort.

**TEXT BOOKS**

1. J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, *Programming in C and Data Structures*, Pearson Education.
2. B.A.Forouzan and R.F. Gilberg, *C Programming & Data Structures*, Third Edition, Cengage Learning.

**REFERENCES**

1. Stephen G. Kochan, *Programming in C*, III Edition, Pearson Education.
2. J.A. Jones & K. Harrow, *C Programming with problem solving*, Dreamtech Press.
3. Dr.N.B.Venkateswarlu, Dr. E.V.Prasad, S. Chand, *C and Data Structures*, a snapshot oriented treatise with live engineering examples.
4. E.Balaguruswamy, *C and Data Structures*, Tata McGraw Hill.
5. A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, *Data Structures using C*, Pearson Education / PHI, Eighth Edition.

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**(20ME0303) BASIC THERMODYNAMICS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Know the basic terms of thermodynamics, work and heat interactions, balance of energy between system and its surroundings.*
2. *Understand the fundamental laws of thermodynamics and its applications to various gas process and cycles.*
3. *State and explain the Laws of gas and thermodynamic processes.*
4. *Explain various thermodynamic cycles with the help of P-V and T-S Diagrams.*
5. *Analyze the performance of Rankine Cycle.*
6. *Elucidate various methods of improving cycle performance.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *State and explain the open and closed systems as well as develop and apply continuity equation for them.*
2. *Describe the Basic concepts of thermodynamics such as temperature, pressure, system, Properties, process, state, cycles and equilibrium.*
3. *Explain the Basic laws of thermodynamics and their applications.*
4. *Interpret the Concepts of enthalpy, entropy and other thermodynamic properties of ideal gas Process.*
5. *Analyze Thermodynamic cycles and behavior of pure substances, usage of steam tables and Mollier chart in solving steam related problems.*
6. *Summarize various types of boilers, their construction, working and their applications.*

**UNIT – I**

**Basic Concepts:** Definitions of system, boundary, surrounding and control volume. Types of Thermodynamic systems, Properties of system-definitions for properties-pressure, volume, temperature, enthalpy, internal energy, density with their units, Point and Path Functions State, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium.

**Work & Heat Transfer:** Work transfer, Types of work transfers, Heat transfer, Comparison of Work and Heat transfers.

**Zeroth Law of Thermodynamics:** Zeroth Law of Thermodynamics. Heat and temperature – concept of thermal equilibrium

**UNIT – II**

**First Law of Thermodynamics:** First law of thermodynamics- simple problems on heat and work conversions in process and cycle. Steady flow energy equation (SFEE), Limitations of First law of thermodynamics.

**Second Law of Thermodynamics:** Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, availability and unavailability – concept of change in entropy- expression for change in entropy.

**UNIT – III**

**Law of Perfect Gas:** Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure, Specific Heats, Internal Energy and Enthalpy of Gas.

**Thermodynamic Processes on Gases:** Flow process, Non Flow Process, P–V and T-S diagrams on Isochoric process, Isobaric, Isothermal process, Isentropic process, Polytrophic process. Problems on Non flow Processes.

#### UNIT – IV

**Thermodynamic Cycles:** Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, Sterling Cycle, Ericson Cycle Problems.

**Pure Substances:** P-V, P-T, T-S diagrams of Pure Substances, Mollier Diagram, Dryness fraction Enthalpy and Entropy of Steam using Steam Tables. Problems.

#### UNIT – V

**Vapour Power Cycle:** Rankine cycle- Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Rankine cycle Efficiency, Problems on simple Rankine cycle. Methods of Improving cycle performance-Regeneration, Reheat, Problems on Reheat and Regenerative cycle.

#### TEXT BOOKS

1. P.K Nag, *Engineering Thermodynamics*, Tata Mcgraw Hill Publishers, 5<sup>th</sup> Edition 2013.
2. Yunus Cengel And Michael Boles, *Thermodynamics: An Engineering Approach* Mcgraw Hill Education, 8<sup>th</sup> Edition, 2014

#### REFERENCES

1. P. Chattopadhyam, *Engineering Thermodynamics* Oxford University Press, 1<sup>st</sup> Revised Edition 2011
2. J.P. Holman, *Thermodynamics* –Mcgraw-Hill Book Company, 2<sup>nd</sup> Edition, 1975.
3. YVC Rao, *An Introduction to Thermodynamics* Universities press, Revised 1<sup>st</sup> Edition, 2009

**NOTE:** *Steam tables, Mollier Diagrams should be supplied*

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**(20CE0163) BASICS OF ENGINEERING MECHANICS  
(Common to Agricultural Engineering & Mechanical Engineering)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the forces and force systems and their applications*
2. *learn about friction and the use the concept of Friction*
3. *Explain the concept of finding centroid of different objects using Mathematical formula*
4. *learn how to find Moments of Inertia of different objects using Mathematical formula*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Construct free body diagrams and develop appropriate equilibrium equations*
2. *Understand the concepts of friction and to apply in real life problems*
3. *Determine the centroid for composite sections*
4. *Explain the centre of gravity for the given sections*
5. *Calculate the Moment of Inertia for composite sections*
6. *Describe the equilibrium conditions and analyze the various type trusses.*

**UNIT-I**

**FORCES & FORCE SYSTEMS:** Fundamental Principles – Resolution and Composition of Forces and Equilibrium of Particles – Lami’s Theorem – Principle of Transmissibility –Principles of Continuum – Types of Force Systems –Resultant of Coplanar, Concurrent and Non-Concurrent Force Systems - Varignon’s Theorem – Equilibrium of Coplanar Force Systems – Types of Beams and Supports – Support Reactions.

**UNIT-II**

**FRICITION:** Types of Friction– Laws of Friction–Limiting Friction–Cone of Limiting Friction - Ladder Friction - Wedge, Screw jack and differential Screw Jack

**UNIT-III**

**CENTROID:** Centroids of Simple Figures (From Basic Principles) – Centroids of Composite Figures  
**CENTRE OF GRAVITY:** Centre of Gravity of Simple Body -Centre of Gravity of Composite Bodies- Pappus Theorem

**UNIT-IV**

**MOMENT OF INERTIA:** Definition – Parallel Axis Theorem and Perpendicular Axis Theorem– Polar Moment of Inertia – Radius of Gyration – Moment of Inertia of Basic Shapes - Composite Sections - Simple Solids.

**UNIT-V**

**ANALYSIS OF PERFECT TRUSSES:** Types of Trusses – Perfect, Deficient and Redundant Trusses - Cantilever Trusses and Simply Supported Trusses – Analysis of Trusses using Method of Joints and Methods of Sections.

**TEXT BOOKS**

1. Bhavikatti SS, *A Text Book of Engineering Mechanics*, New Age International, 3<sup>rd</sup> Edition, 2016.
2. Dr. R. K. Bansal, *Engineering Mechanics*, Laxmi Publications, 4<sup>th</sup> Edition, 2011

**REFERENCES**

1. D.S. Kumar, *Engineering Mechanics*, S.K. Kataria & Sons, 3<sup>rd</sup> Edition
2. K. Vijaya Kumar Reddy & J. Suresh Kumar, *Singer's Engineering Mechanics: Statics and Dynamics*, B.S. Publications, 3<sup>rd</sup> Edition, 2011.
3. J.L.Meriam, L.G.Kraige, *Engineering Mechanics: Dynamics*, Wiley India Pvt .Ltd, 6<sup>th</sup> Edition, 2010

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**I B.Tech- II Sem**

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**(20HS0850) ENGINEERING PHYSICS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Explore the application of Interference and Diffraction by doing concerned experiments.*
2. *Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.*
3. *Understand the concept of Rigidity modulus, energy gap and B-H curve.*
4. *Develop an ability to apply the knowledge of physics experiments in the later studies.*
5. *Recognize the significance of Laser by studying its characteristics and its application in finding the particle size.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Operate various optical instruments.*
2. *Estimate wavelength of laser and particles size using laser.*
3. *Plot the intensity of the magnetic field of induction along the axis of circular coil carrying current with distance.*
4. *Evaluate the acceptance angle of an optical fiber and numerical aperture.*
5. *Determine energy loss by B-H curve.*
6. *Calculate the rigidity modulus of a given wire.*

**Suggested list of experiments from the following: (Perform any TEN experiments from the following)**

1. Determination of wavelengths of various colors of Mercury vapor lamp using Diffraction Grating – Normal Incidence method.
2. Determination of Dispersive power of prism.
3. Rigidity Modulus – Torsional Pendulum
4. Determination of thickness of thin object by wedge method.
5. Determination of radius of curvature of Plano convex lens – Newton's Rings.
6. Determination of wavelength of a given laser source by using diffraction grating.
7. Determination of particle size (Lycopodium particles deposited on glass plates) using Laser source.
8. Determination of energy gap of a semi-conductor using p – n junction diode.
9. B- H curve.
10. Magnetic field along the axis of current carrying coil – Stewart & Gee's Method.
11. Determination of frequency of tuning fork - Melde's Apparatus.
12. Determination of spring constant – Coupled Oscillator.

13. Determination of dielectric constant of dielectric material using charging and discharging of capacitor.
14. Determination of Numerical Aperture of an Optical fiber.
15. Measurement of resistance with varying temperature –Thermistor.

**REFERENCES**

1. S. Balasubramanian, M.N. Srinivasan, *A Text book of Practical Physics*, S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php> -Virtual Labs, Amrita University.

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**(20CS0502) C PROGRAMMING AND DATA STRUCTURES LAB  
(Common to EEE, ME and ECE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Explain basic construction of C language*
2. *Describe the problem solving techniques*
3. *Develop applications in C using strings, pointers, functions, structures*
4. *Discuss the different operations that can be performed on data structures*
5. *Introduce the different search and sorting algorithms*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Read, understand and trace the execution of programs written in C language*
2. *Develop C programs for simple applications making use of basic constructs, arrays and strings*
3. *Write C programs involving functions, recursion, pointers, and structures*
4. *Select the data structure appropriate for solving the problem*
5. *Illustrate the working of stack and queue*
6. *Implement searching and sorting algorithms*

**List of Experiments:**

1. Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,\*,/,% and use Switch Statement)
2. a) Write a C program to find the sum of individual digits of a positive integer.  
b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. a) Write a C program to calculate the following Sum:  
 $Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$   
b) Write a C program to find the roots of a quadratic equation.
4. a) Write a C program to determine if the given string is a palindrome or not  
b) Write a C program to determine whether the given number is Armstrong number or not.
5. a) Write a C program to generate Pascal's triangle.  
b) Write a C program to construct a pyramid of numbers.
6. a) Write a C program to find both the larges and smallest number in a list of integers.  
b) Write a C program that uses functions to perform the following:
  - i) Addition of Two Matrices
  - ii) Multiplication of Two Matrices
7. Write C programs that use both recursive and non-recursive functions
  - i) To find the factorial of a given integer.
  - ii) To find the GCD (greatest common divisor) of two given integers.

- iii) To solve Towers of Hanoi problem.
8. Write a C program to swap(exchange) values of two integer variables using pointers
  
  9. Write a C program that uses functions to perform the following operations:
    - a) To insert a sub-string in to given main string from a given position.
    - b) To delete n Characters from a given position in a given string.
  10. a) Write a C program to check whether the entered string is palindrome or not.  
b) Write a C program to read student roll no, name and marks in six subjects for n number of students and give class of each student.
  11. Write a C programs that implement stack (its operations) using Arrays
  12. Write a C programs that implement queue (its operations) using Arrays
  13. Write a C program that uses functions to perform the following operations on singly linked list.
    - i) Creation
    - ii) Insertion
    - iii) Deletion
    - iv) Traversal
  14. Write a C program that uses functions to perform the following operations on doubly linked list:
    - i) Creation
    - ii) Insertion
    - iii) Deletion
    - iv) Traversal in both ways
  15. a) Write a C program to perform Linear Search on the elements of a given array.  
b) Write a C program to perform Binary Search on the elements of a given array.
  16. a) Write a C program to sort the elements using Bubble sort.  
b) Write a C program to sort the elements using Insertion sort.

### TEXT BOOKS

1. J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, *Programming in C and Data Structures*, Pearson Education.
2. B.A.Forouzan and R.F. Gilberg, *C Programming & Data Structures*, Third Edition, Cengage Learning.

### REFERENCS

1. P. Padmanabham, *C programming and Data Structures*, Third Edition, BS Publications
2. E Balaguruswamy, *C and Data Structures*, TMH publications.

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**(20ME0302) WORKSHOP PRACTICE LAB  
(Common to All Branches)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Familiarize with the different types of wood and carpentry joints.
2. Develop Tapered Tray and Conical funnel using sheet metal.
3. Acquire practical knowledge on Fitting and Electrical Wiring.
4. Learn about various peripherals of a computer.
5. Know about installation of MS Windows & Linux.
6. Gain knowledge on Productivity tools & Networking.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Describe the different types of wood and carpentry joints.
2. Produce Tapered Tray and Conical funnel using sheet metal.
3. Understand about Fitting and Electrical Wiring.
4. Identify various peripherals of a computer.
5. Explain the procedure to install MS Windows & Linux.
6. Understand about Productivity tools & Networking.

**PART A**

**List of Experiments:**

**Carpentry:** Familiarity with different types of woods and tools used in wood working and make following joints

1. T-Bridle joint
2. Corner Dovetail joint

**Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal jobs using GI sheets.

1. Tapered tray
2. Conical funnel

**Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises

1. Step Fitting
2. V-Fit

**Electrical Wiring:** Familiarity with different types of basic electrical circuits and makes the following connections

1. Parallel and series
2. Two way switch
3. Go down lighting
4. Tube light
5. Three phase motor
6. Soldering of wires

## PART B

### Task 1:

Identification of the peripherals of a computer: To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

### Task 2:

A practice on disassembling the components of a PC and assembling them.

### Task 3:

1. Basic DOS commands, Installation of MS windows.
2. Basic Linux Commands, Installation of Linux.

### Task 4:

Hardware Troubleshooting (Demonstration): Identification of a problem and fixing the solution (improper assembly or defective peripherals). Software Troubleshooting (Demonstration): Identification of a problem and fixing the PC for any software issues

### Productivity tools

### Task 5:

1. **MS Word Orientation:** Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving
2. **Presentations:** Creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper linking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.
3. **Spread sheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

### Task 6:

**Networking:** Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimping activity, logical configuration etc should be done by the student. The entire process has to be documented.

### TEXT BOOKS

1. V Ramesh Babu, *Engineering Work shop practice for JNTU*, VRB Publishers Pvt. Ltd., 2009.
2. Peter Norton, “*Introduction to Computers*”, McGraw Hill, 7<sup>th</sup> Edition, 2017.
3. Joan Lambert, Joyce Cox, *MOS study guide for word, Excel, Power point & Outlook Exams*, PHI. 1<sup>st</sup> Edition, 2011.

### REFERENCES

1. P. Kannaiah & K.L. Narayana, *Work shop Manual*, SciTech Publishers, 2010.
2. *Introduction to Information Technology*, ITL Education Solutions limited, Pearson Education.2009.
3. Rusen, *Networking your computers and devices*, PHI, 2009.
4. Bigelows, *Trouble shooting, Maintaining & Repairing PCs*, TMH, 2010.

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**(20HS0816) INDIAN CONSTITUTION**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Know the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
2. *Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role.*
3. *Address entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*
4. *Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.*
5. *Acquire knowledge for various competitive examinations.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Explain the key concepts of political economy.*
2. *Analyze the significant developments in the political ideologies.*
3. *Describe the salient features of the constitution of India interpret, integrate and critically.*
4. *Discuss about the importance of political economy of Indian international relations and gain knowledge in Judiciary system.*
5. *Apply their knowledge and skills acquired to write various competitive examinations.*
6. *Recognize the constitutional rights in relating to Practical life.*

**UNIT-I**

**Constitution:** Definition, Introduction, Meaning of the term,- Indian Constitution: Sources and Features

**UNIT-II**

**Historical Perspective of Indian Constitution:** The Government Act of 1919 and 1935 - A Dual Form of Government – The Constitutional Reforms of Simon commission – Formation of Drafting Committee – The Role of Constitution Assembly. Salient features and characteristics of the Constitution of India: Structure of the Indian Union: Federalism, Centre- State relationship.

**UNIT-III**

**Scheme of the Fundamental Rights:** Concept of Fundamental Rights in India, Justifiability of Fundamental Rights - Reach of Fundamental Rights -The scheme of the Fundamental Duties and its Legal Status: Fundamental Duties in India – Article 51A - Introduction to Fundamental Duties in India – Importance of Fundamental Duties. The Directive Principles of State Policy - Its importance and implementation - The Potential of Directive Principles of State Policy for the Judicial Enforcement of Socio-Economic Rights.

**UNIT-IV**

**Parliamentary Form of Government in India:** Origin, growth and development of the parliamentary system in India – Chief Characteristics of Indian Parliament – Constitutional Powers and Functions of Indian Parliamentary system. The President of India: Qualifications of President - Election of President, Tenure of President - Status, Powers and Functions of President. The Historical Perspectives of the Constitutional Amendments in India: Types of Amendments & Constitutional Amendment Process in India - Indian Polity-Judiciary System: Introduction to Indian Judiciary System - Independent Indian Judiciary - Indian Judiciary Structure - Powers and Functions of Indian Judiciary.

**UNIT-V**

**Local Self Government** – Constitutional Scheme in India - District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, Panchayati Raj: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**Election Commission:** Role and Functions of Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institutions and Bodies for the welfare of SC/ST/OBC and women.

**TEXT BOOKS**

1. Government of India Ministry of Law and Justice (Legislative Department) *The Constitution of India, 1950 (Bare Act)* Government Publication, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1<sup>st</sup> Edition, Government Publication 2015.

**REFERENCES**

1. M. P. Jain, *Indian Constitution Law*, Lexis Nexis, 7<sup>th</sup> Edition, 2014.
2. D.D. Basu, *Introduction to the Constitution of India*, Lexis Nexis, 2015.
3. P.M. Bakshi, *Constitution of India*, Universal Law Publishing, 15<sup>th</sup> Edition, 2018.

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**(20HS0833) NUMERICAL METHODS, PROBABILITY & STATISTICS  
(Common to CE, ME & AGE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Introduce the tools of differentiation and integration of functions of numerical methods that is used in various techniques dealing engineering problems.*
2. *Develop the essential tool of Probability & Statistics in a comprehensive manner.*
3. *Develop the skill pertinent to the practice of the mathematical concepts including the Student abilities to formulate and modeling the problems, to think creatively and to synthesize information.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Develop the mathematical skills of the students in the areas of numerical methods.*
2. *Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.*
3. *Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.*
4. *Understand the laws of probability axioms and rules.*
5. *Explain the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.*
6. *Calculate and interpret the correlation and Regression between two variables.*

**UNIT I**

**Solution of algebraic and transcendental equations:**

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method.

**Interpolation:**

Finite differences, Interpolation using Newton's forward and backward difference formulae.

**UNIT- II**

**Numerical solution of Ordinary differential equations:**

Taylor's series (first and second order), Euler's method, Modified Euler's method and Runge-Kutta method of fourth order for solving first order differential equations.

**Numerical integration:**

Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.

**UNIT III**

**Basic Statistics:**

Measures of Central tendency, Moments, skewness and Kurtosis.

**Basic Probability:**

Probability spaces, Addition theorem, conditional probability, independence, Multiplication theorem, Baye's theorem.

**UNIT IV****Random variables:**

Discrete and Continuous random variables- distribution functions, densities and their properties.  
Expectation of Discrete and Continuous Random Variables.

**UNIT V****Probability Distributions and Correlation:**

Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.  
Correlation and regression – Rank correlation.

**TEXT BOOKS**

1. Grewal B S, *Higher Engineering Mathematics*, 44<sup>th</sup> edition, Khanna Publishers, 2017.
2. Iyengar T.K.V, Krishna Gandhi B, Ranganatham S & Prasad M.V.S.S.N, *Probability & Statistics*, S.Chand publications, 2018.

**REFERENCES**

1. Rukmangadachari. E & Keshava Reddy E, *Engineering Mathematics*, Volume-III, Pearson Publishers, 2010.
2. Ramana B. V, *Higher Engineering Mathematics*, Mc Graw Hill Education, 2010.
3. Iyengar T.K.V, Krishna Gandhi B, Ranganatham S & Prasad M.V.S.S.N, *Engineering Mathematics-III*, S.Chand publication, 2014.
4. Gupta S.P, *Statistical methods*, S.Chand publications, 2011.

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**(20CE0160) FLUID MECHANICS & HYDRAULIC MACHINERY**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the basic concepts of Fluid properties and fluid statics.*
2. *Identify the applications of fluid kinematics and dynamics.*
3. *Explain the behaviour of pipe flow and losses in pipe flow.*
4. *Know the concepts of flow measurements and boundary layer flows.*
5. *Describe the working principles of hydraulic machinery.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *State Newton's Law of Viscosity, discuss and calculate fluid properties.*
2. *Define Pascal's Law and applies it for measuring pressure devices.*
3. *Classify various fluid flows and derive continuity, Euler's, Bernoulli's, Impulse Momentum, Darcy Weisbach Equation and applying them for fluid flow problems and pipe flow Problems.*
4. *Analyze impact of jets on vanes and develop velocity triangle.*
5. *Discuss operation principles of hydroelectric power plant.*
6. *Explain the principles of pumps and turbine.*

**UNIT-I**

**Fluid Properties:** Definition of a fluid – Physical properties of fluids- Density, Specific weight, Specific volume, Specific gravity, viscosity, Compressibility, Vapour pressure, Surface tension and capillarity.

**Fluid Statics:** Pascal's law - Pressure variation in a static fluid – Atmospheric, gauge and absolute pressures, Measurement of pressure – Piezometer – U-tube and Inverted U-tube differential manometers.

**UNIT-II**

**Fluid Kinematics:** Types of flow – Streamline – Streak line – Path line – Stream tube – Control volume – Continuity equation in one and three dimensional forms – Stream function and velocity potential function – Flow net.

**Fluid Dynamics:** Euler's equation of motion– Bernoulli's energy equation – Impulse momentum equation – Force on a bend – Energy gradient line – Hydraulic gradient line.

**UNIT-III**

**Flow Measurement:** Velocity measurement by Pitot tube and Pitot static tube – Discharge measurement by Venturimeter and orifice meter.

**Analysis of Pipe Flow:** Loss of head through pipes - Darcy Weisbach equation - Minor losses in pipe flow - Pipes in Series - Pipes in Parallel.

**UNIT- IV**

**Impact of Jets:** Hydrodynamic force of jets on stationary and moving flat inclined and curved vanes - Jet striking centrally and at tip - Velocity triangles at inlet and outlet - Expressions for work done and efficiency.

**Introduction to Hydroelectric Power Plant:** Types of hydroelectric power plant - Heads and efficiency of power plants – Components of a hydro electric dam.

**UNIT -V**

**Hydraulic Turbines:** Classification of turbines – Heads and efficiencies of turbines -Pelton Wheel turbine - Modern Francis turbine – Kaplan turbine - Main components and working principle- Expressions for work done and efficiency – Draft tube.

**Centrifugal Pumps:** Classification and types of pumps – Components and working of a centrifugal pump – Work done by the impeller – Heads and efficiencies – Net positive suction head(NPSH)- Priming – Minimum starting speed – Multistage pumps – Pumps in series and parallel – Expression for specific speed.

**TEXT BOOKS**

1. Dr.P.N.Modi & Dr.S.M.Seth, *Hydraulics and Fluid Mechanics Including Hydraulics Machines*, Standard Book House, 20<sup>th</sup> Edition, 2015.
2. Dr.R.K.Bansal, *A Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 9<sup>th</sup> Edition, 2017.

**REFERENCES**

1. Streeter, Wylie, Bedford, *Fluid Mechanics*, McGraw Hill Education, 9<sup>th</sup> Edition, 2017.
2. C.S.P. Ojha, R. Berndtsson & P.N. Chandamouli, *Fluid Mechanics and Machinery*, Oxford University Press, 1<sup>st</sup> Edition, 2010.
3. S. C. Gupta, *Fluid Mechanics and Hydraulic Machines*, Pearson India Education Services Pvt. Ltd, 1<sup>st</sup> Edition, 2006
4. Rama Durgaiyah D., *Fluid Mechanics and Machinery*, New Age International, 1<sup>st</sup> Edition, 2007

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**(20CE0164) MECHANICS OF SOLIDS  
(Common to Mechanical & Agricultural Engineering)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn about simple stresses and strains and their applications*
2. *Learn how to find shear forces and bending moments and construction of SFD & BMD*
3. *Understand about the concept of simple bending, shear stress distribution & deflection of beams*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Summarize the basic principles of elasticity, theory of failures and apply them to estimate the stress and strain for axial members*
2. *Draw shear force and bending moment diagrams under different loading conditions*
3. *Study the theories related to the bending stress, shear stress distribution and torsional stress for beams of different cross sections and their applications*
4. *Describe the slope and deflection of beam and calculate the slope and deflection for statically determinate beams by using different methods*
5. *Classify different type of column and derive Euler's equation for long columns with different end conditions*
6. *Analyze the pressure vessels subject to internal and external fluid pressure*

**UNIT – I**

**Simple Stresses and Strains:** Elasticity and plasticity – Types of stresses and strains – Hooke's law – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – Composite bars – Temperature stresses – Principal Stress – Mohr's Circle

**Theories of Failures:** Various theories of failures like Maximum Principal stress theory – Maximum principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

**UNIT – II**

**Shear Force and Bending Moments:** Types of supports – Types of beams – Shear force and bending moment diagrams for simply supported - Cantilever and over hanging beams with point loads, uniformly distributed load, uniformly varying loads and couples – Relationship between shear force and bending moment.

**Theory of Simple Bending:** Derivation of flexure formula:  $M/I = f/y = E/R$  – Section Modulus

**UNIT – III**

**Shear Stress Distribution:** Derivation of formula – Shear stress distribution in rectangular, triangular, circular, I and T sections

**Torsion of Circular Shafts and Springs:** Theory of pure torsion - Torsional theory applied to circular shafts – Power transmission - Close and open coiled helical springs under axial loads and axial twist – Carriage springs

**UNIT – IV**

**Deflections of Beams:** Slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods for finding slope and deflection for

cantilever and simply supported beams with point load, udl, gradually varying and combination loads

**Columns:** Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns– assumptions – derivation of Euler's critical load formulae for various end conditions

#### UNIT – V

**Thin Cylinders:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – Hoop, longitudinal and volumetric strains – Changes in diameter and volume of thin cylinders – Riveted boiler Shells - Thin spherical shells

**Thick Cylinders:** Thick cylinders – Lamé's equation – Design of thick cylindrical shells – Compound cylinders – Shrink fit allowance – Initial difference of radii at the junction

#### TEXT BOOKS

1. Dr. R. K. Bansal, *A Textbook of Strength of Materials*, Laxmi Publications, 6<sup>th</sup> Edition, 2017
2. Er.R.K.Rajput, *Strength of Materials (Mechanics of solids)*, S.Chand Publishing, 6<sup>th</sup> Edition, 2015

#### REFERENCES

1. Dr. B. C. Punmia, Dr.Ashok Kr.Jain, Dr.Arun Kumar Jain, *Mechanics of Materials*, Laxmi Publications, Revised Edition, 2016
2. R. S. Khurmi, *Strength of Materials*, S.Chand Publishing, 24<sup>th</sup> Edition, 2015
3. R. Subramanian, *Strength of Materials*, Oxford University Press, 3<sup>rd</sup> Edition, 2010

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**(20ME0304) KINEMATICS OF MACHINERY**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Know the basic concepts of mechanisms and their kinematic Inversions.*
2. *Understand the effects of mechanism with lower pair and steering mechanism in machine components.*
3. *State and explain velocity and Acceleration concept of Kinematics components.*
4. *Explain drawing concept of Cam and Cam Profile.*
5. *Analyze the working concept of gear profile and gear train.*

**COURSEOUTCOMES**

On successful completion of the course, the students will be able to

1. *Familiarize with common mechanisms used in machines and everyday life.*
2. *Identify different mechanisms, Inversions of kinematic chains*
3. *Have Ability to perform analysis of different types of links, position, velocity, acceleration analysis*
4. *Understand drafting concepts of Cam and Cam profile.*
5. *Recognize different types of gears and their profiles.*
6. *Explain the kinematic mechanism of different machine elements.*

**UNIT -I**

**Basics of Mechanisms** – Classification of links and kinematic, pairs – Sliding, Turning, Rolling, Screw and spherical pairs – Lower and higher pairs – Degree of freedom, Mobility–Kutzbach criterion, Gruebler’s criterion– Grashof’s Law

**Kinematic Inversions** of four-bar chain, Single and double slider crank chains –Quick return mechanisms

**UNIT-II**

**Mechanisms with Lower Pairs-** Straight line motion mechanisms, Peaucellier, Hart, Scott Russel, Grass hopper, Watt, Tchebicheff, Roberts mechanisms and Pantograph.

**Steering Mechanisms-** Conditions for correct steering– Davis Steering gear, Ackermanns steering gear. Hooke’s Joint (Universal coupling) - Single and double Hooke’s joint—applications–Simple problems.

**UNIT-III**

**Kinematics-** Displacement, Velocity and acceleration analysis of simple mechanisms–Graphical method– Velocity and acceleration of polygons

**Velocity Analysis** using instantaneous centers– kinematic analysis of simple mechanisms– Coincident points– Coriolis component of acceleration

**UNIT-IV**

**Cams-** Classification of cams and followers– Terminology and definitions– Displacement diagrams– Uniform velocity, Parabolic, Simple harmonic and Cycloidal motions.

**Cam Profiles** – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting– Sizing of cam.

**UNIT-V**

**Gears** –Law of toothed gearing– Involute and cycloidal tooth profiles–Spur gear terminology and definitions–Gear tooth action–Contact ratio–Condition for constant velocity ratio for transmission of motion- Interference and under cutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only].

**Gear Trains**– Speed ratio, Train value– Parallel axis gear trains– Epi-cyclic Gear trains, Differential gear of an automobile, Simple problems only.

**TEXT BOOKS**

1. R. S. Khurmi, Theory of Machines, S. Chand Publications, 14th Edition, 2005.
2. S. S. Rattan, Theory of Machines, Tata McGraw-Hill publications, 3rd Edition, 2013.

**REFERENCES**

1. J. E. Shigley, Theory of Machines and Mechanisms , Oxford University Press publisher, 4th Edition, 2014.
2. Thomas bevan, Theory of Machines, Pearson (P) publisher, 3rd Edition, 2012.
3. Ramamurthy, Mechanics of Machines, V. Narosa Publishing House, 3rd Edition, 2009.

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**(20ME0305) THERMAL ENGINEERING**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Familiarize the student with Air compressors and its classification.
2. Make the student learn about Brayton Cycle and methods of improving cycle performance.
3. Enable the student to know about the Steam nozzles and condensers.
4. Understand about Steam turbines, classification & its Governing.
5. Impart brief knowledge on I.C Engines

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Gets familiarized with Classification and working of Air Compressors.
2. Carryout thermodynamic analysis on Brayton cycle.
3. Learns about methods of improving Brayton cycle performance.
4. Knows about the Steam nozzles and condensers.
5. Understands about Steam turbines, Compounding & its governing.
6. Gains brief knowledge on I.C Engines & its performance.

**UNIT-I**

**Air Compressors-** Classification of Compressors-Reciprocating Compressors, Single Stage Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors-Problems.

**Rotary compressors-** Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

**UNIT-II**

**Gas Turbines-** Open and Closed cycle- Brayton Cycle-Thermodynamic Analysis, Problems on Brayton cycle.

**Performance and its improvement-** Regenerative, Intercooled, Reheated cycles and their combinations.

**UNIT-III**

**Steam Nozzles-** Expansion of steam through nozzle, Types of nozzles, Condition for maximum discharge, Critical pressure ratio, Effect of friction, Super saturated flow, Degree of Super Saturation and Degree of under Cooling, Problems on Steam Nozzles.

**Condensers-** Types of Condensers- Mixing and Non-Mixing Type of Condensers.

**UNIT-IV**

**Steam Turbines -** Principles of impulse and reaction turbines, Compounding of Steam Turbines, Velocity diagrams for single & multistage turbines, Work done on turbine blades & efficiencies, Losses in steam turbines, Governing of steam turbines.

**UNIT-V**

**I.C. Engines-** Definition of Engine and Heat Engine, I.C Engine Classification – Working of Two Stroke & Four Stroke Engines, Valve and Port Timing Diagrams.

**Testing and Performance** - Parameters of Performance - Measurement of Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Indicated Power – Friction power– Heat Balance Sheet.

**TEXT BOOKS**

1. R.K.Rajput, *Thermal Engineering*, Laxmi Publications, 6th Edition, New Delhi, 2010.
2. V. Ganesan, *Internal Combustion Engines*, TMH, 4th Edition, 2012

**REFERENCES**

1. P.W Gill. J.H Smith & E.J Ziurgs, *Fundamentals of I.C Engines*, Oxford& I B H Publication 1990, New Delhi.
2. R.Yadav, *Steam & Gas Turbines*, Central Publishing House, 1996.
3. P.L Ballaney, *Thermal Engineering*, Khanna Publication, 15thEdition, 2002.

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**(20CE0112) FLUID MECHANICS & HYDRAULIC MACHINERY LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn the concepts of Venturimeter & Orifice meter*
2. *Learn the concepts of notch's*
3. *Learn the basic concepts of turbines*
4. *Learn the basics concepts of different types of pumps*

**COURSE OUTCOMES**

On successful completion of this course, the student should be able to

1. *Calibrate Venturi meter & Orifice meter*
2. *Calculate losses in flows*
3. *Estimate the efficiency of different pumps*
4. *Study the performance of different turbines*
5. *Study importance of liquid properties and its methods of determination*
6. *Calculate forces and pressure due to fluid action under different conditions*

**LIST OF EXPERIMENTS**

1. Verification of Bernoulli's equation.
2. Calibration of Coefficient of discharge for Venturimeter.
3. Calibration of Coefficient of discharge for Orifice meter.
4. Calibration of Friction factor. (Major losses experiment)
5. Determination of loss of head due to sudden contraction (Minor losses experiment)
6. Impact of jet on vanes.
7. Performance test on Pelton wheel turbine.
8. Performance test on Francis turbine.
9. Efficiency test on centrifugal pump.
10. Study on Hydraulic jump.

*Any eight experiments may be conducted*

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**(20CE0106) STRENGTH OF MATERIALS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Conduct test on engineering materials*
2. *Determine the elastic properties such as compression, tension, torsion and modulus of elasticity*

**COURSE OUTCOMES**

On successful completion of this course, the student should be able to

1. *Conduct tension test on mild steel bar and plot stress strain curve*
2. *Conduct compression test on wood, brick and concrete and can calculate their compression test*
3. *Conduct impact test on metal specimens*
4. *Find hardness of different materials*
5. *Determine modulus of elasticity of given material of beam by studying deflection for different loads*
6. *Determine tensile and torsional strength of mild steel bars and find stiffness of a helical spring*

**LIST OF EXPERIMENTS**

1. Bending test on simple support beam by using central load and eccentric load
2. Water absorption and Compression test on brick
3. Compression test on wood
4. Compression test on concrete
5. Shear test on wood
6. Impact test on metal specimen (Izod and Charpy)
7. Compression test on helical spring
8. Tension test on mild steel bar
9. Torsion test on mild steel bar
10. Continuous beam – deflection test
11. Hardness test on metals (Rockwell and Brinell Hardness Number Tests)
12. Verification of Maxwell's Reciprocal theorem on beams

*Any ten experiments may be conducted*

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**(20ME0306) THERMAL ENGINEERING LAB**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Impart knowledge on importance of four stroke engine in daily life.*
2. *Make the student to learn about the boilers.*
3. *Draw the valve timing & port timing diagram of an engine.*
4. *Make the student to conduct performance test on 4 -Stroke Diesel Engine & VCR Petrol Engine.*
5. *Impart knowledge in conducting Heat Balance test on a 4 -Stroke Diesel Engine.*

**COURSE OUTCOMES**

On successful completion of this course, the student should be able to

1. *Describe the Maintenance of Air filter, Spark plug and carburetor of a two wheeler.*
2. *Understands about suspension systems, Chain Overhauling and dismantling brakes of a two wheeler.*
3. *Explains about tire changing, injector testing, Wheel alignment & Balancing, Disc Braking of a four wheeler.*
4. *Construct valve timing & Port timing diagram of an engine.*
5. *Estimate the performance of 4 -Stroke Diesel Engine & VCR Petrol Engine.*
6. *Execute Heat Balance test on a 4 -Stroke Diesel Engine.*

**LIST OF EXPERIMENTS**

1. Valve Timing Diagram of four stroke Engine.
2. Port Timing Diagram of Two stroke Engine.
3. Performance Test on a 4 -Stroke Diesel Engine.
4. Performance Test on 2-stroke Petrol Engine
5. Heat Balance test on a 4 -Stroke Diesel Engine.
6. Air/Fuel ratio and volumetric efficiency of 4-stroke diesel engine
7. Retardation test on 2-stroke petrol engine
8. Performance test on Reciprocating Air-compressor unit
9. Study of boilers
10. Assembling & Disassembling of IC Engines

**Additional Experiments:**

1. Performance Test on Variable Compression Ratio (VCR) Petrol Engine.
2. Performance test on two-stage air compressor

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**(20ME0365) AUTOMOBILE ENGINEERING LAB -I**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Know the 2 wheeler spark plug tester*
2. *Describe types of braking systems used in automobile*
3. *Educate the working of carburetor in 2 wheelers*
4. *Illustrate the Chassis, Frame, body in automobile vehicles.*
5. *Demonstration on Power transmission, brake.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Understand the working principle of Automobile 2-Wheeler Spark Plug and Drum Brake*
2. *Differentiate Disc brakes, ABS*
3. *Know about the carburetor cleaning and air filter cleaning*
4. *Demonstrate on cut model of 4 stroke petrol engine*
5. *Identify the use of Chassis, Frame and Body in Automobile vehicles*
6. *Recognize the use of steering mechanism, front axle, transmission system and brakes.*

**PART-1 AUTOMOBILE TWO WHEELER LAB**

1. Introduction to Automobile Two wheeler with Example.
2. Study of Automobile 2-Wheeler Spark Plug Cleaner and Tester.
3. Study of Automobile Two Wheeler Drum Brake, Disc Brake Replacement.
4. Practices Carburetor Cleaning.
5. Practices Engine Oil Replacement, Chain Cleaning & Air Filter Cleaning Method.
6. Practices Cut Model of Four Stroke Motorized Petrol Engine.

**PART-2 AUTOMOBILE FOUR WHEELER LAB**

1. Introduction to Automobile Four wheeler with Example.
2. Study modern automobile vehicles.
3. Study of Chassis, Frame and Body in Automobile vehicles.
4. Study of the steering mechanism and front axle in the automobile vehicles.
5. Study of transmission system.
6. Study of different types of brakes.

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**(20HS0801) ENVIRONMENTAL SCIENCE**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Identify the importance of interlinking of food chains.
3. Learn about various attributes of pollution management and waste management practices.

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. Recognize the physical, chemical and biological components of the earth's systems and show how they function.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts and methods from multiple disciplines and apply to environmental Problems.
4. Create informed opinions about how to interact with the environment on both a personal and a social level.
5. Perform independent research on human interactions with the environment.
6. Recognize the ecological basis for regional and global environmental issues

**UNIT - I**

**INTRODUCTION:**

Definition, Scope and Importance of environmental science, Need for Public Awareness

**NATURAL RESOURCES:**

**Forest resources:** Use and over-exploitation, deforestation, Mining, dams and their effects on forests and tribal people.

**Water resources :** Use and over utilization of surface and ground water. Floods, drought, conflicts over water, dams benefits and problems.

**Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral

Energy resources: Renewable and Non- Renewable sources of energy. Solar energy, Hydro electrical energy, Wind energy, Nuclear energy .

**UNIT-II**

**ECOSYSTEMS:**

Concept of an ecosystem, structure and function of an ecosystem. Producers, Consumers and Decomposers. Biogeochemical cycles, Ecological succession, energy flow in an ecosystem, Food chains, food webs and ecological pyramids. Types of ecosystems (a) Forest ecosystem, (b) Grassland ecosystem, (c) Desert ecosystem, (d) Aquatic ecosystem.

**UNIT-III**

**BIODIVERSITY AND ITS CONSERVATION:**

Introduction, Definition, genetic, species and ecosystem diversity, Bio-geographical classification of India, India as a Mega diversity Nation, Hot spots of biodiversity, Value of biodiversity, Threats to biodiversity, Endemic, Endangered and Extinct species of India, In-Situ and Ex-situ conservation of biodiversity.

**UNIT-IV****ENVIRONMENTAL POLLUTION AND GLOBAL ENVIRONMENTAL ISSUES:**

**Natural Disasters:** Droughts, Floods, Cyclone, Landslides, Earthquake.

**Pollution episodes:** Air pollution, Water pollution, Land pollution, Noise pollution, Automobile, Nuclear pollution. Global warming, Acid rain, Ozone layer depletion and controlling measures.

**Global Environmental Issues:** Population Growth, Urbanizations, Land Management, Water and Waste Water Management. Climate change and impacts on human environment.

**Solid Waste Management:** causes, effects and control measures of Municipal solid wastes.

E-waste and management, Role of an individual in prevention of pollution .

**UNIT-V****ENVIRONMENTAL LEGISLATIONS, LAWS, POLICIES FOR SUSTAINABLE DEVELOPMENT:**

Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water Act. Wildlife protection Act, Forest conservation Act. Municipal Solid Waste management. International conventions/Protocols Earth summit, Kyoto protocol and Montreal Protocol. Unsustainable to sustainable development, Role of NGO's for Sustainable development. Role of IT in Environment, GIS methods for Sustainable development.

**Field work-** visit to a local area to document environmental assets, river, forest, grassland/hill, mountain and polluted sites (urban/rural/industrial/Agriculture).study simple ecosystems.

**TEXT BOOKS:**

1. A.Kaushik and C.P.Kaushik, *Environmental Sciences*, 5<sup>th</sup> edition, New age international publishers, 2015.
2. M.Anji Reddy, *Text Book of Environmental Science and Technology*, BS Publications, 2016.

**REFERENCES:**

1. Anil Kumar and Arnab Kumar De, *Environmental Studies*, New Age International Publishers, New Delhi, 3<sup>rd</sup> Edition 2015.
2. R.K. Trivedi, *Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards*, Vol.I and II, Enviro Media, 2016.
3. Rajagopalan.R, *Environmental Studies-From Crisis to Cure*, Oxford University Press, 2005.

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**(20HS0815) ENTREPRENEURSHIP DEVELOPMENT**

(Common to EEE, ME & ECE)

**COURSE OBJECTIVES**

The objective of this course is to

1. *Acquire necessary skills and knowledge for organizing and carrying out entrepreneurial activities,*
2. *Develop the ability of analyzing and understanding business situations on which entrepreneurs act*
3. *Develop the ability of analyzing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Distinct entrepreneurial traits and identify the successful elements of successful entrepreneurial ventures*
2. *Consider the legal and financial conditions for starting a venture and to assess the opportunities and constraints for new ventures*
3. *Design strategies for the successful implementation of ideas*
4. *Comprehend the evaluation of business opportunity from the prospective of an investor*
5. *Identify the most suitable sources of finance for start-ups*
6. *Write and execute their own business plan*

**UNIT-I**

**Introduction to Entrepreneurship** - Concept of Entrepreneur's, Enterprise and Entrepreneurship; Characteristics, Qualities, Functions of entrepreneur and Advantages of Entrepreneurship; Role of entrepreneurship in Economic development, Challenges faced by entrepreneurs, Entrepreneurial scenario in India and Abroad; Elements of Social Entrepreneurship, Types of Entrepreneurs, Entrepreneurship vs. Intrapreneurship.

**UNIT-II**

**Small Business and its Importance** - Introduction, Need, Classification of Micro, Small and Medium Enterprises (MSMEs), Role of MSMEs, Problems of MSMEs, Steps for Starting MSMEs, The role of government in supporting MSMEs in India.

**Forms of Business Organization:** Evaluation of Form of Business organization: Sole Proprietorship, Partnership, Joint Hindu Family, Joint Stock Company and Co-operative Society. Special forms of business ownership: Licensing, Franchising and Leasing.

**UNIT-III**

**Innovation and Idea Generation in Entrepreneurship** - Concept of Invention and Innovation, types of innovation, Sources of Innovation, Importance of Innovation in Entrepreneurship. Sources of new ideas, Methods of generating ideas and Opportunity recognition and idea generation in entrepreneurship. Intellectual Property Rights (IPRs): Patents, trademarks, copyrights, and trade secrets. E-commerce and Business Start-ups, Sources of information for Start-up Entrepreneurs in India. Problems of Start-ups without IPRs.

**UNIT-IV**

**Entrepreneurial Motivation** - Concept of Motivation and Factors influencing the entrepreneurs; Motivational Theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory.

Entrepreneurship Development Programs (EDPs) - Need and Role of EDPs. Opportunities for entrepreneurship in present scenario. Successful entrepreneurs

**Financing of Enterprises** - Source of financing - Debt capital, seed capital, venture capital, Loans available for starting ventures in India, Role of government agencies in small business financing. Role of consultancy organizations.

**UNIT-V**

**Project Planning and Feasibility Study** - Meaning of Project, Project Life Cycle, and Stages of Planning Process. Project Planning and Feasibility, Project proposal and report preparation.

**TEXT BOOKS:**

1. Robert D Hisrich, Mathew J.Manimala, Michael PPeters, Dean A.Shepherd, *Entrepreneurship*, 8/e, McGraw Hill Education.
2. Vasanth Desai, *The Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, Mumbai.

**REFERENCES:**

1. S.S. Khanka, *Entrepreneurial Development*, S. Chand and Company Limited.,
2. H. Nandan, *Fundamentals of Entrepreneurship*, PHI.
3. Bholanath Dutta, *Entrepreneurship Management – text and cases*, Excel Books.
4. Holt, *Entrepreneurship – New venture Creation*, PHI.
5. Ramachandran, *Entrepreneurial Development*, Tata McGraw Hill, New Delhi.

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**(20ME0307) CAD/CAM**

**COURSE OBJECTIVES**

The objective of this course is to

1. Gain Knowledge in handling 2-D drafting and 3-D modeling software systems.
2. Understand the basics of synthetic curves representations.
3. Familiarize with manual part programming and know the applications of CNC machines.
4. Learn the applications of computer in various aspects in manufacturing viz..Design, proper planning, manufacturing cost, layouts and material handling.
5. Identify the Basic need for integration of CAD and CAM.

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. Apply geometric transformation techniques in CAD.
2. Produce mathematical models to represent curves and surfaces.
3. Design engineering components using solid modeling techniques.
4. Understand about NC and CNC systems.
5. Create programs for CNC to manufacture industrial components.
6. Summarize the different types of techniques used in MRP-I & MRP-II.

**UNIT I**

**Introduction of Automation**, Product cycle, CAD, CAM and CIM -CAD Tools, CAM Tools-Utilization in an Industrial Environment-Evaluation criteria CAD standards- CAD data structure

**Computer Graphics**: Co-ordinate systems- Graphics package functions- 2D and 3D transformations, Translations, Scaling, Rotation about a Fixed Point, Reflections and Shears- homogeneous transformations.

**UNIT II**

**Geometric Modeling**: Various construction methods, wire frame modeling- synthetic curves and their representations, Bezier curve, B-spline curves, rational curves- surface modeling.

**Solid Modeling**: Solid representation- fundamentals-introduction to boundary representations- constructive solid geometry- analytical solid modeling.

**UNIT III**

**Numerical Control (NC)**: Introduction- Basic components of an NC system-NC Procedure-NC Coordinate system-NC Motion control system-Application of NC

**CNC & Part Programming**: Introduction to CNC - Fundamentals-canned cycles- cutter radius compensation, length compensation- computed assisted part programming using APT.

**UNIT IV**

**Group Technology**: Part families, Parts classification and coding, Production flow analysis, Machine cell design – FMS, Introduction, components of FMS, material handling systems, Computer control systems, advantages of FMS.

**Computer Aided Quality Control**: Terminology in Quality control, Inspection and testing, Contact inspection methods, optical and non-optical, integration of CAQC with CAD and CAM

**UNIT V**

**Computer Aided Processes Planning:** Retrieval type and Generative type-benefits Machinability data systems-Computer generated time standards.

**Computer Integrated Production Planning:** Capacity planning- shop floor control-MRP-I, MRP-II-CIMS benefits.

**TEXT BOOKS**

1. A Zimmers & P.Groover, *CAD/CAM*, PE Publishing , 5<sup>th</sup> Edition , 2008.
2. P.N. Rao, *CAD/CAM-Principles and applications*, TMH, 3<sup>rd</sup> Edition, 2010.

**REFERENCES**

1. Radhakrishnan and Subramanian, *CAD/CAM/CIM*, New Age, 3<sup>rd</sup> Edition, 2008.
2. R. Sivasubramaniam, *CAD/CAM Theory and Practice*, TMH Publishers.
3. K.Lalit Narayan, *Computer Aided Design and Manufacturing*, PHI, 2008.

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**(20ME0308) MANUFACTURING PROCESSES**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Understand the conventional manufacturing processes like casting, metal forming.
2. Impart fundamentals of various joining processes like gas welding and Arc welding
3. Know the principles of rolling, forging, extrusion and metal forming processes.
4. Recognize the importance of Powder Metallurgy in steel industry.
5. Understand the principle and manufacturing processes of plastics.

**COURSE OUTCOMES**

On successful completion of the course, the student will be able to

1. Interpret the pattern making, core making and examine the defects present in casting.
2. Select appropriate Joining Processes to join Work piece.
3. Analyze the Rolling, Forging and Extrusion processes for specific application.
4. Describe the different sheet metal working processes.
5. Explain the process of plastic moulding in Manufacturing Industries.
6. Categorize and select a suitable manufacturing process for metals and plastics according to their needs and applications.

**UNIT-I**

**Metal Casting Processes:** Introduction 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

**Principle of special casting processes:** Shell, Investment, Ceramic mould, Pressure die casting, Centrifugal Casting, CO<sub>2</sub> process, Stir casting - Defects in Sand casting.

**UNIT-II**

**Joining Processes:** Fusion welding processes, Type of Gas welding, Flame characteristics, Filler and Flux materials – Arc welding, Electrodes, Coating and specifications

**Principles of Various Welding Processes:** Types of Resistance welding, Gas metal arc welding, Submerged arc welding, Electro slag welding, Gas Tungsten arc welding, laser beam welding, Electron Beam Welding, Solid state Welding - Weld defects

**Other Joining Process:** Brazing and Soldering, Adhesive bonding, Types and applications

**UNIT-III**

**Rolling:** Bulk deformation processes, principles and theory of rolling, types of Rolling mills, defects in rolled products.

**Forging:** Principles of forging –Types of Forging – Smith forging, Drop Forging – Roll forging - Rotary forging – forging defects,

**Extrusion:** Basic extrusion process and its characteristics - Forward extrusion and backward extrusion – Impact extrusion - Hydrostatic extrusion.

**UNIT-IV**

**Sheet Metal Processes:** Sheet metal characteristics – shearing, bending and drawing operation, Stretch forming operations – Formability of sheet metal, Metal spinning

**Powder Metallurgy:** Introduction - Production of Metallic Powder - Processing methods: Mixing and Blending, Compacting, Sintering – Secondary finishing operations, Advantages and

**UNIT-V**

**Manufacture of Plastic Components:** Types and characteristics of plastics, Moulding of thermoplastics, working principles and applications – injection moulding, Compression moulding, Transfer Moulding –Typical industrial applications, Introduction to blow moulding, Rotational moulding, Film blowing, Extrusion – Thermoforming, Bonding of Thermoplastics.

**TEXT BOOKS**

1. S.K. Hajra Choudhary and AK Hajra Choudhury, *Elements of workshop Technology*, Volume I and II, Media Promoters and Publishers Private Limited, 2008.
2. P.N. Rao, *Manufacturing Technology Foundry, Forming and Welding*”, McGraw Hill Education, 5<sup>th</sup> Edition,2018.

**REFERENCES**

1. R.K. Jain, *Production Technology*, Khanna Publishers, 17<sup>th</sup> Edition,2010.
2. J. T. Black, *DeGarmo's Materials and Processes in Manufacturing, SI Version*, Wiley India Edition, 2017.
3. R.K. Rajput, *Manufacturing Technology*, Laxmi Publishers, 1<sup>st</sup> Edition,2008.

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**(20ME0309) MATERIALS SCIENCE**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Study the Structure of Metals and Constitution of Alloys.*
2. *Know the different types of Equilibrium of Diagrams.*
3. *Identify the various Ferrous and Nonferrous metals.*
4. *Learn the Heat treatment process of alloys and Fracture mechanism.*
5. *Understand the Structure of Composites materials and Ceramic materials*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Have a broad knowledge on different types of Metal structures and Solid solutions.*
2. *Demonstrate the different types of Equilibrium Diagrams.*
3. *Describe the various properties of Ferrous and Non Ferrous Metals.*
4. *Differentiate between different types of Heat treatment processes.*
5. *Recognize the factors affecting the fracture in metals.*
6. *Identify the applications of different types of Composite materials*

**UNIT-I**

**Introduction to Materials:** Classification of Materials-Properties of materials-Bonds in Solids, Metallic bond -Metals, Properties, Crystallization –Grain boundaries, Effect on the properties of metal/alloys.

**Constitution of Alloys and Solid solutions:** Necessity of alloy, Alloy vs composite - Solid state phases-Hume Rothery's rules

**UNIT-II**

**Phase and Phase Equilibrium:** Use of Phase diagram –Binary Phase Diagram- Lever Arm Rule- Classification of equilibrium diagram, Eutectic systems- Peritectic reaction.

**Transformations in the solid state:** Allotropy- Eutectoid, Peritectoid reactions- Relationship between equilibrium diagrams and properties of alloys- Binary phase diagrams of Cu-Ni, Al-Cu and Fe-Fe<sub>3</sub>C.

**UNIT-III**

**Ferrous Metals:** Types of Ferrous Metals- Classification of Cast Iron, Structure and Properties of White, Malleable, Grey, Spheroidal graphite, Alloy cast irons- Wrought iron-Classification of steels, Structure and properties of plain carbon, Low alloy, Hadfield manganese, Tool, die and stainless steels- Applications.

**Non-Ferrous Metals and Alloys:** Structure and properties of copper and its alloys Aluminum and its alloys- Titanium and its alloys.

**UNIT-IV**

**Heat Treatment of Alloys:** Purpose of heat treatment, Techniques- Effect of alloying elements on Iron-Iron carbon system- TTT diagrams- Surface hardening methods.

**Fracture Mechanism:** Fracture mechanism- Fracture, Types of fracture- Ductile fracture, steps- Brittle fracture, factors effecting- Fracture toughness.

**UNIT-V**

**Plastics and Ceramics Materials:** Plastics, Types- Thermoplastics, Thermosetting plastics- Classifications of ceramics- Glasses

**Composite Materials:** Composite materials classifications, Advantages, Disadvantages, Properties- Particle Reinforced composites- Fiber reinforced composites- Polymer matrix composites- Metal Matrix composites- Ceramic Matrix composites and Carbon-Carbon composites-Applications.

**TEXT BOOKS**

1. H. Sidney, Avner, *Introduction to Physical Metallurgy*, Tata McGraw-Hill Publishers, 2<sup>nd</sup> Edition, US, 2007.
2. R.K. Rajput, *Engineering Materials and Metallurgy*, S.Chand Publishers, 3<sup>rd</sup> Edition, 2008.

**REFERENCES**

1. Dieter, G. E., *Mechanical Metallurgy*, McGraw Hill, 3rd Edition, 2012.
2. Dr. Kodgire, V.D, *A Text Book of Material Science and Metallurgy for Engineers*, Everest Publishing House, 12<sup>th</sup> Edition, 2007
3. JF Shackel ford, *Introduction to Material Science for Engineers*, Pearson Publishers, 8<sup>th</sup> Edition, 2014.

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**(20ME0310) THEORY OF MACHINES**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the principle of gyroscopic effect, construction and purpose of turning moment diagram.*
2. *Know the working and uses of clutches and Dynamometer.*
3. *Explain the principal Design and application of Governor's.*
4. *Apprehend the concept of dynamic balancing in different types of engines.*
5. *Discuss about the concept of free and forced vibration and their analysis.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Know the Effect of gyroscopic couple, it's reactions and design flywheel for a machinery.*
2. *Study and realize the uses of clutch and it's application*
3. *Design an Governor in an optimized size with maximum effort*
4. *Balance any machinery with rotating parts in any plane*
5. *Balance rotating and reciprocating parts in engine to reduce vibration and noise.*
6. *Relate the cause of vibration and calculate it's magnitude to reduce it.*

**UNIT -I**

**Precession-** Gyroscopes, effect of precession motion on the stability of moving vehicles- motor car, motor cycle, aero planes and ships.

**Turning Moment Diagrams and Fly Wheels:** Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - Coefficient of Fluctuation of energy, Coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching Machines.

**UNIT-II**

**Clutches** - Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch

**Brakes and Dynamometers** - Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types- Prony brake, Rope brake, Epicyclic-train & torsion dynamometers- General description and methods of operation.

**UNIT-III**

**Governors** - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

**UNIT-IV**

**Balancing** - Balancing of rotating masses - single and multiple – single and different planes Balancing of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in- line and radial engines for primary and secondary balancing.

**UNIT-V**

**Mechanical Vibrations** - Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped

vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method,. Torsional vibrations - two and three rotor systems.

### TEXT BOOKS

1. R.S. Khurmi, *Theory of Machines*, Khanna Publishers, 2003.
2. S. S. Ratan, *Theory of Machines*, Tata McGraw Hill, 2<sup>nd</sup> Edition, 2005

### REFERENCES

1. Ghosh A. and Mallick A.K, *Theory of Mechanisms and Machines*, Affiliated East-West Press, 2<sup>nd</sup> Edition, 1988.
2. Thomas Bevan, *Theory of Machines*, CBS Publishers, 3<sup>rd</sup> Edition, 1984
3. J.S Rao. & R.V Dukupati, *Mechanism and Machine Theory*, New age publishers, 2<sup>nd</sup> Edition 1992

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**(20ME0311) COMPUTER AIDED MACHINE DRAWING LAB**

**COURSE OBJECTIVES:**

The objectives of this course is to

1. *Make the student understand and draw the conventional representation of various materials and Machine components.*
2. *Enable the students to learn and draw various types of thread profiles.*
3. *Familiarize the student in drawing Machine elements such as Bolt, Nut and Keys.*
4. *Develop the imagination and drafting skills of students.*
5. *Impart knowledge in drawing various part and Assembly drawings.*

**COURSE OUTCOMES:**

On successful completion of this course, the students will be able to

1. *Understand and draw the conventional representation of various materials and machine components.*
2. *Design various thread profiles.*
3. *Explain the step to draw Machine elements such as Bolt, Nut and Keys.*
4. *Design a component with given part drawings.*
5. *Explain the procedure to draw part drawings from a given assembled diagram.*
6. *Know the various commands and tool bars used in CAD software.*

**LIST OF EXPERIMENTS:**

**1. Exercises on Machine drawing conventions using drafting software.**

- Conventional representation of materials.
- Conventional representation of machine components.

**2. Exercises on Machine drawing thread profiles using drafting software.**

- Types of thread profiles-Square, Metric, ACME, Worm, Buttress.

**3. Exercises on drawing of machine elements using drafting software.**

- Bolted joints-Hexagonal bolt and nut, Square bolt and nut.

**4. PART DRAWINGS:**

Drawing parts of the following assembled drawings

- Knuckle Joint

**5. ASSEMBLY DRAWINGS:**

Drawing assembled views for the following drawings

- Tool Post
- Connecting rod
- Screw jack
- Stuffing box

**Software Used: AUTOCAD /CATIA / SOLID EDGE**

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**(20ME0312) MANUFACTURING PROCESSES LAB**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Understand the various manufacturing processes and machining related to moulding and casting*
2. *Learn the various Metal joining processes in welding process*
3. *Know the various manufacturing processes used in Mechanical press*
4. *Describe the various moulding techniques in the manufacturing process*
5. *Connect various circuits in the electronic circuits*

**COURSE OUTCOMES**

On successful completion of this course, the students will be able to

1. *Demonstrate Engineering principles on metallurgy and material science) in manufacturing processes*
2. *Understand the knowledge in Arc welding and spot welding*
3. *Transfer metallic objects into sheets using press working for piercing and drawing Operation*
4. *Prepare plastic materials through injection molding and blow molding process*
5. *Soldering process to join electronic component on Electronic circuit.*

**I. Metal Casting Lab**

1. Pattern Design and making - for casting drawing.
2. Sand properties testing - Exercise -for strengths, Moisture, Grain size and permeability
3. Moulding: and Casting

**II. Welding Lab**

1. Arc Welding: Lap & Butt Joint
2. Spot Welding

**III. Mechanical Press Working**

1. Blanking & Piercing operation and study of simple, compound and progressive press tool
2. Hydraulic Press: Deep drawing and extrusion operation.

**IV. Processing of Plastics**

1. Injection Moulding
2. Blow Moulding

**V. Soldering Processing**

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**(20ME0313) MATERIALS SCIENCE LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1 *Make students know about types of Metals, Steels, Cast irons and their Microstructures; Heat Treatment procedures; Data acquisition and recording; Grain size analysis; Phase segmentation.*
- 2 *Prepare metallographic samples for microscopic examinations.*
- 3 *Analyze the microstructure and estimate the amount of porosity and grain size of the casted specimen.*
- 4 *Apply the knowledge of phase diagrams and testing methods to suit design specification in related areas.*
- 5 *Use the software for various analyses of microstructures.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Have a broad knowledge on different types of Metal structures.*
2. *Demonstrate the different types of Phase Diagrams.*
3. *Describe the various properties of Ferrous and Non Ferrous Metals.*
4. *Differentiate between different types of Heat treatment processes.*
5. *Identify the microstructure of different materials.*
6. *Have a broad knowledge on Metallurgical behavior of different metals.*

**LIST OF EXPERIMENTS**

1. Preparation and study of the Micro Structure of Iron.
2. Preparation and study of the Micro Structure of Cu.
3. Preparation and study of the Micro Structure of Al.
4. Preparation and study of the Microstructure of Mild steels.
5. Preparation and study of the Microstructure of low carbon steels.
6. Preparation and study of the Microstructure of high – C steels.
7. Study of the Micro Structures of Cast Irons.
8. Study of the Micro Structures of Non-Ferrous alloys.
9. Study of the Micro structures of Heat treated steels.
10. Hardenability of steels by Jominy End Quench Test.

**ADDITIONAL EXPERIMENTS**

11. To find out the hardness of various treated steels.
12. To find out the hardness of various untreated steels.

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**(20ME0366) COMPUTER AIDED MODELING LAB- I**

**COURSE OBJECTIVES**

Objective of this course is to

1. *Impart brief knowledge on SOLID EDGE software.*
2. *Familiarize student with various commands used to sketch a part.*
3. *Make the student draw various part drawings using SOLID EDGE software.*
4. *Learn various assembly commands used to assemble the component.*
5. *Make the student assemble various part drawings of the component.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Describe the interface of SOLID EDGE software.*
2. *Explain various commands used to sketch a part.*
3. *Understand the use of different commands in Assembly interface.*
4. *Draw various part drawings using SOLID EDGE software.*
5. *Summarize various assembly commands used to assemble the component.*
6. *Produce a component by assembling various part drawings of the component.*

**LIST OF CONTENTS**

1. Introduction to *SOLID EDGE* Software.
2. Installation of *SOLID EDGE* Software
3. Basic commands practice
4. Conversion of different file formats
5. Part drawing practices
6. Assembly drawing Practices
7. Modeling of Component in 3D – EXTERNAL THREADING
8. Modeling of Component in 3D – HELICAL SPRING
9. Modeling of Component in 3D – ELBOW
10. Assembly of Component in 3D – CROSSHEAD
11. Assembly of Component in 3D – PIPE VICE
12. Assembly of Component in 3D – PLUMMER BLOCK

**Software Used: AUTOCAD /CATIA / SOLID EDGE**

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**(20ME0314) DESIGN OF MACHINE ELEMENTS-I**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Familiarize the various steps involved in the Design Process.*
2. *Understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.*
3. *Understand the different theories of failure and develop an ability to apply its knowledge for design of mechanical component and determine the resisting areas against failure.*
4. *Know to use standard practices and standard data.*
5. *Learn to use catalogues and standard machine components.*
6. *Make the student understand about Bolted joints, Keys and Couplings*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Apply design procedures using theories of failure for different elements.*
2. *Design simple components under cyclic loading using Goodman's and Soderberg's criterions.*
3. *Design Bolted joints with pre stress and joints under eccentric loading.*
4. *Understand different welded joints structure and able to apply its knowledge to analyze its strength when subjected to simple, coplanar and eccentric loading..*
5. *Implement the concepts to design cotter joint, knuckle joint and shafts.*
6. *Produce various key, rigid and flexible shaft couplings.*

**UNIT-I**

**Introduction:** Concept of Design, Types of design, General considerations and standards of design, Design procedure, Selection of engineering materials, Properties, Manufacturing considerations in the design, BIS codes of materials, Preferred numbers.

**Stress in Machine Members:** Simple stresses, Torsional and Bending stresses, Combined stresses, Impact stresses, Stress-strain relation, Principal stresses, Failure from static loading.

**UNIT-II**

**Theories of Failure:** Factor of safety – Design for strength and rigidity. Concept of stiffness in tension, Types of failure from static loading, Modes of failures.

**Design for Fluctuating Loads-**Variable (fatigue) stresses, Stress concentration, Notch sensitivity, and Design for fluctuating stresses fatigue failure, Endurance limit, Estimation of endurance strength, Goodman's line, Soderberg's line and Gerber's line, Modified Goodman's Line, Design for Finite Load, Cumulative damage-Miners equation.

**UNIT-III**

**Design of Bolted Joints:** Forms of Screw threads, Stresses in Screw fasteners, Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

**Design of Welded Joints:** Introduction, Advantages and Disadvantages of Welded Joints over Riveted Joints, Axially Loaded Unsymmetrical Welded Sections, Eccentrically Loaded Welded joints

**UNIT-IV**

**Design of Shafts:** Shaft design on the basis of strength, Torsional rigidity and lateral rigidity, ASME, Code for shaft design.

**Design of Cotters and Knuckle Joints:** Spigot and socket, Sleeve and cotter, Jib and cotter joints, Knuckle joint.

**UNIT-V**

**Design of Keys:** Sunk, Saddle, Round, Woodruff, Splines, Keyways.

**Design of Couplings:** Design of rigid couplings-Sleeve or muff, Split-muff or compression and flange couplings, Design of flexible couplings-Bushed pin type flange coupling.

**TEXT BOOKS**

1. R.S. Kurmi and J.K. Gupta, *Machine Design*, S. Chand Publications, 1<sup>st</sup> Multi colour Edition, 2005.
2. V.B. Bhandari, *Design of Machine Elements*, Tata McGraw Hill Publications, 2<sup>nd</sup> Edition, 2007.  
<https://www.mhlearnsmart.com/flow/flowswf.html?isbn=9352603427&name=smartbook&product=148767>

**REFERENCES**

1. Sadhu Singh, *Machine Design*, Khanna Publications, 1<sup>st</sup> Edition, 2019.
2. Joseph E. Shigely, *Mechanical Engineering Design*, Tata McGraw Hill Publications, 5<sup>th</sup> Edition, 2006.
3. Pandya and Shah, *Machine Design*, Tata McGraw Hill Publications, 20<sup>th</sup> Edition, 2015.

**Data Books**

1. Design Data Book by PSG College of Technology.
2. Design Data Hand Book – Mechanical & Automobile -S. Md. Jalaludeen.

**NOTE:** Design data books are permitted in the examinations.

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**(20ME0315) HEAT AND MASS TRANSFER**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Elucidate the fundamental mechanisms of heat transfer*
2. *Teach the governing laws of heat transfer by conduction, convection and radiation*
3. *Train the students in using the analytical and empirical methods for estimating heat transfer under different conditions .*
4. *Explicate the rudimentary aspects in heat transfer with phase change.*
5. *Introduce different approaches for solving sizing and rating problems in Heat Exchanger design*
6. *Gain experience in designing experiments for thermal systems, fabrication*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Explain the fundamental principles associated with heat transfer phenomena and demonstrate their application in a wide range of application areas.*
2. *Describe the laws of heat transfer in conduction, convection and Radiation*
3. *Develop solutions for transient heat convection in simple geometries Carryout analysis on different types of links, position, velocity, acceleration*
4. *Understand the fundamentals of heat exchangers*
5. *Recognize the basic laws of Mass transfer and its real time applications*
6. *Design an appropriate heat exchanger i.e condenser, evaporator, radiator etc., for a given heat transfer requirement using LMTD and NTU- $\epsilon$  methods*

**UNIT-I**

**Basic Concepts:** Modes of Heat Transfer – Conduction - Fourier Law of Conduction Heat Transfer by convection and radiation - General Differential equation of Heat Conduction for Cartesian coordinates cylindrical coordinates and spherical coordinates.

**UNIT II**

**One Dimensional Steady State Heat Conduction:** Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems –Critical radius of insulation.

**Extended Surfaces:** Types of Fins, Effectiveness and Efficiency of Fins, Problems.

**UNIT III**

**Convection:** Dimensionless numbers and their physical significance. Classifications of Convection.

**Free Convection:** Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Horizontal cylinders and Spheres.

**Forced Convection:** Laminar flow over a flat plate, Boundary layer definition and characteristics - External Flow – Flow over Plates - Cylinders Spheres and Bank of tubes.

**UNIT IV**

**Boiling & Condensation:** Types General aspects, Boiling Regimes – Factors affecting nucleate boiling. Drop wise and film wise condensation -Laminar film condensation on a vertical plate, correlations in condensation.

**Radiation:** Introduction, Surface emission properties - Absorptivity, Reflectivity and Transmissivity, Concept of a black body. Laws of Radiation – Stefan Boltzmann Law, Kirchhoff's Law, Plank's Law, Wien's Displacement Law

**UNIT V**

**Heat Exchanger:** Types of Heat Exchangers- LMTD method - Overall Heat Transfer Coefficient– Fouling Factors – Heat Exchanger Effectiveness-NTU Method

**Mass Transfer:** Introduction, Modes of Mass transfer – Fick's law – Mass Transfer coefficient – Convective Mass Transfer and its correlations

**TEXT BOOKS**

1. Rajput, R. K., *Heat & Mass Transfer*, Laxmi Publications, 3<sup>rd</sup> Edition, 2006.
2. Sachdeva R.C., *Fundamentals of Heat and Mass Transfer*, New Age International (P) Ltd., 4<sup>th</sup> Edition, 2012.

**REFERENCES**

1. Holman, J.P., *Heat and Mass Transfer*, Tata Mc Graw Hill, 10<sup>th</sup> Edition, 2000.
2. P.K. Nag, *Heat Transfer*, Tata Mc Graw Hill, 3<sup>rd</sup> Edition, New Delhi, 2002
3. Frank P. Incropera and David P. Dewitt, *Fundamentals of Heat Mass Transfer*, John Wiley & Sons, 5<sup>th</sup> Edition, 1998

**Note:** C. P. Kothandaraman, S.Subramanyan, *Heat & Mass Transfer Data Book*, New Age International (P), are permitted in the examinations

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**(20ME0316) METAL CUTTING AND MACHINE TOOLS**

**COURSE OBJECTIVES**

The objectives of this courses is to

1. *Gain knowledge on working principle of different metal cutting processes.*
2. *Familiarize student with cutting forces and cutting fluids.*
3. *Make the student learn about principles of lathe machines.*
4. *Know about machining processes and its principles of operations.*
5. *Make the student understand about jigs and fixtures.*
6. *Understand the various surface finishing operations like broaching and lapping operations*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Basic knowledge in machining aspects of orthogonal cutting, oblique cutting, tool geometry, mechanism of chip formation and control. Interpret Merchant's cycle diagrams.*
2. *Analyze the forces acting on the chip and Merchant's force diagram, machining parameters, selection of the tool material, tool life and characteristics of cutting fluids.*
3. *Work on lathe and its work holding, tool holding devices, perform different operations. And also capable of operate automatic machines.*
4. *Explain the advanced late machines and its operations. Study of automatic machines and CNC lathes.*
5. *Aware of identifying and working on drilling, boring, shaping, slotting, planning and milling machines.*
6. *Select the abrasives for grinding wheels, lapping and honing operation. Broaching operations to illustrate surface finishing.*

**UNIT-I**

**Introduction of Metal Cutting Theory** – Basic Elements of cutting, Methods of metal cutting- Orthogonal and Oblique cutting–Classification of cutting tools –Geometry of single point tool and angles, ASA and ORS systems, chip formation and types of chips – Built up edge and its effects, Chip breakers.

**UNIT-II**

**Cutting Force and Temperature Measurements-** Mechanics of orthogonal cutting-Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, Thermal aspects of Machining- Temperature measurement and heat distribution, work tool temperature measurement, tool life, coolants. Cutting Tool materials and cutting fluids –types and characteristics.

**UNIT-III**

**Engine lathe** – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.

**Advanced Lathes** - Turret and capstan lathes- Automatic lathes – Classification – Single spindle and multi- spindle automatic lathes - Introduction of CNC lathe.

**UNIT-IV**

**Drilling and Boring machines** – Principles of working, specifications, types, operations performed – Tool holding devices – Twist drill – Boring tools – Reaming - Machining time calculation.

**Shaping, Slotting and planning machines** –Principles of working – Principal parts – specification, classification, Operations performed.

**Milling machine** – Principles of working – Specifications – Classifications of milling machines – Principal features – Machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

**UNIT-V**

**Grinding machine** –Theory of grinding – Classification– Cylindrical and surface grinding machine – Tool and cutter grinding machine – Special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel

**Lapping, Honing and Broaching machines** – Comparison of grinding, lapping and honing and types of broaching machines.

**TEXT BOOKS**

1. B.S.RaghuVamshi, *Workshop Technology – Vol II*, DhanpatRai & Co, 9<sup>th</sup> Edition, 2013.
2. R.K. Jain and S.C. Gupta, *Production Technology*, Khanna Publishers, 17<sup>th</sup> Edition, 2012.
3. S.K. Hajra Chowdary, *Elements of Workshop Technology Vol II*, Media promoters & publishers Pvt. Ltd, 13<sup>th</sup> Edition, 2010.

**REFERENCES**

1. Kalpakzian, *Manufacturing Technology*, Pearson Education India, 5<sup>th</sup> Edition, 2009.
2. Milton C.Shaw, *Metal cutting Principles*, Oxford Second Edition, 2<sup>nd</sup> Edition, 2012.
3. K.L.Narayana, *Production Technology*, IK International Publishing house Pvt Ltd 3<sup>rd</sup> Revised Edition 2014.
4. P.N. Rao, *CAD/CAM-Principles and applications*, TMH, 3<sup>rd</sup> Edition, 2010.
5. G K Lal, *Introduction to Machining Science*, NEW AGE; 3<sup>rd</sup> , 2007.

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**III B. Tech - I Sem**

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**(20ME0329) INDUSTRIAL ENGINEERING AND MANAGEMENT  
[Professional Elective Course (PEC) – I ]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the roles, function, responsibilities & difference among Management, Administration and Organization.*
2. *Acquire knowledge on plant layout & production system*
3. *Describe the basic concepts of work study, work measurements and quality control.*
4. *Know the economics and factors governing the economics of an organisation.*
5. *Recognize the importance of management in supply and purchase*
6. *Provide a brief knowledge on industry functioning mechanisms and factors governing it*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Interpret the roles and responsibilities of Management-Administration and Organization.*
2. *Apply concept and evaluate to obtain effective plant setup.*
3. *Estimate the cost of an project taken in to consideration of all factors involves in to also provide solution to improve on existing system*
4. *Improve managerial skills in the economics to compete*
5. *Plan the distribution and collection with the concept of supply chain management*
6. *Understand and grasp the industry setup and easy to involve to their activities.*

**UNIT-I**

**Concepts of Management-Administration and Organization** – Functions of Management, Taylor’s Scientific Management, Fayol’s Principles of Management, Douglas McGregor’s Theory X and Y, Herzberg’s Two factor Theory of Motivation, Maslow’s Hierarchy of Human needs. Functions of Administration.

**Organizational Structures-** Principles, Classification - Scalar, Line, Staff and Functional Organization– Departmentation and Decentralization with Merits, and Demerits

**UNIT II**

**Plant Location:** Factors affecting the Plant Location, Comparison of Rural and Urban sites, Methods for Selection of Plant – Schemes offered by Government for rural Entrepreneurs

**Plant Layout:** Definition, Objectives, Types – Process and Product Layout – Various Data Analyzing Forms –Travel Chart, Process Chart, Diagrams, Templates, Models, RELchart -Material Handling Systems- Types-Selection Criteria.

**UNIT III**

**Work Study and Method Study** – Definition, Objectives and Steps Involved–Method study symbols - Recording Techniques - Types of Charts and diagrams – Micro motion and Memo motion Studies.

**Work Measurement-**Definition, Objectives, Work measurement Techniques - Time Study, - Steps

involved - Performance Rating - Allowances-Standard Time Calculation -Work Sampling - Definition, Procedure – Applications

#### UNIT IV

**Managerial Economics** –Introduction - Demand Analysis- Elasticity of Demand-Demand forecasting- factors governing demand Forecasting- Methods of demand forecasting –Cost Concept of Break-Even Analysis (BEA)

**Marketing**-Types of Markets - Perfect and Imperfect Competition – Features - Price - Output determination- Pricing Methods and Strategies.

#### UNIT V

**Supply Chain Management** - Supply Chain – Fundamentals, Importance, Decision Phases, Process View. Supplier- Manufacturer –Customer chain, Drivers of Supply Chain Performance. Structuring Supply chain Drivers. Overview of Supply Chain Models and Modeling Systems.

#### TEXT BOOKS

1. O. P. Khanna, *Industrial Engineering and Management*, Dhanpati Rai, 18<sup>th</sup> Edition, 2013.
2. A R. Aryasri, *Managerial Economics and Financial Analysis*, TMH, 2<sup>nd</sup> Edition, 2018.
3. Sunil Chopra and Peter Meindi, *Supply Chain Management – Strategy Planning and Operation*, Pearson Education, 5<sup>th</sup> Edition, 2014.

#### REFERENCES

1. Martind Telsang, *Industrial Engineering and production management*, S. Chand, 12<sup>th</sup> Edition, 2018.
2. Dr. C. Nadamuni Reddy, *Industrial Engineering and Management*, New Age International Publishers, 4<sup>th</sup> Edition, 2011.
3. S.A. Siddiqui and A.S. Siddiqui, *Managerial Economics and Financial Analysis*, New Age International, 4<sup>th</sup> Edition, 2009.

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**III B. Tech - I Sem**

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**(20ME0330) PRODUCTION AND OPERATIONS MANAGEMENT  
[Professional Elective Course (PEC) – I]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Explain about the production planning & control and new product design & development.
2. Describe the concept of forecasting, its types and techniques.
3. Familiarize with facilities location, planning and latest computerized layouts.
4. Discuss about the Strategies of aggregate planning and Inventory Management.
5. Provide Knowledge on Scheduling policies and concept of lean management
6. Make students understand production planning and control, forecasting, plant facilities, strategies, inventory and lean management

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Understand the functions of production planning & control, design of goods and services and aggregate planning
2. Know the importance of forecasting, uses, principles and its techniques.
3. Gain knowledge on various plant facilities and computerized layouts.
4. Implement aggregate planning strategies and manage inventory.
5. Apply Scheduling policies and lot sizing technique, implementation of lean management
6. Perform the practices in production and operations in contemporary organizations

**UNIT-I**

**Introduction:** Production, Operations management, Production planning and control, Productivity, Productivity measurement, Design of goods and service - selection, generating new products, product development, issues in product design.

**UNIT-II**

**Forecasting** – Definition, Need for forecasting, Types of forecasting, Uses of forecasting, Limitations of forecasting,

**Forecasting techniques** – Qualitative methods and Quantitative methods, accuracy of forecasting methods.

**UNIT-III**

**Plant Layout** - Definition, Characteristics of plant layout, Factors affecting facilities location

**Types of Plant layout:** product layout, process layout, group technology layout, Assembly line balancing, Computerized layout: ALDEP, CRAFT, and CORELAP (Only Basics).

**UNIT-IV**

**Production Planning Strategies:** Aggregates planning, Chase planning, Expediting, Controlling aspects.

**Inventory management** – Functions of inventories – Relevant inventory costs – ABC analysis –VED analysis – EOQ model – Inventory control systems – P-Systems and Q-Systems-(S, s) Policy

#### UNIT-V

**Scheduling Policies** – Techniques, flow shop and job shop scheduling techniques - MRP – Lot sizing techniques in MRP, introduction to ERP, Line of Balance (LOB).

**Lean Management**- Philosophy and creation of lean enterprise, JIT concepts - Kanban System, Elements of total quality management, Six Sigma Quality Control.

#### TEXT BOOKS

1. R Panneerselvam, *Production and Operation management*, PHI Learning Private Limited, 3<sup>rd</sup> Edition, 2012.
2. Elwood Baffa & RakeshSarin, *Modern Production/Operations Management*, Wiley India Private Limited, 8<sup>th</sup> Edition, 2009.

#### REFERENCES

1. S.N. Chary, *Production and Operations Management*, Tata McGraw Hill Education Private Limited, 5<sup>th</sup> Edition, 2012.
2. R B Khanna, *Production and Operation Management*, PHI Learning Private Limited, 2<sup>nd</sup> Edition, 2015.
3. S.N. Chary, *Operations Management*, McGraw Hill Higher Education, 3<sup>rd</sup> Edition, 2006.
4. Franklin G. Moore, *Production Control*, McGraw Hill Text publisher, 3<sup>rd</sup> Edition, 1969

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**III B. Tech - I Sem**

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**(20ME0331) TOTAL QUALITY MANAGEMENT  
[Professional Elective Course (PEC) – I]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Explain the importance of the quality, costs of quality, and Basics concepts of quality.
2. Focus on TQM Principles, employee involvement, team spirit and PDCA cycle.
3. Familiarize with the management tools like Six sigma, Bench Marking.
4. Discuss about TQM tools like control charts, QFD, Taguchi loss function and TPM.
5. Describe the tools and techniques of quality management to manufacturing and services processes.
6. Facilitate the understanding of Quality Management principles and process

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Understand the importance of the quality, costs of quality, and Basics concepts of quality.
2. Describe the TQM principles, employee involvement, and team spirit and PDCA cycle.
3. Explain the management tools like Six Sigma, Bench Marking.
4. Recognize various stages of FMEA and its classification.
5. Summarize TQM tools like control charts, QFD, Taguchi loss function and TPM.
6. Apply the tools and techniques of quality management to manufacturing and services processes.

**UNIT-I**

**Introduction**–Need for quality -Evaluation of Quality, Definition of quality, Basic concepts and Features of TQM, - TQM Framework - Contributions of Deming, Juran and Crosby – Benefits of TQM

**Quality statements** - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

**UNIT-II**

**TQM Principles** - Leadership - Strategic quality planning, Quality Statements – Employee involvement -Motivation, Empowerment, Team and Teamwork.

**Continuous process improvement**– PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT-III**

**TQM Tools And Techniques I** - The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, Applications to manufacturing, Service sector including IT **Bench marking** - Reason to bench mark, Bench marking process - FMEA – Requirements- Failure modes and effects of failure – Other Types of FMEA

**UNIT-IV**

**TQM Tools And Techniques II** - Control Charts - Process Capability - Quality Function Development (QFD) - Taguchi quality loss function - TPM – Signal to noise Ratio and its types - Performance measures. Introduction to quality standards.

**UNIT-V**

**Statistical Quality Control** - Techniques - Variables and Attributes - Control Charts: X and R Charts, P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves- Problems

**TEXT BOOKS**

1. Dale H. Besterfield, *Total quality Management*, 3<sup>rd</sup> Edition, Pearson Education Asia, Indian Reprint, 2006.
2. James R. Evans and William M. Lindsay, *The Management and Control of Quality*, 8<sup>th</sup> Edition, 2012

**REFERENCES**

1. Joel E. Ross, Susan Perry, *Total Quality Management*, Routledge Publications, 3<sup>rd</sup> Edition, 2014
2. Suganthi. L and Anand Samuel, *Total Quality Management*, Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., *Total Quality Management*, Prentice Hall (India) Pvt. Ltd., 8<sup>th</sup> Edition, 2006.

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**( 20CE0170) FUNDAMENTALS OF CIVIL ENGINEERING  
[Open Elective (OE)-I]**

**COURSE OBJECTIVES**

The objectives of this course to

1. *Impart basic knowledge on Civil-Engineering.*
2. *Familiarize the materials and measurements used in Civil Engineering.*
3. *Provide the exposure on the fundamental elements of civil engineering structures.*
4. *Have knowledge on surveying and the instruments used in it*
5. *Explain the importance of water treatment and its applications*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Explain the usage of construction material and proper selection of construction materials*
2. *Attain the knowledge of building planning and construction of buildings.*
3. *Understand various basic methods and techniques of surveying and its applications*
4. *An ability describe to the various functional units in water treatment and distribution system*
5. *Describe water quality criteria and standards, and their relation to public health*
6. *Understand the rigid pavements as per IRC & Describe different components of permanent way in Railway Track*

**UNIT – I**

**Introduction to Civil engineering:** Introduction - History of Civil Engineering- Sub-Disciplines of Civil Engineering

**Building materials :** Classification - Properties of Building Materials- Most Common Building Materials- Uses of Building Materials- Bricks- Classification- Size and weight of bricks- Qualities of good brick- Stones- Sources of stones- Common Building Stones in India- Timber- Qualities of good timber- Common timbers used for building work- Steel-Uses of steel in building work.

**UNIT – II**

**Building Construction:** Building Components-Basic Requirements of Building Components, Planning Regulations-Foundation-Purpose of Providing a Foundation, Types of Foundations-Mortar-Functions, Types of Mortars and their Preparation-Masonry Works-Stone Masonry, Classification of Stone Masonry, Brick Masonry, Types of Brick Masonry-Concrete-Ingredients of Concrete and their Functions, Mixing of Concrete, Curing of Concrete.

**UNIT – III**

**Surveying :** Objectives of Surveying- Principles of Surveying-Equipment's used in surveying-Types of Surveying- Classification of Surveying- Basic methods used in surveying- Linear and angular measurements- chain Surveying, -Levelling - Purpose of Levelling, Major parts in levelling instrument, Technical terms used in levelling -Introduction to Theodolite.

**UNIT – IV**

**Introduction to Water Supply:** Importance and Necessity of protected water supply system - Objectives of protected water supply system- Flow chart of public water supply system,

**Wastewater Characteristics:** Characteristics of sewage – Physical, Chemical and Biological.

**Wastewater Treatment:** Layout and general outline of various units in a wastewater treatment plant– Primary treatment–Screens–Grit Chamber– Skimming tanks – Sedimentation tanks.

**UNIT – V**

**Transportation Engineering:** Introduction- Planning and design aspects of transportation Engineering-different modes of transport- Pavement Design- Types of pavement ,Components and their functions - Railway Engineering - Permanent way components , Cross section of permanent way , Functions and requirements of Rails, Sleepers and Ballast , Types of gauges, Rail fastenings.

**TEXT BOOKS :**

1. I.Sateesh Gopi, *Basic Civil Engineering, Pearson publications*, Published by Dorling Kindersley (India) Pvt. Ltd.
2. Madan Mohan Das, Bharga b Mohan Das, Mimi Das Saikia, Et Al. Saikia, *Elements Of Civil Engineering (1st Edition)*, Published by Ashoke K PHI Learning Pvt. Ltd.
3. Modi, P.N., *Water Supply & Waste Water Engineering, Vol. I & II*, Standard Book House, New Delhi, 2010.

**REFERENCES :**

1. S.C.Saxena and S.P.Arora, *A Text Book of Railway Engineering*, Dhanpat Rai Publications, New Delhi, 2011
2. L.R.Kadiyali and Lal, *Principles and Practice of Highway Engineering Design*, Khanna Publications, 7<sup>th</sup> edition, 2013
3. Punmia, B.C., Jain, A.K., and Jain.A.K, *Water Supply & Waste Water Engineering, Vol. I & II*, Laxmi Publications, 2010
4. Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, *Surveying-Vol I*, Lakshmi Publications(P) Ltd., New Delhi, Seventeen Edition,2016.

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**(20EE0227) GENERATION OF ENERGY FROM WASTE  
[Open Elective (OE)-I]**

**COURSE OBJECTIVES**

The objectives of this course to

1. Understand different types of waste as fuel
2. Introduce Pyrolysis methods and conversion processes
3. Describe the gasification methods for biomass
4. Learn the concepts of biomass resources, combustion types and biogas plant technology

**COURSE OUTCOMES (COs)**

On successful completion of this course, the student will be able to

1. Analyse agro based, forest residue and industrial waste conversion processes.
2. Manufacture of Pyrolytic oils and gases
3. Manufacture of charcoal, yields and applications
4. Describe various types of gasifiers operation
5. Understand inclined and fluidized bed combustors operation
6. Identify types of biogas plants and biomass energy programme in India

**UNIT- I**

**Introduction to Energy from waste:** Classification of waste as fuel – Agro based- Forest residue- Industrial waste- MSW- conversion devices- Incinerators- Gasifiers-Digestors.

**UNIT- II**

**Bio-mass Pyrolysis:** Pyrolysis- Types- Slow-Fast- Manufacture of Charcoal- methods- yields and application. Manufacture of Pyrolytic oils and gases – yields and applications.

**UNIT- III**

**Biomass Gasification:** Gasifiers- Fixed bed system- Downdraft and Updraft gasifiers- Fluidized bed gasifiers- construction and operation- Gasifier burner arrangement for thermal heating.

**UNIT- IV**

**Biomass Combustion:** Biomass stoves- Types- Inclined combustors- Fluidized bed combustors- construction and operation of above biomass combustors.

**UNIT- V**

**Properties of Biogas:** Biogas plant Technology and status – Biomass resources and their classification- Biomass conversion processes- thermo chemical conversion – Direct Combustion- Biomass gasification- Pyrolysis and liquefaction – bio-chemical conversion- anaerobic digestion- Types of biogas plants- applications-Biomass Energy Programme in India.

**TEXT BOOKS**

1. Desai Ashok V, *Non-Conventional Energy*- Wiley Eastern Ltd, 2010.
2. Khandelwal K.C. and Mahdi SS, *Biogas Technology – A Practical Hand Book*, Vol I & II. Tata Mc Graw Hill Publishing Co Ltd., 2008.

**REFERENCES**

1. Challal D.S., *Food, Feed and Fuel from Biomass*, IBH Publishing Co Pvt Ltd.,1991.
2. GD Roy, *Non-conventional Energy Sources*, Khanna Publishers, 6<sup>th</sup> Edition
3. Khahid Rehman Hekeem, Mohammad Jawald., Umar Rashid, *Biomass & Bioenergy*, Springer International Publishing Ltd.

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**(20EC0451) INTRODUCTION TO COMMUNICATION SYSTEMS  
[Open Elective (OE)-I]**

**COURSE OBJECTIVES**

The objectives of this course to

1. Study the fundamental concepts of the analog communication system.
2. Analyze various analog modulation and demodulation techniques.
3. Understand, analyze, and design fundamental digital communication systems.
4. Focus on developing digital communication systems.
5. Understand basics of various Communications.

**COURSE OUTCOMES (COs)**

On successful completion of this course, the student will be able to

1. Demonstrate knowledge in elements of Analog Digital and Wireless Communication Systems.
2. Analyze the analog modulated and demodulated systems.
3. Understand the principle involved in different modulation techniques.
4. Understand the basic principles of baseband and pass band digital modulation schemes.
5. Analyze probability of error performance of digital systems and are able to design digital communications.
6. Implement various Keying and accessing techniques in real time wireless communication systems.

**UNIT- I**

**Communication:** Introduction, Elements of communication systems, wired Communications systems, Wireless Communications systems, Modulation, Need of modulation, modulation Methods, difference between Analog and Digital communication

**Amplitude Modulation & Demodulation:** DSB-FC(AM) modulation & its demodulation, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Single sideband (SSB) transmission, Comparison of various amplitude modulation techniques.

**UNIT- II**

**Angle Modulation & Demodulation:** Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM) and Wide band FM (WBFM), Phase modulation(PM).

**UNIT- III**

**Noise in Communication Systems:** Types of noise, Noise figure.

**Analog Pulse Modulation Schemes:** Pulse amplitude modulation (PAM), Pulse Width modulation (PWM) and Pulse Position modulations (PPM)

**UNIT IV**

**Digital Communication:** Introduction-Elements of digital communication systems, sampling process, quantization, quantization noise.

**Source Coding Systems:** Pulse-Code Modulation (PCM), Differential PCM (DPCM), Delta modulation (DM), Comparison of PCM, DPCM, DM.

**Pass Band Data Transmission:** Introduction, Amplitude shift keying (ASK), binary phase shift keying (BPSK), Binary Frequency shift keying (BFSK) Comparison of ASK, PSK, FSK.

#### UNIT V

**Introduction to Wireless Communication Systems:** Evolution of Mobile Radio Communication Systems, Examples of wireless communication Systems – Paging Systems, Cordless Telephone, Cellular Telephone Systems, Overview of generation of cellular systems.

**Multiple Access Techniques for Wireless Communications:** Introduction to Multiple Access, FDMA, TDMA, CDMA, SDMA.

#### TEXT BOOKS

1. Simon Haykin, *Communication Systems*, Wiley India Edition, 4<sup>th</sup> Edition, 2011.
2. B.P. Lathi, & Zhi Ding, *Modern Digital & Analog Communication Systems*, Oxford University Press, International 4<sup>th</sup> edition, 2010.

#### REFERENCES

1. Sam Shanmugam, *Digital and Analog Communication Systems*, John Wiley, 2005.
2. Bruce Carlson, & Paul B. Crilly, *Communication Systems – An Introduction to Signals & Noise in Electrical Communication*, McGraw-Hill, 5<sup>th</sup> Edition, 2010
3. Bernard Sklar, *Digital Communications*, Prentice-Hall PTR, 2<sup>nd</sup> edition, 2001.
4. Herbert Taub & Donald L Schilling, *Principles of Communication Systems*, Tata McGraw-Hill, 3<sup>rd</sup> Edition, 2009.
5. *MATLAB*, J.G.Proakis, M Salehi, Gerhard Bauch, *Modern Communication Systems Using CENGAGE*, 3<sup>rd</sup> Edition, 2013.

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**(20CS0550) RELATIONAL DATABASE MANAGEMENT SYSTEM  
[Open Elective (OE)-I]**

**COURSE OBJECTIVES**

The objectives of this course to

1. *Explain different issues involved in the design and implementation of a database system.*
2. *Explain physical and logical database designs, database modelling, relational, hierarchical, and network models*
3. *Introduce data manipulation language to, update, query and manage a database*
4. *Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling and designing a DBMS.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Develop relational algebra expressions for queries and optimize them.*
2. *Design the databases using E\_R method for a given specification of requirements.*
3. *Apply Normalization techniques on given database.*
4. *Determine the transaction atomicity, consistency, isolation, and durability for a given transaction-processing system.*
5. *Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.*
6. *Understand Physical Storage Media and RAID concepts.*

**UNIT- I**

**Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Data Abstraction, Data Independence, Data Models, Database Languages, Database Architecture, Database Users and Administrators.

**UNIT-II**

**Introduction to Data base design:** ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets.

**Relational Algebra and Calculus:** Relational Algebra - Selection and Projection, Set operations, Renaming, Joins.

**UNIT-III**

**Form of Basic SQL Query-** Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values.

**UNIT-IV**

**Introduction to Schema Refinement-** Problems Caused by redundancy, Normal Forms - FIRST, SECOND, THIRD Normal forms.

**Properties of Decompositions:** Lossless join Decomposition, Dependency preserving Decomposition - FOURTH Normal Form, FIFTH Normal form.

**UNIT- V**

**Recoverability:** System Recovery – Media Recovery –Two Phase locking – Deadlock- Detection, Recovery and Prevention.

**Physical Storage and Database Concepts:** Overview of Physical Storage Media and RAID.

**TEXT BOOK**

1. Henry F. Korth and S. Sudharshan, *Database System Concepts*, Sixth Edition, Abraham Silberschatz, Tata McGraw Hill, 2011.
2. Raghurama Krishnan, Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGrawHill Education,2003.

**REFERENCES**

1. J. D. Ullman, *Principles of Database and Knowledge – Base Systems*, Vol 1 Computer Science Press. 1993.
2. Peter Rob & Carlos Coronel, *Database Systems Concepts*, Cengage Learning, 2008.
3. C.J. Date, *Introduction to Database Systems*, Pearson Education.
4. G.K. Gupta, *Database Management Systems*, McGraw Hill Education.

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**(20HS0813) MANAGEMENT SCIENCE  
[Open Elective (OE)-I]**

**COURSE OBJECTIVES**

The objectives of this course to

1. *Understand the basic concepts, principles and processes of management*
2. *Help the students gain an understanding of the functions, responsibilities of managers*
3. *Get an awareness about the latest developments and contemporary issues in the field of management*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Utilize appropriate theoretical frameworks to real life business and managerial problems*
2. *Identify appropriate operational risks and develop appropriate responses to them*
3. *Apply human resource principles to recruit, select and manage employees to achieve organizational goals*
4. *Enact strategy, including contingent plans for the effective management of the organization*
5. *Identify, plan, and implement the projects and evaluate the performance of the projects*
6. *Analyze effective application of latest developments to diagnose and solve organizational problems*

**UNIT I**

**INTRODUCTION TO MANAGEMENT:**

Management-Concept and meaning-Nature-Functions-Management as a science and art and both. Schools of management thought-Taylor's scientific theory-Henry Fayol's principles- Weber's Ideal Bureaucracy - Elton Mayo's Human relations-Systems theory- Situational or Contingency theory- Social responsibilities of management.

**Organizational structure and design:** Features of organizational structure-work specialization- Departmentation -Span of control-Centralization and Decentralization.

**Organizational designs**-Line organization-Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of organization.

**UNIT II**

**OPERATIONS MANAGEMENT:**

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study- Statistical Quality Control: *C* chart, *P* chart, (simple Problems) Deming's contribution to quality.

**Material Management:** Objectives-Inventory- Functions, types, inventory classification techniques-EOQ-ABC Analysis-Purchase Procedure and Stores Management.

**Marketing Management:** Concept- Meaning - Nature-Functions of Marketing- Marketing Mix- Channels of distribution -Advertisement and sales promotion- Marketing Strategies based on Product Life Cycle.

**UNIT III****HUMAN RESOURCES MANAGEMENT (HRM):**

HRM- Definition and meaning – nature-Managerial and Operative functions-Evolution of HRM- Human Resource Planning(HRP)-Employee Recruitment-sources of recruitment- employee selection- process and tests in employee selection- Employee training and development-On- the-job and Off- the- job training methods-Performance Appraisal systems- Concept-MethodsofPerformanceAppraisal-Placement-EmployeeInduction-WageandSalary Administration-Objectives-Essentials of Wage and Salary Administration-Job Analysis- Process -Job Evaluation- Employee Grievances-techniques of handling Grievances.

**UNIT IV****STRATEGIC MANAGEMENT:**

Definition& Meaning-Setting of Vision- Mission- Goals- Corporate Planning Process- Environmental Scanning-Steps in Strategy Formulation and Implementation-SWOT Analysis. **Project Management (PERT/CPM):**Network Analysis- Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying Critical Path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

**UNIT V****CONTEMPORARY ISSUES IN MANAGEMENT:**

The concept of MIS- Materials Requirement Planning(MRP)- Just-In-Time (JIT) System-Total Quality Management (TQM)- Six Sigma Concept- Supply Chain Management-Enterprise Resource Planning (ERP)- Performance Management- Business Process Outsourcing (BPO), Business Process Re-engineering and Bench Marking -Balanced Score Card-Knowledge Management.

**TEXT BOOKS:**

1. A.R Aryasri: *Management Science*, TMH,2013
2. Stoner, Freeman, Gilbert, *Management*, Pearson Education, New Delhi, 2012.

**REFERENCES:**

1. Kotler Philip & Keller Kevin Lane, *Marketing Management*, PHI, 2013.
2. Koontz & Weihrich, *Essentials of Management*, 6/e, TMH, 2005.
3. Thomas N.Duening & John M.Ivancevich, *Management Principles and Guidelines*, Biztantra.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2004.
5. Memoria & S.V.Gauker, *Personnel Management*, Himalaya, 25/e,2005

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**(20ME0317) HEAT TRANSFER LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Define the fundamental concepts to students through experimentation in the area of heat transfer and its applications.
2. Computing thermal conductivity and increased rate of heat transfer with extended surface (Pin Fin).
3. Identify difference in emissivity effect of black body & gray body
4. Analyze the free convection and forced convection process
5. Evaluate Stefan Boltzmann Constant.
6. Perform heat conduction, convection, and radiation experiments

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Evaluate thermal conductivity of a given metal rod
2. Check the increased rate of heat transfer with extended surface (Pin Fin).
3. Compare differences in rate of heat transfer between Forced & Natural Convection and also explain the transient heat conduction process.
4. Compute rate of heat transfer in Parallel and counter flow heat exchanger.
5. Understands emissivity effect of black body & gray body, and also Stefan Boltzmann Constant
6. Know about heat transfer phenomenon of conduction, convection and radiation

**LIST OF EXPERIMENTS**

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through Lagged pipe apparatus
3. Thermal Conductivity of metal (conductor).
4. Heat transfer in Pin-fin apparatus
5. Experiment on Transient Heat Conduction
6. Heat transfer coefficient in Natural convection
7. Heat transfer coefficient in Forced convection.
8. Experiment on Parallel and Counter flow heat exchanger.
9. Emissivity measurement apparatus.
10. Experiment on Stefan Boltzmann Apparatus.

Note: Any Eight experiments of the above showed be performed

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**(20ME0318) MACHINE TOOLS LAB**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Impart knowledge on general purpose machine maintenance.*
2. *Provide hands on experience on lathe, drilling, shaping, milling, slotting, grinding and tool and cutter grinding machines.*
3. *Familiarize with different machine tools used in production floor.*
4. *Know about the importance of metal cutting parameters.*
5. *Apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Demonstrate different machine tools used in machine shop.*
2. *Describe various taper turning methods.*
3. *Illustrate knurling, threading and shaping operations on a job.*
4. *Evaluate various fundamental parameters of tool and surface roughness by using different instruments.*
5. *Understands about machine tool structures and machining economics.*
6. *Explain the use of keyway in milling and slotting operations.*

**LIST OF EXPERIMENTS**

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planing machine, slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine.
3. Job on Thread cutting and knurling on lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Grinding of cylindrical surface on a Cylindrical grinding machine.
9. Grinding of plane surface on a surface grinding machine.
10. Grinding of tool angles on single point cutting tool using tool and cutter grinder.

Note: Any Eight experiments of the above showed be performed

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**(20HS0859) ENGLISH FOR CORPORATE COMMUNICATION SKILLS**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Improve the students' fluency in English, through a well-developed vocabulary*
2. *Enable them listening spoken English at normal conversational speed by English speakers*
3. *Respond appropriately in different social-cultural and professional contexts*
4. *Develop drafting skills among the students.*
5. *Develop Inter-personal and Intra-personal Skills*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Use fluency in English for all kinds of professional communication*
2. *Enhancing job required skills for getting success in their professions*
3. *Improving Effective Speaking Abilities for their business or professional correspondence*
4. *Prepare effective Interview techniques to get job in the present scenario*
5. *Using the appropriate skills in all kinds of professional activities*
6. *Use effective communicative approaches by preparing job application, report and other kinds of spoken and written correspondences.*

**UNIT I**

**COMMUNICATIVE COMPETENCY**

1. Functional English
2. Reading Comprehension
3. Vocabulary for competitive purpose
4. Spotting Errors

**UNIT II**

**TECHNICAL WRITING**

5. Cover Letter
6. Curriculum vitae
7. Report writing

**UNIT III**

**PRESENTATIONAL SKILLS**

8. Impromptu Speech
9. Oral presentation
10. Power point presentation
11. Poster presentation

**UNIT IV**

**CORPORATE SKILLS**

12. Problem Solving
13. Team Work
14. Leadership Skills

**UNIT V****GETTING READY FOR JOB**

15. Group Discussion
16. Interview skills

**Minimum requirements for English for Corporate Communication Skills Lab**

3. Computer Assisted Language Learning (CALL) Lab: The Computer Assisted Language Lab for 60 Students with 60 systems one Master Console, LAN facility and English Language Software for self-study by learners.
4. English for Corporate Communication Skills Lab with movable chairs and audio visual aids with a P. A. system, Projector, a Digital stereo audio & video system and Camcorder etc.

**System Requirement (Hardware component):**

Computer network, LAN with minimum 60 multimedia systems with the following

**Specifications**

- iii)
  - a) Intel(R) core (TM) i3
  - e) Speed 3.10 GHZ
  - f) RAM – 4 GB
  - g) Hard Disk – 320 GB
- iv) Headphones with High quality

**SOFTWARE**

Walden Info Tech Software

**REFERENCES**

1. Rizvi, *Effective Tech Communication*, Tata McGraw – Hill Education, 2007.
2. Sanjay Kumar & Pushpalatha, *Communication skills*, Oxford University Press, 2012.
3. Writing Tutor. *Advanced English Learners' Dictionary*, 9<sup>th</sup> Edition, Oxford University Press, 2015.
4. Anjana Agarwal, *Powerful Vocabulary Builder*, New Age International Publishers, 2011.
5. Miles Craven, *Listening Extra*, Cambridge University Press, 2008.

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(AUTONOMOUS)

III B.Tech – I Sem

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**(20HS0817) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE****COURSE OBJECTIVES**

The objective of the course is to

1. *Impart basic principles of thought process, reasoning and inference.*
2. *Connect society and nature through sustainability.*
3. *Know Holistic life style of yogic science and wisdom capsules in Sanskrit literature.*
4. *Introduce Indian knowledge system and Indian perspective of modern scientific world-wide.*
5. *Learn the basic principles of Yoga and holistic health care system.*

**COURSE OUTCOMES**

On successful completion of the course the students will be able to

1. *Connect up the basic principles of thought process.*
2. *Understand Holistic life style of yogic science and wisdom capsules in Sanskrit literature.*
3. *Analyze the society and nature through sustainability.*
4. *Explain Indian knowledge system and Indian perspective of modern science.*
5. *Use the basic principles of Yoga and holistic health care system.*
6. *Identify the importance of Indian traditions and Philosophy.*

**UNIT-I**

- Basic structure of Indian Knowledge System: 4 ved
- 4 Upaved (Ayurved, Dhanurved, GandharvaVed&SthapthyaAdi.)

**UNIT-II**

- 6 Vedanga (Shisha, Kalppa, Nirukha, VYkaran, Jyothish&Chand)
- 4 Upanga (Dharma Shastra, Meemamsa, Purana&TharkaShastra)

**UNIT-III**

- Modern Science and Indian Knowledge System
- Yoga and Holistic Healthcare

**UNIT-IV**

- Philosophical Tradition ( Nyaya, ,Sankhya, Yog, Jain &Boudha
- Indian Linguistic Tradition –(Phonology, morphology, syntax and semantics)

**UNIT-V**

- Indian Artistic Tradition - Chitrakala, Vasthukala, Sangeetha, Nruthya Sahithya
- Casestudies

**TEXT BOOKS**

1. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya VidyaBhavan, Mumbai. 5<sup>th</sup>Edition,2014.
2. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya VidyaBhavan.
3. Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya VidyaBhavan.
4. FritzoF Capra, *Tao ofPhysics*.
5. FritzoF Capra, *The Wave oflife*.

**REFERENCES**

1. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International ChinmayFoundation, Velliarnad, Arnakulam.
2. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakashan, Delhi 2016.
3. RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, VidyanidhPrakashan, Delhi 2016.
4. P B Sharma (English translation), Shodashang Hridayan
5. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya VidyaBhavan, Mumbai. 5th Edition, 2014.
6. S.C. Chaterjee& D.M. Datta, An Introduction to Indian Philosophy, University of Calcutta, 1984.
7. K.S. Subrahmanialyer, Vakyapadiya of Bhartrihari, (Brahma Kanda), DeccanCollege Pune 1965.
8. Panini Shiksha, MotilalBanarasidas
9. V.N. Jha, Language, Thought and Reality, Vasudevasharan AGRAWAL Kala yevamSamskruthi, ShithyaBhavanElahabad, 1952.
10. Pramod Chandra, India Arts, Howard Univ. Press, 1983.
11. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.
12. R. Nagaswamy, Foundations of Indian Art, Tamil Arts Academy, 2002.

**R20**

**B. Tech – M.E**

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR  
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**III B. Tech- I Sem**

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**20ME0319 (INTERNSHIP-1)**

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**Internship-1 of 60 hours (Mandatory) after second year (to be evaluated during V semester)**

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR  
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**III B.Tech- II Sem**

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**(20ME0320) DESIGN OF MACHINE ELEMENTS-II**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Understand various elements involved in a mechanical system.*
2. *Study selection of rolling element bearing and design of hydrodynamic bearing.*
3. *Analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.*
4. *Produce assembly and working drawings of various mechanical systems involving machine elements like gears, springs etc.*
5. *Select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Create helical springs for two wheel vehicle and laminated springs for trucks.*
2. *Design and analyze journal bearings, ball bearings and roller bearings and explain the advantages of rolling contact bearings against sliding contact bearings.*
3. *Summarize the knowledge to design crane hooks, C-clamps and various belt, rope and chain drives.*
4. *Design spur and helical gears for different input conditions*
5. *Explain bevel gears and its classification*
6. *Apply the concepts to know various forces acting on I.C. engine parts and failure criteria to be adopted for various parts.*

**UNIT-I**

**Design of Mechanical Springs**– Types of springs, Stress and deflections of helical springs, coaxial springs, Energy storage capacity. Design of Helical Torsion springs, and Design of Leaf springs.

**UNIT-II**

**Design of sliding contact Bearings:** Types of bearings, Lubrication, Bearing Modulus, bearing materials, journal bearing Design.

**Design of rolling contact bearing:** Design of Ball and roller bearings, Static loading of ball & roller bearings, bearing life, Failure of bearings, Design for variable loading.

**UNIT-III**

**Design of Curved Beams:** Introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular and T-Section, Design of crane hooks, C –clamps.

**Design of Power Transmissions Systems-** Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes.

**UNIT-IV**

**Spur & Helical Gears** –Nomenclature of spur and Helical gears, Force Analysis, Load concentration factor, Dynamic load factor, Surface compressive strength, Bending strength, Design analysis of spur gears, Estimation of center distance, module and face width, check for plastic deformation, Check for dynamic and wear considerations.

**UNIT-V**

**Design of Gears:** Design of Bevel and Worm Gears

**Design of IC Engine Parts:** Cylinder and Cylinder Liner, Design of a Cylinder. Piston - Design Considerations for a Piston, Material for Pistons, Piston Head or Crown, Piston Rings. Connecting Rod - Forces Acting on the Connecting Rod, Design of Connecting Rod.

**TEXT BOOKS**

1. R.S. Kurmi and J.K. Gupta, *Machine Design*, S. Chand Publications, 1st Multi color Edition, 2005.
2. V.B. Bhandari, *Design of Machine Elements*, Tata McGraw Hill Publications, 2nd Edition, 2007.

**REFERENCES**

1. Sadhu Singh, *Machine Design*, Khanna Publications, 1st Edition, 2019.
2. Dr. G. K. Vijayaraghavan & Dr. S. Vishnupriyan, *Design of Machine Elements*, Laxmi Publications, 6th Edition, 2015.
3. C.S. Sharma, *Design of Machine Elements*, PHI Learning Pvt. Ltd., 1st Edition, 2002.
4. Machine Design by Pandya and Sha, Chatotra Publications

**DATA BOOKS**

1. *Design Data Book* by PSG College of Technology.
2. *Design Data Handbook for Mechanical Engineering* in SI and Metric Units by Balaveera and Mahadevan.

NOTE: Design data books are permitted

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**III B.Tech- II Sem**

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**(20ME0321) METROLOGY AND MEASUREMENTS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Use of slip gauges, system of limits, fits & tolerances and design of gauges.*
2. *Identify the use of Comparators (Mechanical, Optical, and Electrical & Pneumatic), Sine bar, Interferometer, and measurement of Screw threads & Gear tooth parameters.*
3. *Know the measurement of screw thread, Gear profiles.*
4. *Describe the Measurement of Displacement, Speed and Stress- Strain.*
5. *Illustrate the measuring process of Pressure, Force, Torque, and Temperature & Power.*
6. *Do the instrument calibration*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Describe the concept of different types of dimensional tolerances and fits.*
2. *Explain the basic standards of measurements and also application of Slip gauges.*
3. *Evaluate engineering parts with various precision instruments.*
4. *Check the surface roughness of parts.*
5. *List out various measuring techniques for Pressure, Strain and Temperature.*
6. *Estimate the Instruments accuracy and Perform calibration of measuring instruments.*

**UNIT-I**

**Limits, Fits & Tolerances:** Introduction, Definition of limits and tolerances– unilateral and bilateral tolerance system, Types of Fits, Hole and Shaft basis systems – Interchangeability and selective assembly, Indian standards– International Standard.

**Limit Gauges and Gauge Design:** Plug Ring, Snap, Gap, Taper gauges. Taylor`s principle.

**UNIT-II**

**Linear Measurement:** Calibration of Slip gauges, Vernier gauges, Micrometers, Dial indicator.

**Measurement of Angles and Tapers:** Bevel protractor, Sine bar, Angle gauges, Spirit level, Clinometer.

**UNIT-III**

**Surface Measurement:** Surface roughness, Surface waviness- Terminology`s of surface finish – CLA, R.M.S Values – Ra, Rz values, BIS symbols for indication of surface finish, Talysurf, Auto collimators.

**Screw Thread Measurement:** Elements– Measurement of diameters, angle of thread and thread pitch– Errors In Screw Threads, Toolmaker`s microscope.

**Gear Measurement:** Elements -Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, tooth thickness.

**UNIT-IV**

**Measurement of Displacement and Speed:** Theory and construction of various transducers to measure displacement - Piezoelectric, Inductive, capacitance, resistance, ionization and Photo electric transducers. Mechanical Tachometers - Electrical tachometers.

**Stress & Strain Measurements:** Various types - Electrical strain gauge - method of usage of Resistance strain gauge for bending, compressive and tensile strains - usage for measuring Torque, Strain gauge rosettes.

**UNIT-V**

**Measurement of Temperature:** Standards and calibration of thermal expansion methods, thermocouples, Electrical Resistance sensors, Digital thermometers.

**Measurement of Pressure:** Standards and Calibration - Basic methods of pressure measurement, Dead weight gauges and Manometers.

**Measurement of Force, Torque, Power:** Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, Shaft power measurement.

**TEXT BOOKS**

1. M. Mahajan, *Engineering Metrology*, Dhanpat Rai publisher, 2<sup>nd</sup> Edition, 2013.
2. R.K. Jain, *Engineering Metrology*, Khanna Publishers, 20<sup>th</sup> Edition, 2013.

**REFERENCES**

1. Thomas G. Beckwith, Roy D. Marangoni, *Mechanical Measurements*, John H. Lien hard V, Pearson Publisher, 6<sup>th</sup> Edition, 2006.
2. Earnest. O Doebelin, *Measurement systems Application and design*, McGraw Hill Higher Education, 4<sup>th</sup> Revised Edition, 1990.
3. Dr. D.S. Kumar, *Mechanical Measurements & Control*, Metropolitan Book Co. (P) Ltd., 5<sup>th</sup> edition, 2015

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**III B.Tech- II Sem**

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**(20ME0322) NON- CONVENTIONAL ENERGY RESOURCES**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Know the importance of energy, resources of renewable energy, their usage and impact on environment.*
2. *Recognize the significance of solar energy, its harnessing technologies & its applications.*
3. *Identify the method of exploiting energy from wind and parameters to be considered for the selection of site for wind turbine installation.*
4. *Explain the concept of bio energy and its conversion devices.*
5. *Differentiate various renewable energies such as tidal energy, fuel cells.*

**COURSE OUTCOMES**

On successful completion of the course, the student will be able to

1. *State various sources of energies, its availability and explain the importance of them by observing the global energy scenario.*
2. *Distinguish the types of solar energy tapping devices and describe the method of harnessing the solar energy.*
3. *Summarize the wind energy systems and elucidate the impact of it in environmental aspects.*
4. *Describe the biomass conversion process and list out various bioenergy applications.*
5. *Interpret the knowledge of renewable energies such as tidal energy, OTEC.*
6. *Identify numerous applications renewable energy resources and illustrate its harnessing technologies.*

**UNIT-I**

**Fundamentals of Energy system:** Energy source, various forms of renewable energy, Conservation of energy and Energy scenario, need for non-conventional energy sources, alternative energy sources, Environmental consequences of oil fuel use, Role of new and renewable sources.

**Solar Radiation:** Environmental Impact of solar power, Direct & Diffuse Radiation, Terrestrial and extraterrestrial solar radiation, Solar radiation on tilted surface- Measurement of Solar Radiation using Pyranometer, Pyrheliometer, and Sunshine recorder.

**UNIT-II**

**Solar thermal conversion:** Flat Plate and Concentrating Collectors – Solar direct Thermal Applications– Solar thermal Power Generation

**Photo voltaic Conversion:** Fundamentals of Solar Photo Voltaic Conversion – Solar Cells –Solar PV Power Generation – Solar PV Applications

**UNIT-III**

**Wind Energy:** Wind Formation - Site Selection for Wind Turbine – wind speed and power relations, power extracted from the wind.

**Wind Energy System:** Types of Wind Energy Systems – Components of Wind Turbine – Horizontal Vs Vertical axis turbine -Performance –Safety and Environmental Aspects.

**UNIT-IV**

**Bio – Energy:** Origin of biomass, Bioenergy conversion technology – Biomass gasifiers: classification of biomass gasifiers, Biogas plants: classification of biogas plant

**Bio Fuel:** Ethanol production – Biodiesel – Cogeneration - Applications of Biofuel

#### UNIT-V

**Hydrogen Energy:** production of Hydrogen-Storage and Transportation of Hydrogen, Safety aspects and Applications of hydrogen.

**Other Sources of Energy:** Tidal energy – Wave Energy –OTEC Cycles - Open and Closed OTEC cycles, Geothermal Energy- Types of cycles

#### TEXT BOOKS

1. R. K.Rajput, *Non-conventional Energy Sources and Utilization*, S. Chand Publishers, 2<sup>nd</sup> Edition, 2014.
2. G. D Rai, *Non-Conventional Energy Sources*, Khanna Publishers, 1<sup>st</sup> Edition, 2010.
3. Nicholas Jenkins & Janaka Ekanayake, *Renewable Energy Engineering*, Cambridge University Press; 1<sup>st</sup> Edition, 2017.

#### REFERENCES

1. Dr. R K Singal, *Non-Conventional Energy Resources*, S.K Kataria & Sons, 4<sup>th</sup> Edition, 2014.
2. John Twidell & Tony Weir, *Renewable Energy Sources*, Routledge publisher, 3<sup>rd</sup> Edition, 2015.
3. Sukhatme. S.P, *Solar Energy, Principles of Thermal Collection and Storage*, Tata McGraw Hill Publishing Company Limited, 6<sup>th</sup> Edition, 1990.

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**III B.Tech- II Sem**

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**(20ME0332) AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS  
[Professional Elective Course (PEC)– II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Study basic principles of batteries and starting system*
2. *Understand the charging system lighting and accessories*
3. *Understand the spark plugs, ignition systems*
4. *Know the advance mechanisms in automobiles*
5. *Describe the working of various Sensors and microprocessors in automobiles*
6. *Gain knowledge in safety systems in automobile.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Identify the batteries and starting system in automobile*
2. *Understanding the working of charging system lighting and accessories*
3. *Describe how the electronic ignition and injection system operation*
4. *Apprehend the advance mechanisms in automobiles*
5. *Identify sensors and microprocessors in automobiles*
6. *Understand importance safety systems in automobiles*

**UNIT I**

**Automobile Engineering components:** -Introduction of vehicle chassis, Clutches, Gears.

**Batteries and starting system:** Different types of batteries – principle, rating testing and charging.

**Starter motors:** Characteristics, capacity requirements. Drive mechanisms. Starter switches

**UNIT II**

**Charging system lighting and accessories:** DC generators and alternators their characteristics. Control unit- cut out, electronic regulators.

**Vehicle lighting system:** Vehicle interior and exterior lighting system. Wiring Requirements. Lighting design. Dashboard instruments, Horn, trafficator.

**UNIT III**

**Electronic ignition:** Spark plugs. Advance mechanisms. Different types of ignition systems.

**Fuel injection systems:** Electronic fuel injection systems, Multi point fuel injection system (MPFI), Common rail direct injection system (CRDI).

**UNIT IV**

**Sensors and Microprocessors in Automobiles:** Basic sensor arrangements. Types of sensors – oxygen sensor, Hot wire anemometer sensor, Vehicle speed sensor, Detonation sensor, accelerometer sensor, Crack position sensor.

**Microprocessor and microcomputer controlled devices in automobiles:** Voice warning system, Travel information system(TIS), Keyless entry system, Automatic transmission system(ATS), Electronic steering system(ESS).

**UNIT V**

**Safety systems:** Antilock braking system, Air bag restraint system, Voice warning system,

**Seat belt system:** Road navigation system, Anti-theft system.

**TEXT BOOKS**

1. Kirpal Singh, *Automobile Engineering*, Vol.1 & Vol.2, Standard Publishers Distributors, 13<sup>th</sup> Edition, 2013
2. Judge. A.W., *Modern Electrical Equipment of Automobile*, Chapman & Hall. Landon, 1992

**REFERENCES**

1. Young.A.P., & Griffiths.L., *Automobile Electrical Equipment*, English language book society new press, 1990
2. Spreadbury. F.G, *Electrical Ignition Equipment*, constable & Co Ltd., London, 1962
3. Robert N Brady, *Automotive Computers And Digital Instrumentation*. A Reston book, prentice Hill, Eagle wood cliffs, New jersey, 1988.

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**III B.Tech- II Sem**

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**(20ME0333) AUTOMOBILE ENGINEERING**

**[Professional Elective Course (PEC)– II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Study basic principles of actual Automobile systems*
2. *Understand the construction and principle of operation various parts of an automobile*
3. *Identify the importance and features of different systems like axle, differential, brakes, Steering, suspension, and balancing*
4. *Describe the working of various Fuel supply system and pollution in Automobile Systems*
5. *Gain knowledge in functioning of the engine and its accessories, gear box, clutch, braking system*
6. *Study basic principles of steering Braking System Automobile systems*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Identify the different parts of the automobile system for future developments in the automobile industry*
2. *Understanding the working of various parts like engine, transmission, clutch, brakes*
3. *Describe how the steering and the suspension systems operate*
4. *Apprehend the environmental implications of automobile emissions*
5. *Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems*
6. *Understand importance and features of different systems like axle, differential, steering, suspension, and balancing*

**UNIT I**

**Engine Components & Chassis:** Classification of automobiles- IC Engine components –Functions - SI and CI Engine, combustion and combustion chambers

**Types of drives, Types of Automobile Chassis** - vehicle chassis, frame and body constructional features

**UNIT II**

**Fuel Supply System:** Fuel injection system for MPFI, CRDI and Turbocharger, Cooling System: Radiators, Thermo-syphon cooling system and Forced circulation cooling system

**Pollution standards:** National & International pollution control techniques- Three way catalytic converter, Alternate fuels

**UNIT III**

**Engine lubrication:** Properties of Lubricants- Grading- Types of lubrication Systems- Filters

**Electrical system:** Ignition Systems, Battery coil ignition system and magnetic coil ignition system. Starting system, Bendix drive. Solenoid switch, lighting, horn, wiper, fuel gauge, speedometer, temperature indicator

**UNIT IV**

**Transmission System:** Clutches- Classification of clutches - Fluid coupling -Propeller shaft

**Gear Box:** Types- over drive- torque converter, propeller shaft- Hotch-kiss drive, Torque tube drive, Universal Joint, Differential, Rear Axle, front axle

**UNIT V**

**Steering and Suspension system:** Steering gears, Types of steering gears, Suspension Systems, Rigid Axle Suspension System and Independent Suspension System-Torque bar, shock absorber

**Braking System:** Hydraulic Brakes, Pneumatic, Brakes, and Vacuum Braking System, ABS, EBD and Traction control

**TEXT BOOKS**

1. Kirpal Singh, *Automobile Engineering*, Vol.1 & Vol.2, Standard Publishers Distributors, 13<sup>th</sup> Edition, 2013
2. William Crouse, *Automobile Engineering*, TMH, 10<sup>th</sup> Edition, 2006

**REFERENCES**

1. Ramalingam K.K, *Internal combustion engines – theory and practice*, Sci Tech Publication India Pvt. Ltd, Chennai, 3<sup>rd</sup> Edition 2000
2. Willam H.crouse, *Automotive Engines*, McGraw Hill Publishers, 8<sup>th</sup> Edition 1985
3. R.K. Rajput, *Automobile Engineering*, Laxmi Publications, 1<sup>st</sup> Edition, 2013

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR  
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**III B.Tech - II Sem**

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**(20ME0334) THEORY OF COMBUSTION AND EMISSION  
[Professional Elective Course (PEC)– II]**

**COURSE OBJECTIVES**

The Objective of this course is to

1. *Understand the basic terminology of combustion, reactions and flame propagation*
2. *Know the combustion phenomenon in SI engines and the parameters which effect the combustion*
3. *Comprehend the concept of spray behavior in diesel engines and the design considerations of combustion chamber*
4. *Recognize the importance of gas turbine combustion and the materials used for that*
5. *Know the importance of emission reduction from engines*
6. *Understand the different types alternative fuels emissions in vehicles*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Understand the Combustion reaction equations and the factors affecting the flame propagation*
2. *Interpret Types of combustions in S.I engines and after treatment devices*
3. *Analyze Stages of combustion in C I engines and the influence of injection parameters in combustion*
4. *Gain knowledge in Gas turbine combustion phenomenon and the materials used for combustion chamber*
5. *Understand the Formation of emissions in combustion devices and the methods of controlling the emissions*
6. *Summarize the different types alternative fuels emissions in vehicles*

**UNIT I**

**Combustion Principles:** Combustion - Combustion equations, heat of combustion - Theoretical flame temperature, Chemical equilibrium and dissociation.

**Theories of Combustion:** Pre-flame reactions, Reaction rates-Laminar and Turbulent, Flame Propagation in Engines.

**UNIT II**

**Combustion in SI Engine:** Initiation of combustion, stages of .combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables.

**Features and design:** consideration of combustion chambers.- Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems, Heat release correlations.

**UNIT III**

**Combustion in CI Engine:** Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement.

**Features and design:** considerations of combustion chambers- delay period correlations, heat release correlations, and influence of the injection system on combustion.

**UNIT IV**

**Combustion in Gas Turbines:** Flame stability, Re-circulation zone and requirements – Types of combustion systems, Requirements of combustion chambers, Combustion chamber configuration.

**Factors affecting the combustion chamber:** Design and performance, Use of cheap fuels and its effect- gas turbine emissions and its reduction.

**UNIT V**

**Emissions:** Main pollutants in engines, Kinetics of NO formation, NO<sub>x</sub> formation in SI and CI engines. CO emissions, Unburned-hydrocarbons, sources, formation in SI and CI engines.

**Emission control:** Control measures for SI and CI engines, Effect of emissions on environment and human beings.

**TEXT BOOKS**

1. V.Ganesan, *Internal Combustion Engines*, Mc Graw Hill, second edition, 2006
2. R. K. Rajput, *Internal Combustion Engine*, Laxmi Publications, second edition, 2014

**REFERENCES**

1. V.Ganesan, *Gas Turbines*, Tata McGraw Hill, second edition, 2006
2. Williard. W. Pulkrabek, *Engineering Fundamentals of the Internal Combustion Engines*, Prentice Hall, Second Edition, 2005
3. Hoon Kiat Ng, *Advances in Internal Combustion Engines and Fuel technologies*, Intech Publications, First Edition, 2013

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III B.Tech –II Sem.

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**(20CE0147) FUNDAMENTALS OF URBAN PLANNING  
[Open Elective (OE)-II]**

**COURSE OBJECTIVES**

The objectives of this course to

1. *Understand the concept of balanced town by ensuring that new and existing facilities are complimentary to each other*
2. *Provide sustainable buildings by considering the environmental, social and economic conditions*
3. *Create awareness about the traffic management within the town*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Recognize issues related to town planning and discuss the objectives, necessity and stages of town planning*
2. *Summarize importance of zoning, can classify various town planning practices and can conduct surveys for town planning*
3. *Classify the residential building, list the agencies involved in improving house and review the problems associated with residential housing*
4. *Discuss the issues associated with slums and recognize the methods to improve condition of slums*
5. *Interpret norms laid down for public and industrial building and can summarize building bye-laws*
6. *List and discuss various urban roads and the concepts of traffic management in a town*

**UNIT – I**

**Introduction to Town Planning:** Objects of town planning - Necessity of town planning - Principles of town planning - Stages of Town Planning - Origin and growth of towns - Development of towns - Modern town planning in India - Socio - Economic aspects of town planning - Selection of site for an ideal town – Cost of town planning.

**UNIT – II**

**Surveys & Planning:** Various types of surveys to be conducted for town planning project - Data to be collected in different types of town planning survey - Types of planning - A brief note on urban, rural and regional planning.

**Zoning:** Definition - Objects and principles of zoning - Advantages of zoning - Special Economic Zone (SEZ) - Maps for zoning.

**UNIT – III**

**Housing:** Classification of residential building as per HUDCO norms - Low Cost Housing - Housing policy - Different types of housing agencies involved in housing - Investment in Housing - Housing Problems in India.

**Slums:** Causes - growth - Characteristics - Effects - Slum clearance and re-housing - Prevention of slum formation - Financial assistance for slum clearance.

#### UNIT – IV

**Public Buildings & Industries:** Classification - Location - Design Principles of public building - Grouping of public buildings - Effects of Industries on towns and cities - Classification of industries – Requirements of an industry - Regulation of their location.

**Building Bye-Laws:** Objectives of bye-laws - Importance of bye-laws - Function of local authority - Responsibility of owner - Applicability of bye-laws - Principles underlying building bye-laws.

#### UNIT – V

**Urban Roads:** Objectives – Requirements - Classification - Types of street systems - Through and bypass roads - Outer and inner ring roads - Expressways - Freeways.

**Traffic Management:** Objectives - Traffic surveys - Traffic congestion - Traffic control - Parking - Road accidents - Traffic capacity of roads - Road intersections - Traffic islands - Roundabouts - Traffic signals - Road signs - Road markings - Street lighting in a town.

#### TEXT BOOKS

1. Rangwala, *Town Planning*, Charotar Publishing, 30<sup>th</sup> edition, 2018
2. G K Hiraskar, *Fundamentals of Town Planning*, Dhanpat Rai Publications, New Delhi, 17<sup>th</sup> edition, 2018

#### REFERENCES

1. Abirb and yopadhyay, *Text book of Town Planning*, Books & Allied (P) Ltd, 2000
2. Peter Hall and Mark Tewdwr-Jones, *Urban and Regional Planning*, Routledge Publications, 5<sup>th</sup> edition, 2010
3. Catanese A J, *Urban Planning*, McGraw Hill Publications, 2<sup>nd</sup> edition, 2014

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III B.Tech – II Sem.

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**(20EE0235) INDUSTRIAL INSTRUMENTATION  
[Open Elective (OE)-II]**

**COURSE OBJECTIVES**

The objectives of this course are to

1. *Analyse the Common errors that occur in measurement systems, and their classification.*
2. *Understand the characteristics of signals, their representation, and signal modulation techniques.*
3. *Learn the Methods of Data Transmission, Telemetry, and Data acquisition.*
4. *Study working principles of different Signal Analyzers and Digital meters.*
5. *Learn about several types of transducers and their use for measurement of non-electrical quantities.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Identify and explain the types of errors occurring in measurement systems.*
2. *Differentiate among the types of data transmission and modulation techniques.*
3. *Apply digital techniques to measure voltage, frequency and speed.*
4. *Analyse the working principles of different Signal Analyzers and Digital meters.*
5. *Understand the operation of several types of transducers.*
6. *Choose suitable Transducers for the measurement of non-electrical quantities.*

**UNIT-I**

**Characteristics of Signals and their representation:** Measuring Systems, Performance Characteristics, Static Characteristics, Dynamic Characteristics; Errors in Measurement Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signals and their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

**UNIT-II**

**Data Transmission, Telemetry and DAS:** Methods of Data Transmission–General Telemetry System .Frequency Modulation (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Data Acquisition Systems –Components of Analog DAS–Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing –Digital DAS–Block Diagram—Modern Digital DAS (Block Diagram)

**UNIT-III**

**Signal Analyzers, Digital Meters:** Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers-Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, QMeter. Peak Reading and RMS Voltmeters, Digital Voltmeters- Successive Approximation, Ramp and Integrating Type- Digital Frequency Meter- Digital Multimeter- Digital Tachometer

**UNIT-IV**

**Transducers:** Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle of Operation of Resistive, Inductive, Capacitive Transducers, LVDT, Strain Gauge and its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Synchros, Piezo electric Transducers, Photovoltaic, Photo Conductive Cells, Photodiodes.

**UNIT-V**

**Measurement of Non-Electrical Quantities:** Measurement of strain, Gauge Sensitivity, Measurement of Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

**TEXTBOOKS:**

1. A.K. Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai & Co., 2012.
2. D.V.S. Murty, *Transducers and Instrumentation*, Prentice Hall of India, 2<sup>nd</sup> Edition, 2004.

**REFERENCE BOOKS:**

1. A. Dhelfrick and W.D. Cooper, *Modern Electronic Instrumentation and Measurement technique*, Pearson/Prentice Hall of India., 1990.
2. H.S. Kalsi, *Electronic Instrumentation*, Tata McGraw-Hill Edition, 2010.
3. T.R. Padmanabhan, *Industrial Instrumentation–Principles and Design*, Springer,

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**(20EC0452) ELEMENTS OF EMBEDDED SYSTEMS  
[Open Elective (OE)-II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the fundamental concepts of embedded systems.*
2. *Learn the core of embedded systems.*
3. *Learn to program the open source electronics.*
4. *Understand the principles of Internet of Things (IoT).*
5. *Understand the concepts of Internet of Things (IoT).*

**COURSE OUTCOMES**

On successful completion of this course, students will be able to

1. *Differentiate between general computing system and the embedded system, also recognize the classification of embedded systems.*
2. *Enumerate and describe the components of an embedded system.*
3. *Learn about open source electronics platform.*
4. *Program an embedded system by interfacing sensors & actuators.*
5. *Identify the basic building blocks of Internet of Things and characteristics.*
6. *Implement their own ideas in various application areas of Embedded systems and IoT.*

**UNIT – I**

**Introduction to Embedded Systems:** Definition –Embedded systems vs General computing systems – History – Classification – Purpose - Major application areas – Characteristics – Architecture of embedded system – CPU, RAM & ROM, timers, clocks, address bus & data bus – overview of design process of embedded systems – programming languages and tools for embedded design.

**UNIT – II**

**Typical Embedded System:** Core of the embedded system– RISC vs CISC design philosophy– Memory – Harvard and Von-Neuman architecture–sensors and actuators– Other system components – reset, brownout protection, oscillator, RTC, Watch dog timer. Embedded firmware.

**UNIT – III**

**Communication:** Communication Interfaces – On-board (I2C, SPI, UART, 1-wire interface, parallel interface), External (RS-232 & RS-485, USB, IEEE 1394, IrDA, Bluetooth, Wi-Fi, ZigBee, GPRS).

**UNIT – IV**

**Designing of Embedded Systems with Arduino Microcontrollers:** Introduction to Arduino platform– Overview of Arduino UNO board–ATMega328/P Block diagram–Pin functions– Introduction to Arduino programming –Interfacing & programming sensors –Interfacing & programming actuators Interfacing & programming serial communication devices.

**UNIT – V**

**Introduction to IOT:** Introduction to Internet of Things– reference architecture of IoT– Internet principles – IP addresses, MAC addresses, TCP and UDP ports– Application layer protocols– Data protocols– MQTT, XMPP, CoAP– challenges of IoT, Case studies demonstrating IoT – Home automation, cities, Environment, Agriculture.

**TEXT BOOKS**

1. Shibu K V, *Introduction to Embedded systems*, Tata McGraw-Hill Education, 1<sup>st</sup> Edition, 2009.
2. Raj Kamal, *Embedded systems*, Tata McGraw-Hill Education, 2<sup>nd</sup> Edition, 2011.
3. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press/Orient Black Swan Pvt. Ltd, 1<sup>st</sup> Edition, 2015.

**REFERENCES**

1. Adrian McEwen & Hakim Cassimally, *Designing of Internet of Things*, John Wiley and sons Ltd, 1<sup>st</sup> Edition, 2014.

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**(20CS0551) JAVA PROGRAMMING  
[Open Elective (OE)-II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Introduce standard tools and techniques for software development.*
2. *Understand the object oriented approach for automated software build process.*
3. *Introduce the concepts of AWT framework.*

**COURSE OUTCOMES (COs)**

On successful completion of this course, the student will be able to

1. *Implement simple abstract data types and design abstraction functions.*
2. *Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.*
3. *Apply object-oriented design patterns for problem solving.*
4. *Implement Exception handling with synchronization.*
5. *Execute programs on Multithreading and String handling concepts.*
6. *Design applications with an event-driven graphical user interface.*

**UNIT- I**

**The Java Language:** Importance of Java -Programming Paradigms -The History and Evolution of Java -Java Byte Code.

**Introduction of OOP:** Abstraction, Encapsulation, Inheritance, Polymorphism-Understanding static - Varargs -Data Types -Type Casting -Java Tokens - Java Statements -Arrays.

**UNIT- II**

**Introducing Classes** –Class Fundamentals -Declaring Objects -Introducing Methods Introduction to Constructors -Garbage Collection-Introducing final -Inheritance - Method Overriding -abstract classes -Packages and Interfaces.

**UNIT- III**

**Exception Handling** - Exception Fundamentals - Exception Types -Uncaught Exceptions - Using try and catch - Nested try Statements -throw -throws –finally -Creating Your Own Exception Subclasses - Chained Exceptions.

**UNIT-IV**

**Multithreaded Programming** - The Java Thread Model -Thread Priorities -The Thread Class and the Runnable Interface - Creating Multiple Threads -Using isAlive( ) and join( ) –Synchronization- String Handling.

**UNIT- V**

**Generics**-A simple Generic Example-General form of Generic class -Generic Interfaces Collection Framework-Collections overview, Collection class, Collection interfaces.

**Introducing the AWT** - Using AWT Controls-Layout Managers -Introducing Swing -Exploring Swing.

**TEXT BOOKS**

1. Herbert Schildt, *The Complete Reference Java*, Eighth Edition , McGraw Hill.
2. Y Daniel Liang, *Introduction to Java programming* — Que E &T.

**REFERENCES**

1. P.J. Deitel and H.M. Deitel, *Java for Programmers*, Pearson education.
2. Bruce Eckel, *Thinking in Java*, Pearson Education.

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**(20HS0814) INTELLECTUAL PROPERTY RIGHTS  
[Open Elective (OE)-II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Provide an understanding of the concept and significance of intellectual property rights*
2. *Understand the concept of trademarks, copy rights, patents and the need for their protection*
3. *Comprehend the concept of competition, unfair competition and the latest developments in the laws pertaining to intellectual property rights*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Become aware of intellectual property rights, concepts, treaties, agencies and international organizations involved in sanctioning IP rights*
2. *Identify different types of intellectual properties, ownership rights and the scope of the protection*
3. *Get an adequate knowledge on patents, trademarks, copy rights and to get property rights for their intellectual work*
4. *Able to identify, apply, and assess ownership rights, registration processes for IP rights*
5. *Discern the approaches for intellectual property management and intellectual property audits*
6. *Have Demonstrate knowledge and understanding the impact of unfair competition and latest developments in IP rights at international level*

**UNIT-I**

**INTRODUCTION TO INTELLECTUAL PROPERTY:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT-II**

**TRADE MARKS:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

**UNIT-III**

**LAW OF COPY RIGHTS:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

**LAW OF PATENTS:** Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT-IV**

**TRADE SECRETS:** Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.

**UNFAIR COMPETITION:** Misappropriation right of publicity, False advertising.

**UNIT-V**

**NEW DEVELOPMENT OF INTELLECTUAL PROPERTY:** new developments in trade mark law; copy right law, patent law, intellectual property audits -International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

**TEXT BOOKS**

1. Deborah, E. Bouchoux, *Intellectual property right*, cengage learning
2. Nityananda KV, *Intellectual property rights: Protection and Management*. Cengage Learning India Private Limited.

**REFERENCES**

1. Prabuddha ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.
2. Ahuja VK, *Law relating to Intellectual Property rights*. IN: Lexis Nexis
3. Neeraj P & Khushdeep D, *Intellectual Property Rights*, India. PHI learning Pvt limited.

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**(20ME0323) COMPUTER AIDED MODELING LAB-II**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Impart brief knowledge on Solid edge software.*
2. *Familiarize student with various commands used to sketch a part.*
3. *Make the student draw various part drawings using solid edge software.*
4. *Learn various assembly commands used to assemble the component.*
5. *Make the student assemble various part drawings of the component.*
6. *Understand the uses of different tools used in assemble the component.*

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. *Describe the interface of Solid edge software.*
2. *Explain various commands used to sketch a part.*
3. *Understand the use of different commands in Assembly interface.*
4. *Draw various part drawings using solid edge software.*
5. *Summarize various assembly commands used to assemble the component.*
6. *Produce a component by assembling various part drawings of the component.*

**List of Experiments**

1. Introduction to Solid Edge Software.

**2. PART DRAWINGS**

- a) Modeling of Component in 3D– MACHINE ELEMENTS
- b) Modeling of Component in 3D– MACHINE LINK 1
- c) Modeling of Component in 3D– MACHINE LINK 2
- d) Modeling of Component in 3D– BRACKET
- e) Modeling of Component in 3D– DOVETAIL STOP

**3. ASSEMBLY DRAWINGS**

- a) Assembly of Component in 3D- KNUCKLE JOINT
- b) Assembly of Component in 3D- SCREW JACK
- c) Assembly of Component in 3D- FLANGE COUPLING
- d) Assembly of Component in 3D- UNIVERSAL COUPLING

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**(20ME0324) INSTRUMENTATION & CONTROL SYSTEMS LAB**

**COURSE OBJECTIVES**

The objective of the course is to

1. Prepare the students for successful career in industry and motivate for higher education.
2. Provide strong foundation to solve control and instrumentation problems
3. Provide strong foundation in circuit theory, control theory and signal processing concepts.
4. Provide good knowledge of Instrumentation systems and their applications.
5. Provide knowledge of advanced control theory and its applications to engineering problems

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. Characterize and calibrate measuring devices.
2. Identify and analyse errors in measurement.
3. Analyse measured data using regression analysis.
4. Understand the Calibration of Pressure & Temperature.
5. Analyse and use LVDT, capacitive transducers.
6. Use flow measuring devices like rotometer

**LIST OF EXPERIMENTS**

1. Calibration of pressure gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for temperature measurement.
4. Calibration of thermocouple for temperature measurement.
5. Calibration of capacitive transducer for angular displacement.
6. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
7. Calibration of resistance temperature detector for temperature measurement.
8. Study and calibration of McLeod gauge for low pressure
9. Study and calibration of rotometer for flow measurement.
10. Calibration of thermistor for temperature measurement.

**Note:** Any 8 of the above 10 experiments are to be conducted.

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**(20ME0325) METROLOGY LAB**

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**COURSE OBJECTIVES**

The objective of the course is to

1. *Learn measurement of lengths, heights, diameters by vernier calipers micrometers*
2. *Analyze and measuring of bores by internal micrometers and dial bore indicators*
3. *Practice to use the gear teeth, vernier calipers and checking the tooth height of spur gear*
4. *Study the Tool maker's microscope and its application*
5. *Use angle and taper measurements by Bevel protractor, Sine bar*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Measure lengths, heights, diameters by Vernier calipers micrometers*
2. *Measure of bores by internal micrometers and dial bore indicators*
3. *Use gear teeth, Vernier calipers and checking the tooth height of spur gear*
4. *Use the tool maker's microscope and its application*
5. *Measure Angle and taper measurements by bevel protractor, sine bars*
6. *Measure thread by two wire / Three wire method or using tool makers microscope*

**LIST OF EXPERIMENTS**

1. Measurement of Components By Using Vernier Caliper& Vernier Height Gauge.
2. Measurement of Bores By Dial Bore Indicator.
3. Measuring of Internal Bores By Three Point Inside Micrometer
4. Measurement of Gear by Gear tooth Vernier calipers
5. Angle Measurement Using Bevel Protractor & Sine Bar.
6. Thread measurement by Floating Carriage.
7. Measurement of Surface roughness by Tally-surf roughness tester
8. Study of Tool maker's microscope and its application.
9. Measurement of depth of hole by using Depth Micrometer
10. Calibration of Dial Gauge Using Dial Gauge Tester
11. Measurement of Components By Using Outside Micrometer
12. Study of Machine tool alignment tests on lathe.

**Note:** Any 10 of the above 12 experiments are to be conducted.

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**(20ME0367) AUTOMOBILE ENGINEERING LAB- II**

**COURSE OBJECTIVES**

The objectives of the course is to

1. Know the 2 wheeler spark plug tester
2. Describe types of braking systems used in automobile
3. Educate the working of carburetor in 2 wheelers
4. Illustrate the Chassis, Frame, body in automobile vehicles.
5. Demonstration on Power transmission, brake.

**COURSE OUTCOMES**

On successful completion of the course, the students will be able to

1. Demonstrate on Automobile 2-Wheeler Spark Plug, Two Wheeler Drum Brake
2. Differentiate Disc brakes and ABS
3. Understand the importance of carburetor cleaning, air filter cleaning
4. Demonstrate on cut model of 4 stroke petrol engine
5. Understand the use of Chassis, Frame and Body in Automobile vehicles
6. Familiarize the use of steering mechanism, front axle, transmission system and brakes.

**LIST OF EXPERIMENTS:**

**PART-1 AUTOMOBILE TWO WHEELER LAB**

1. Introduction to Automobile Two wheeler with Example.
2. Study of Automobile 2-Wheeler Spark Plug Cleaner and Tester.
3. Study of Automobile Two Wheeler Drum Brake, Disc Brake Replacement.
4. Practices Carburetor Cleaning.
5. Practices Engine Oil Replacement, Chain Cleaning & Air Filter Cleaning Method.
6. Practices Cut Model of Four Stroke Motorized Petrol Engine.

**PART-2 AUTOMOBILE FOUR WHEELER LAB**

1. Introduction to Automobile Four wheeler with Example.
2. Study modern automobile vehicles.
3. Study of Chassis, Frame and Body in Automobile vehicles.
4. Study of the steering mechanism and front axle in the automobile vehicles.
5. Study of transmission system.
6. Study of different types of brakes.

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**(20HS0864) HUMAN VAUES & PROFESSIONAL ETHICS**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Create awareness on Human Values.*
2. *Impart knowledge on an Engineering Ethics*
3. *Instill morality, accountability in an engineering experimentation*
4. *Create awareness on an assessment of safety, risk and rights*
5. *Develop knowledge on global issues*
6. *Create an awareness on Human Values and appreciate the rights of others and ethics in global issues.*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Identify and analyze human values in their relevant field*
2. *Assess their own engineering ethics and have the social consciousness*
3. *Get knowledge on codes of ethics and on an utilitarian thinking*
4. *Identify safety, risks and an ethical concern in research and intellectual contexts*
5. *know necessity of computer and an environmental ethics, give a picture on weapons development*
6. *Apply the ethics in society, discuss an ethical issues related to engineering, realize the responsibilities and rights in the society*

**UNIT I**

**Human Values** - Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Necessity of Yoga and meditation for professional excellence and stress management.

**UNIT II**

**Engineering Ethics** - Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

**UNIT III**

**Engineering As Social Experimentation**- Engineering as Experimentation--Engineering Projects VS. Standard Experiments, Engineers as responsible Experimenters--Conscientiousness-Comprehensive Perspective - Moral Autonomy - Accountability, Industrial Standards, Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV**

**Safety, Responsibilities And Rights-** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk, Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

**UNIT V**

**Global Issues-**Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

**TEXT BOOKS:**

1. R S Nagarajan, *Professional Ethics and Human Values*, New Age International (P) Limited Publishers, 3<sup>rd</sup> Edition, 2006
2. M.Govindarajan, S.Natarajanad, V.S.SenthilKumar, *Engineering Ethics includes Human Values* -PHI Learning Pvt. Ltd- 2<sup>nd</sup> Edition, 2009

**REFERENCES:**

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, *Engineering Ethics – Concepts and Cases*, Cengage Learning, 2<sup>nd</sup> Edition, 2009
2. John R Boatright, *Ethics and the Conduct of Business*, Pearson Education, New Delhi, 1<sup>st</sup> Edition, 2003
3. Edmund G Seebauer and Robert L Barry, *Fundamentals of Ethics for Scientists and Engineers*, Oxford University Press, Oxford, 4<sup>th</sup> Edition, 2001
4. PSR Murthy, *Indian Culture, Values and Professional Ethics*, BS Publication, 2<sup>nd</sup> Edition, 2013

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**IV B.Tech - I Sem**

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**(20HS0812) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Familiarize the students with the concepts of microeconomics*
2. *Make to understand the concept of demand and supply analysis in business applications*
3. *Understand the pricing and output decisions under different market structures*
4. *Explain the basic financial statements and techniques of financial analysis*

**COURSE OUTCOMES**

On successful completion of this course the students will be able to

1. *Understand the nature of managerial economics and the role of it in business firms*
2. *Identify the determinants of demand and apply cost analysis under different market conditions*
3. *Integrate the concepts of price and output decisions of business firms*
4. *Appreciate the importance of market structures and implement appropriate price and output decisions*
5. *Assess the financial statements of a firm and the financial performance of the firm through the financial statements*
6. *Measure operating, investing and financial performance of a firm*

**UNIT – I**

**Introduction To Managerial Economics** - Managerial Economics - Definition, nature and scope – contemporary importance of Managerial Economics - Demand Analysis: Determinants- Law of Demand - Elasticity of Demand. Significance –Types – measurement of elasticity of demand - Demand forecasting- factors governing demand Forecasting- methods of demand forecasting – Relationship of Managerial Economics with Financial Accounting and Management.

**UNIT – II**

**Theory Of Production and Cost Analysis** -Production Function – Short-run and long- run production - Isoquants and Isocosts, MRTS, least cost Combination of inputs - Cobb-Douglas production function - laws of returns - Internal and External Economies of scale .

**Cost Analysis:** Cost concepts - Break-Even Analysis (BEA) – Managerial Significance and limitations of BEA - Determination of Break Even Point (Simple Problems).

**UNIT – III**

**Introduction to Markets and New Economic Environment** - Market structures: Types of Markets - Perfect and Imperfect Competition - Features, Oligopoly -Monopolistic competition. Price-Output determination - Pricing Methods and Strategies - New Economic Environment- Economic systems – Economic Liberalization – Privatization and Globalization

**UNIT – IV**

**Capital and Capital Budgeting** - Concept of Capital - Over and under capitalization- Remedial measures - Sources of Short term and Long term capital - Estimating Working Capital requirement – Capital budgeting – Features of Capital Budgeting proposals – Methods and Evaluation of Capital budgeting – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems).

**UNIT – V**

**Introduction to Financial Accounting and Analysis** - Financial Accounting – Concept - emerging need and importance - Double-Entry Book Keeping-Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account –Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Techniques – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

**TEXTBOOKS**

1. Aryasri, *Managerial Economics and Financial Analysis*, TMH, 4<sup>th</sup> Edition, 2009.
2. Varshney & Maheswari, *Managerial Economics*, Sultan Chand, 2009.

**REFERENCES**

1. Premchand Babu, Madan Mohan, *Financial Accounting and Analysis*, Himalaya Pub, 2009
2. S.A. Siddiqui and A.S. Siddiqui:, *Managerial Economics and Financial Analysis*, NewAge International, 2009.
3. Joseph G. Nellis and David Parker, *Principles of Business Economics*, Pearson pub, 2<sup>nd</sup> Edition, NewDelhi.
4. Domnick Salvatore, *Managerial Economics in a Global Economy*, Cengage, 2009.
5. H.L.Ahuja, *Managerial Economics*, S.Chand Pub, 3<sup>rd</sup> Edition, 2009

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**(20ME0335) FINITE ELEMENT ANALYSIS  
[Professional Elective Course (PEC)– III]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn basic principles of finite element analysis procedure.*
2. *Gain knowledge of the concepts of Nodes and elements*
3. *Know the theory and characteristics of finite elements that represent engineering structures.*
4. *Apply finite element solutions to structural, thermal, and dynamic problems.*
5. *Develop the knowledge and skills to evaluate finite element analyses effectively.*
6. *Apply the course knowledge to do design analysis.*

**COURSE OUTCOMES**

On successful completion of this course the students will be able to

1. *Understand the concepts behind formulation methods in FEA*
2. *Explain the concepts of Nodes and elements used in the analysis*
3. *Identify the application and characteristics of FEA elements such as bars, beams, trusses and frames.*
4. *Develop element characteristic equation and generation of global equation.*
5. *Apply suitable boundary conditions to Iso-parametric and dynamic problems.*
6. *Summarize the different types of techniques used in FEA.*

**UNIT – I**

**Introduction to Finite Element Analysis:** Introduction, procedure, steps, applications, Steps involved in Two dimensional, Three dimensional equilibrium equations

**Formulation Techniques:** Methodology- Engineering problems and governing differential equations-finite elements- Variational methods-potential energy method

**UNIT – II**

**One Dimensional Finite Element Methods :** Bar elements- temperature effects- Element matrices- assembling of global stiffness matrix- Application of boundary conditions- Elimination and penalty approaches- solution for displacements, reaction, stresses

**Heat transfer problems:** One - dimensional - conduction and convection problems on fins

**UNIT – III**

**Trusses:** Element matrices- assembling of global stiffness matrix- solution for displacements, reaction, stresses, temperature effects.

**Beams:** Element matrices- assembling of global stiffness matrix- solution for displacements, reaction, stresses

**UNIT – IV**

**Two Dimensional Problems:** CST- LST, four noded and eight noded rectangular elements, Lagrange basis for triangles and rectangles -serendipity interpolation functions.

**Heat Transfer Problems:** Conduction and convection- two-dimensional fin

**UNIT – V**

**Iso-parametric Formulation:** Concepts - sub parametric- super parametric elements- numerical integration

**Finite Elements in Structural Dynamics:** Dynamic equations- Eigen value problems, and their solution methods, simple problems

**TEXTBOOKS**

1. Daryl L. Logan, *A First Course in the Finite Element Method*, 4<sup>th</sup> Edition, Chris Carson publishers, 2012
2. Tiruapathi R Chandruputla and Ashok D. Belegundu, *Introduction to Finite element in Engineers*, 4<sup>th</sup> Edition, Pearson Publishers, 2012
3. J N Reddy, *Finite element method in Heat transfer and fluid dynamics*, CRC press, 2<sup>nd</sup> Edition, 1994

**REFERENCES**

1. Zienkiwicz O.C. & R. L. Taylor, *Finite Element Method*, McGraw-Hill, 1983
2. J. N. Oden, *Finite Element of Nonlinear continuation*, McGraw-Hill, New York, 1971
3. K. J. Bathe, *Finite element procedures*, Prentice-Hall, 1996

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IV B.Tech - I Sem

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**(20ME0336) OPERATION RESEARCH  
[Professional Elective Course– III]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn about different Research models.*
2. *Know about Transportation and Assignment problems*
3. *Develop the best strategy of Game and identifying the Queuing theory.*
4. *Explain about optimum Duration in PERT and CPM Techniques.*
5. *Understand the importance of Replacement models*
6. *Recognize the optimum production in sequencing of machines*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Use mathematical models of the real time situations by using different Research models.*
2. *Implement Transportation and Assignment problems to solve the real time industry needs.*
3. *Choose the best strategy of Game and capable of identifying the suitable Queuing theory.*
4. *Optimization of the Project, by applying CPM and PERT Technique in real time industry.*
5. *Apply knowledge of failure mechanisms and Replacement models.*
6. *Find the sequence of machine for optimum production time.*

**UNIT-I**

**Introduction to OR and Linear Programming**-OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method (Minimize & Maximize), Degeneracy – Problems.

**UNIT-II**

**Transportation Problem** – Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel,s Approximation Method, Modified Distribution (MODI) Method, Balanced & Unbalanced Transportation, Maximize profit - Problems

**Assignment Problem** – Formulation, Optimal Solution, Hungarian Assignment method, Traveling Salesman - Problems.

**UNIT-III**

**Game Theory** - Introduction – Minimax (Maximini) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy and Mixed Strategies – 2 X 2 Games – Dominance Principle-Problems

**Queuing Theory**- Introduction to queuing system–Service Channel, Arrival Pattern, Size of Population, Service Pattern, Queue Discipline, Customer Behavior, Probability Distribution-Birth & Death Process, Simple Problems on Single Service channel only.

**UNIT-IV**

**PERT & CPM:** Introduction, Difference between PERT and CPM, Terminology- Activities, Events, Predecessor, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float; CPM- Deterministic Model; PERT- Probabilistic Model, Critical Path, Optimal Project Duration- Problems.

**UNIT-V**

**Sequencing** –Terminology - Johnson's Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

**Replacement**– Failure Mechanism of Items, Types of Replacements-Individual Replacement policy, Group Replacement policy, Replacement of items fail suddenly –problems

**TEXT BOOKS**

1. S. D. Sharma, *Operations Research*, KNRN Publications. 17<sup>th</sup> Edition 2015
2. Hamdy A Taha , *Operations Research*, Pearson Publications, 9<sup>th</sup> Edition 2015

**REFERENCES BOOKS**

1. M. Mahajan, *Operations Research*, Dhanpat Rai & CO, 7<sup>th</sup> Edition 2016
2. Er. Premkumar Guptha & Dr.D.S. Hira, *Operations Research*, S. Chand Publications, 9<sup>th</sup> Edition, 2012.
3. R. Panneerselvam, *Operations Research*, PHI, 2<sup>nd</sup> Edition, 2012.

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**IV B. Tech– I Sem**

**(20ME0337) MECHATRONICS & ROBOTICS  
[Professional Elective Course – III]**

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**COURSE OBJECTIVES**

The objectives of the course is to

1. *Provide knowledge of Mechatronics system and its applications*
2. *Understand the actuators and signal conditioning methods.*
3. *Create awareness about microcontrollers and robot anatomy.*
4. *Learn the concepts of robot sensors.*
5. *Acquire the knowledge on machine vision and root applications.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Identify the importance of mechatronics system, components and its applications.*
2. *Describe the types of actuators and signal conditioning.*
3. *Recognize the importance of PLC in Automation.*
4. *Understand the anatomy of industrial robot drive systems.*
5. *Illustrate various sensors in robot.*
6. *Elucidate the robot applications in manufacturing.*

**UNIT I**

**Introduction:** Mechatronics- Need, Components, design process, benefits and applications- Control Systems- GUI- Real Time operating systems.

**Sensor and transducers:** Static characteristics of sensors, Displacement: strain gauge element- pneumatic sensor- force: strain gauge load cell –Temperature: bimetallic strips, resistance temperature detectors, thermocouple- Pyrometer - Selection criteria for sensors.

**UNIT II**

**Actuators:** Introduction, Characteristics and limitations, Actuators Types, Mechanical, Electrical, Hydraulic and Pneumatic Actuation Systems, -Timing Belts.

**Signal Conditioning & Electronic Interface Subsystems:** Signal conditioning- process, functions, resistors, capacitors, Filters, ADC and DAC- Electronic Interface Subsystems- coupling, protection schemes, circuit breakers.

**UNIT III**

**Microcontrollers and Programmable Logic Controllers:** Microcontroller- elements, memory, 8051 Microcontroller- Programmable Logic Controller- PLC Programming using ladder diagrams, PLC selection criteria- Shift registers.

**Robotics:** Introduction, automation and robotics- The laws of robotics- Robot applications in manufacturing, Definitions of industrial robot, Robot anatomy- Work volume -Robot drive systems - configuration - precision of movement- degrees of freedom.

**UNIT IV**

**Robot sensors:** Sensors in robotics - desirable features of robot sensors- proximity and tactile sensors- Touch sensors- slip sensors- Range sensors, Opto range sensors, Ultrasonic range sensors- Force Sensors- Vision system of inspection-Uses of sensors in robotics.

**UNIT V**

**Robot Vision:** Introduction, Robot vision- Lighting devices- analogue to digital signal conversion- Image processing and analysis- Illumination - Feature extraction- Object inspection, Object recognition-Procedure of Robot vision.

**Robot applications in manufacturing:** Introduction, Robot in industry- Robots in handling-Machine loading and unloading-material transfer-processing operation, spot welding, spray coating-Inspection automation.

**TEXT BOOKS**

1. W. Bolton, *Mechatronics*, Pearson education, 4<sup>th</sup> Edition, 2012.
2. M.P. Groover, Mitchell Weiss, Roger N, Nagel and Nicholas G. Odrey, *Industrial Robotics*, Tata McGraw-Hill Edition, 3<sup>rd</sup> Print, 2008.

**REFERENCES**

1. HMT, *Mechatronics*, Tata McGraw Hill Publishers, New Delhi, 2019
2. Fu K S, *Robotics*, Mc Graw Hill, 4<sup>th</sup> Edition, 2010.
3. R.K. Mittal and Nagrath, *Robot and Control System*, Tata McGraw Hill Publishers, 3<sup>rd</sup> Edition, 2005.

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IV B. Tech – I Sem

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**(20ME0338) GAS DYNAMICS AND JET PROPULSION  
[Professional Elective Course – IV]**

**COURSE OBJECTIVES**

The student will be able to

1. Understand the basic difference between incompressible and compressible flow and effect of MACH number
2. Know the phenomenon of flow through the ducts and the frictional effect on flow
3. Comprehend the concept of normal and oblique shock waves
4. Recognize the importance of jet propulsion and combustors in Rockets
5. Illustrate the significance of propellants in space Technology

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. Understand the concepts of Compressible, incompressible flow and Mach number
2. Illustrate the Flow through ducts and variation of flow parameters
3. Identify the importance of Normal and Oblique shock waves, Prandtl-Meyer relations
4. Know the various types of propulsion systems and its performance
5. Classify rocket propellants and combustion chambers
6. Describe the propellant feeding systems and its applications in rockets

**UNIT I**

**Basic Concepts:** Energy and momentum equations of compressible fluid flows – Mach number and its types, Stagnation states, various regions of flow, Effect of Mach number on compressibility, Mach Cone, Mach Angle and Mach Waves

**Isentropic Flows:** Isentropic flow through variable ducts – Nozzle and Diffusers types, Flow through Nozzle and Diffusers, Problems

**UNIT II**

**Flow Through Ducts:** Flows through constant area ducts with heat transfer (Rayleigh flow), Rayleigh curve, Momentum Equation, Impulse Function, variations of flow properties, Flow through constant area duct (Fanno flow), Fanno Flow equations & its properties, Variations of Mach Number with Duct Length, Numeric Examples and Problem solving

**UNIT III**

**Normal and Oblique Shocks:** Governing equations – Applications, Variation of flow parameters across the normal shocks and oblique shocks and its effect on flow, Oblique shock relations and Problems.

**Velocity Across Shock:** Rankine- Hugoniot Equations, Prandtl – Meyer relations, Flow velocity across the shock – Stagnation Pressure across the shock, Problems.

**UNIT IV**

**Jet Propulsion :** Introduction, Operating principle, cycle analysis, Classification of jets – Ram jet engine, Turbojet Engine, Turboprop Engine, Specific Impulse and Propulsion Efficiency.

**Combustors** – Gas turbine, Ram jet, Supersonic and after burners, Components of Jets and its Efficiencies, Operating Parameters- Jet thrust, Propeller Thrust, Effective speed ration, Specific thrust, TSFC, Problems

**UNIT V**

**Space Propulsion:** Theory of rocket propulsion- Types of rocket engines and its applications, Engine-Aircraft matching.

**Propellants:** Classification of propellants, Equilibrium composition- solid and liquid propellant combustion chambers- Propellant feeding systems, Performance study, Problems.

**TEXT BOOKS:**

1. John (J) and Keith (T), *Gas Dynamics*, Pearson Education ( P) Ltd, 4<sup>th</sup> Edition , 2006
2. S. Senthil, *Gas Dynamics and Jet Propulsion*, ARS Publications, 6<sup>th</sup> Edition, 2009
3. Ganesan. V, *Gas Turbines*, Tata McGraw Hill Publishing Co., 2<sup>nd</sup> Edition, 2010.

**REFERENCES:**

1. Hill. P. and C. Peterson, *Mechanics and Thermodynamics of Propulsion*, Addison – Wesley Publishing company, 2<sup>nd</sup> Edition, 1992.
2. John D Anderson, *Modern Compressible Flow*, McGraw-Hill Publishing Company, 2<sup>nd</sup> Edition, 1996
3. R D Zucker, O Biblarz, *Fundamentals of Gas Dynamics*, John Wiley & Sons publications, 2<sup>nd</sup> Edition, 2002

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**IV B. Tech - I Sem**

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**(20ME0339) POWER PLANT ENGINEERING  
[Professional Elective Course – IV]**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Illustrate India's power development from various resources, create awareness on power plant economics and pollution control*
2. *Describe thermal power plant, fuel handling equipment as well as combustors for optimum fuel combustion*
3. *Provide the knowledge on working of diesel and gas turbine power plants with accessories*
4. *Explain hydrological cycle, classify hydroelectric power plants and their functioning*
5. *Classify nuclear reactors; define their power generating process, and the ways for disposing of radioactive waste.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Identify India's energy sources, explain power plant economics and environmental issues of various power plants*
2. *Know about working of thermal power plant, fuel handling equipment and explain the need for proper combustion equipment in a thermal power plant*
3. *Describe types of diesel engines and gas turbine power plants, as well as their construction, working principles, and auxiliary equipment.*
4. *Define hydrological cycle, the process of converting water energy into electric power through several types of hydroelectric power plants*
5. *Illustrate various forms of nuclear fuel, its usage in nuclear reactors for power generation and the necessity of careful disposal of nuclear waste*
6. *Summarize energy resources, methods of power generation and environmental protection*

**UNIT I**

**Introduction:** Energy, Sources of energy, Classification of power plants, Factors affecting power plant design, Power plant basic terms and factors, Load curve –Significance, Simple Problems.

**Power Plant pollution and its control:** Effluents from power plants and their impact on environment, Greenhouse gases and their effects, Methods of pollution control.

**UNIT II**

**Thermal Power Plant:** General Layout of thermal power plant, Working, Site selection, Types of coals, Coal handling equipment, Coal storage, Ash handling systems, Advantages and disadvantages of thermal power plant and its limitations.

**Combustion and Combustors:** Properties of coal, Stokers- Overfeed and Under feed stokers, Travelling grate stokers, Spreader stokers, Pulverized fuel burning system and its Components, Combustion needs and draught system, Cyclone Furnace.

**UNIT III**

**Diesel Power Plant:** Internal Combustion Engines- Types of IC Engines, Construction details of an IC engines, Diesel power plant layout with auxiliaries- Fuel supply system, Lubrication, Cooling, Supercharging

**Gas Turbine Plant:** Classification, Construction, Layout with auxiliaries, working principles of Closed and Open cycle gas turbines, Inter cooling, Reheating & Regenerating, Advantages and disadvantages of combined cycle power plants

**UNIT IV**

**Hydrology:** Hydropower, Hydrological cycle, Flow measurement, Run off drainage area characteristics, Hydrographs

**Hydro Electric Power Plant:** Definition, Layout of Hydroelectric power plant, Site selection, Classification, Run off river power plants with & without Pondage, Storage reservoir plant, Pumped storage Power Plant, Advantages of hydroelectric power plants.

**UNIT V**

**Nuclear Power Station:** Layout of Nuclear power plant, Working, Nuclear fuel, Nuclear fission, Chain reaction, Breeding and Fertile materials, Nuclear reactor, Reactor operation

**Nuclear Reactors:** Pressurized water reactor, Boiling water reactor, Sodium-graphite reactor, Fast breeder reactor, Homogeneous reactor, Gas cooled reactor, Radiation hazards and shielding, radioactive waste disposal.

**TEXT BOOKS**

1. Arora and S. Domkundwar, *A Course in Power Plant Engineering*, Dhanpat Rai & Co Publishers, 6<sup>th</sup> Revised Edition, 2013
2. A.K.Raja, Amit Prakash Srivastava, Manish Dwivedi, *Power Plant Engineering*, New Age International Publications.
3. G.D. Rai, *An Introduction to Power Plant Technology*, Khanna Publishers, 1987

**REFERENCES**

1. R K Rajput, *A Text Book of Power Plant Engineering*, Laxmi Publications, 5<sup>th</sup> Edition, 2019
2. Sudipta De, *Nag's Power plant Engineering*, McGraw Hill Publishers, 5<sup>th</sup> Edition, 2021
3. P.C. Sharma, *Power plant engineering*, S.K. Kataria Publications, 9<sup>th</sup> Revised 2013, Reprinted 2019
4. P.K. Nag, *Power Plant Engineering*, Tata McGraw Hill Publications, 4<sup>th</sup> Edition, 2014

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**(20ME0340) REFRIGERATION & AIR CONDITIONING  
[Professional Elective Course – IV]**

**COURSE OBJECTIVES**

The objective of this course is to

1. Learn the fundamental principles, different methods and applications of refrigeration.
2. Study of various refrigeration cycles and evaluate performance using Mollier charts and / or Refrigerant property tables
3. Have comparative study of different refrigerants with respect to properties, applications and Environmental issues
4. Explain various types of refrigeration systems
4. Understand and represent the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning
5. Identify various equipment-operating principles and safety controls employed in air conditioning systems

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. Illustrate the fundamental principles and applications of refrigeration and air conditioning system.
2. Obtain cooling capacity and coefficient of performance by conducting test on vapour compression Refrigeration systems
3. Present the properties, applications and environmental issues of different refrigerants
4. Identify the working principles and operation of various refrigeration systems
5. Demonstrate the use of psychrometric chart and Calculate the cooling load for air conditioning Systems.
6. Explain the classification and method of duct design in an air conditioning system

**UNIT-I**

**Introduction:** Introduction to Refrigeration - Unit of Refrigeration and C.O.P. – Ideal cycles, Necessity & Applications of Refrigeration, Types of Air Refrigeration Systems.

**UNIT-II**

**Vapour Compression Refrigeration System:** Working principle and Essential components of VCR system. Vapor compression cycle: P-h and T-S diagrams - sub cooling and super heating, Problems.

**Refrigerants:** Desired properties- Environmental issues, type of refrigerants, Refrigerant Mixtures, Nomenclature of refrigerants, ODP and GWP.

**UNIT-III**

**Other Refrigeration Systems:** Vapour absorption system –working principle, Ammonia-Water system and LiBr-Water system, Electrolux refrigeration system- Two fluid and three fluid

System, Steam jet refrigeration- Thermoelectric refrigeration- Vortex tube refrigeration systems- Cascade systems.

#### UNIT-IV

**Introduction to Air Conditioning:** Psychrometric Properties and Processes-Psychrometric chart & Construction, Need for ventilation and Infiltration – concepts of RSHF, GSHF, ERSHF and ADP, simple Problems.

#### UNIT-V

**Air Conditioning Systems and Distribution of Air:** Human comfort, effective temperature & Comfort chart, classifications of Air Conditioning Systems- summer, winter & all year round air conditioning, Window A/C, Split A/C and Crasest A/C.

**Ducts:** Classification of Ducts, Methods of Duct Design – Grills and Registers, problems.

#### TEXT BOOKS

1. C.P.Arora & Domkundwar, *Refrigeration and Air conditioning*, 3<sup>rd</sup> Edition, McGraw Hill, New Delhi, 2010.
2. R.S.Khurmi. *Refrigeration and Air conditioning*, 5<sup>th</sup> Edition, S.Chand Publishers, 2006.

#### REFERENCES

1. Roy J. Dossat, *Principles of Refrigeration*, Pearson Education Asia, 4<sup>th</sup> Edition, 2009.
2. Stoecker, W.F. and Jones J. W., *Refrigeration and Air Conditioning*, McGraw Hill, New Delhi, 5<sup>th</sup> Edition, 1998.
3. R.K Rajput, *A text book of Refrigeration and Air conditioning*, Katson Books, 6<sup>th</sup> Edition, 2013.

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**(20ME0341) ADVANCED WELDING PROCESSES  
[Professional Elective Course (PEC) – V]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Know the different welding processes and the basics of gas, metal arc welding
2. Understand the application of fusion welding processes and its variables
3. Provide the knowledge of various power source characteristics to give sound welding
4. Knowledge about different methods of solid state and laser welding processes
5. Explain various advanced welding processes and its applications with safety precautions

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. Explain different types of welding processes, classification and use of gas, manual metal arc welding.
2. Understand various applications of fusion welding and its parameters
3. Acquire the knowledge of different power sources used and its control for good weld ability
4. Identify various Applications of Electron beam and laser welding processes and its uses
5. Elucidate numerous solid state welding and explosive welding processes used for joining of metals
6. Describe various advanced welding processes and its applications

**UNIT-I**

**Introduction to Welding:** Classification and survey of welding and allied processes.

**Gas welding:** Introduction and gases, types of flames, weld quality, applications and variants of oxy-fuel gas welding.

**Arc welding:** Shielded metal arc welding operation, metal fusion and weld penetration, variants of SMAW process and applications of SMAW. Arc welding consumables, Electrode coverings and their functions.

**UNIT-II**

**Advanced fusion welding:** Gas shielded welding TIG and MIG and MAG/ CO2 Processes. Shielding gases, Current setting, metal transfer and arc length control.

**Plasma welding:** Working principle, plasma arc welding and Cutting processes, Equipment maintenance, advantages and disadvantages-Applications.

**UNIT-III**

**Electrical power sources for welding:** Characteristics of transformer- rectifier and motor generator sets, Pulsed currents.

**Laser beam welding:** Laser beam welding setup and operations, Process control and applications.

**Electron beam welding:** Electron beam welding equipment, setup and operation, Process characteristics, Process variables, Applications.

**UNIT-IV**

**Solid state welding process:** Friction welding and working process and its types, Friction stir welding working operation, applications of above process.

**Explosive welding:** Explosive welding methods of operations, Diffusion bonding and Adhesive bonding.

**UNIT-V**

**Soldering and brazing:** Soldering mechanism, soldering procedure – brazing, working operation, variant of process, Adhesive bonding: Nature of adhesive joints, Adhesive and classifications, Applications and Safety Precautions.

**Other welding and Joining Processes:** Pressure welding processes, Solid phase bonding, Ultrasonic welding.

**TEXT BOOKS**

1. Dr. R.S. Parmar, *Welding Processes and Technology*, Khanna Publishers, 3rd Edition, 1996, 5th reprint 2018.
2. Paulo Davim J, *Welding Technology*, Springer Publications, 2nd Edition, 2021

**REFERENCES**

1. Jayakumar J. Vora and Vishvesh J. Badheka, P. T, *Advances in Welding Technologies for Process Development*, by CRC Press, Tylor & Francis group, 1st Edition, 2020
2. Konigsberger. F, *Welding Technology*, McGraw Hill Publications, digitized September, 2007.
3. Rossi, Boniface E, *Welding Engineering*, PHI, Publications, digitized December 2007.

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**(20ME0342) MODERN MACHINING METHODS  
[Professional Elective Course – V]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Understand the need and importance of modern machining methods and process selection.
2. Gain the knowledge to remove material by thermo electrical machining process
3. Apply the knowledge to remove material by chemical and electrochemical methods.
4. Analyze various material removal processes by unconventional machining methods.
5. Illustrate the concept of Micro and nanofabrication techniques

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. Interpret the conventional and Non-Conventional Machining Processes
2. Analyze the principles and processes of thermoelectrical machining processes.
3. Learned about Etchant and Maskant techniques.
4. Get knowledge of the electrochemical machining process.
5. Study the importance of EBM and LBM, and PAM principles.
6. Know the fundamentals of the Micro and Nanofabrication Techniques.

**UNIT I**

**Introduction:** Introduction to machining methods– Need – Classification-Difference between Conventional and Non-Conventional Machining Processes, Advantages and Disadvantages.

**Modern Mechanical Machining methods:** Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining-Working Principles – equipment used – Process parameters – MRR-Applications

**UNIT II**

**Thermo Electrical Machining Processes:** Electric discharge machining (EDM)-Working Principle – Equipment's – Process Parameters – MRR – Tool – Power Circuits – Tool Wear – Dielectric – Flushing.

**UNIT III**

**Chemical Machining (CM):** Etchants – Maskant - Techniques of applying maskants – Process Parameters – Surface finish and MRR – Applications

**Electro Chemical Machining Processes:** Electro-Chemical Machining (ECM) - Principles of ECM – equipment's – Surface Roughness and MRR Electrical circuit– Process parameters– Applications. Electro Chemical Grinding (ECG) and Electro Chemical Honing (ECH): Principle– equipment's –Process Parameters – Advantages and disadvantages – Applications

**UNIT IV**

**Thermal Energy Based Modern Machining Processes** – Classification- Electron Beam Machining (EBM), Ion Beam Machining (IBM), Laser Beam Machining (LBM), Principles, Equipment – Types – Applications. Plasma Arc Machining (PAM) - Principles– Equipment – Types- Advantages and disadvantages – Applications

**UNIT V**

**Micro & Nano Machining:** Introduction to Micro fabrication Techniques- Lithography Thin-Film Deposition and Doping, Nanofabrication Techniques-E-Beam Nanofabrication, Scanning Probe Techniques.

**TEXT BOOKS**

1. V.K. Jain, *Advanced Machining Processes*, Allied Publishers Pvt. Ltd, 3rd Edition 2016.
2. Benedict. G.F, *Non-traditional Manufacturing Processes*, Taylor & Francis, New York, 3<sup>rd</sup> Edition , 2010.

**REFERENCES**

1. Pandey. P.C. and Shan H.S, *Modern Machining Processes*, Tata McGraw-Hill, New Delhi, 4<sup>th</sup> Edition, 2017.
2. Hassan El-Hofy, *Advanced Machining Processes*, McGraw-Hill, New york, 4<sup>th</sup> Edition, 2005.
3. P K Mishra, *Nonconventional Machining*, Narosa Publishing House, 1<sup>st</sup> Edition, 1997.
4. <https://www.inup.cense.iisc.ac.in/static/downloads/Introduction-to-Micro-Nanofabrication.pdf>

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**(20ME0343) QUALITY CONTROL & RELIABILITY ENGINEERING  
[Professional Elective Course -V]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Introduce the concept of SQC and provide knowledge on process control and variables.*
2. *Develop the process Capability Analysis.*
3. *Understand acceptance sampling procedure and their Types.*
4. *Provide knowledge on the importance of reliability engineering in the manufacturing sector.*
5. *Illustrate the basic concepts and techniques of Reliability in Mechanical Properties.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Summarize the concept of Quality and Process control for variables*
2. *Apply the process and Measurement System Capability Analysis*
3. *Explain the concept of sampling and to solve problems*
4. *Describe the concept of Reliability Engineering and techniques involved*
5. *Attain the basic techniques for design of reliable process.*
6. *Analyze the reliability of Mechanical Components and system.*

**UNIT I**

**Quality and Control :** Introduction, Definition of Quality and Quality Improvement, Dimensions of Quality, Quality Engineering Terminology –Statistical Methods for Quality Control and Improvement–Quality Philosophy and Management Strategies, Relation Between Quality and Productivity, Quality Costs.

**Process Control for Variables:** Implementing Quality Improvement, Basic Principles, Choice of Control Limits–Analysis of Patterns on Control Charts  $\bar{x}$  and  $R$  Charts.

**UNIT II**

**Process and Measurement System Capability Analysis:** Introduction, Process Capability Analysis Using a Histogram or a Probability Plot, Process Capability Ratio for an Off-Center Process, Normality and the Process Capability Ratio, Linear and Nonlinear Combinations.

**UNIT III**

**Acceptance Sampling:** Lot by lot sampling –Types of Sampling Plans, Lot Formation, Random Sampling – **Single-Sampling Plans for Attributes:** Definition of a Single-Sampling Plan, OC Curve **Double, Multiple, and Sequential:** Sampling, Double-Sampling Plans, Multiple-Sampling Plans, Sequential-Sampling Plans- The Dodge–Romig Sampling Plans - AOQL Plans, LTPD Plans.

**UNIT IV**

**Reliability Engineering:** Introduction Need, development of Reliability Engineering, Probabilistic Reliability Repairable and Non-Repairable Items.

**Reliability Mathematics:** Introduction, Variation, Probability Concepts, Rules of Probability, Continuous Variation, Continuous Distribution Functions-Life Data Classification, Ranking of Data, Weibull Distribution.

#### UNIT V

**Design for Reliability:** Introduction, Design for Reliability Process, Analyses, Verify, Validate, Control and Assessing.

**Properties of Mechanical Components and Systems:** Mechanical Stress, Strength and Fracture, Fatigue, Creep, Wear Corrosion, Temperature Effects and Materials.

#### TEXT BOOKS

1. Douglas.C. Montgomery, *Introduction to Statistical quality control*, 7<sup>th</sup> Edition, John Wiley 2012
2. Connor, P.D.T.O., *Practical Reliability Engineering*, 6<sup>th</sup> Edition, John Wiley, 2012

#### REFERENCES

1. Besterfield D.H., *Quality Control*, 7<sup>th</sup> Edition, Prentice Hall, 2013
2. Srinath. L.S., *Reliability Engineering*, 4<sup>th</sup> Edition, Affiliated East west press, 2008
3. Danny Samson, *Manufacturing & Operations Strategy*, 4<sup>th</sup> Edition Prentice Hall, 1991

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**IV B. Tech- I Sem**

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**(20CE0148) ELEMENTS OF ROAD TRAFFIC SAFETY  
(Open Elective-III)**

**COURSE OBJECTIVES**

The objectives of this course

1. *To understand the accident statistics globally and in India specifically, its causes and measures to overcome the situation.*
2. *The traffic regulation, parking problems, understanding of road signs, signals and marking are also taught; so that the student is well informed about all safety measures that a traffic engineer need to understand*
3. *To understand the various aspects of street lighting*

**COURSE OUTCOMES (COs)**

On successful completion of this course, the student will be able to

1. *Figure out causes of road accidents and implement various methods to control road accidents*
2. *Render solutions to on and off street parking and elucidate traffic regulations*
3. *Prepare the road marking scheme for given type of road and traffic conditions*
4. *Implement street lighting schemes for the given road characteristics*
5. *Select appropriate traffic signs for various roads*
6. *Understand the concepts related to design of road traffic signalling systems*

**UNIT – I**

**Road Accidents – Causes & Prevention:** Road Accidents & Traffic Engineering – Accident Situation in India – International Comparison of Road Accidents – Road & its Effects on Accidents – The Vehicle – The Driven – Skidding – Speed in Relation of Safety – Weather & its Effects on Accidents – Pedestrian Safety -Cyclists – Motor Cycle & Scooter Rider – Parking & Its Influence on Accident – Legislation, Enforcement, Education & Propaganda – Cost of Road Accidents

**UNIT – II**

**Regulations of Traffic:** Basic Principles of Regulation – Regulation of Speed – Regulation of Vehicles – Regulations Concerning the Driver – Regulations Concerning Traffic – Parking Regulations – Enforcement of Regulations.

**Parking:** Traffic & Parking Problems – Ill-Effects of Parking – Zoning & Parking Space Requirement Standards – Design Standards for On-Street Parking Facilities – Traffic Regulatory Measures for On-Street Parking – Off-Street Parking Facilities – Peripheral Parking Schemes – Loading & Unloading Facilities – Truck Terminals – Long Distance Bus Terminals

**UNIT – III**

**Road Markings:** Function – Types of Road Marking – General Principles of Longitudinal Pavement Markings – Material & Colour – Centre Lines – Traffic Lane Lines – No Overtaking Zone Markings – Pavement Edge Lines – Carriageway Width Reduction Transition Marking – Obstruction Approach Markings – Stop Lines – Pedestrian Crossings – Cyclist Crossings – Route Direction Arrows – Word Messages – Markings at Approaches to Intersections – Parking Space Limits – Object Markings

**Street Lighting:** Need for Street Lighting – Definition of Common Terms – Some Laws of Illumination – Mounting Height – Spacing – Lantern Arrangements – Type of Lamps – Lamp Installation of T' Junctions & Cross Roads – Illumination of Traffic Rotaries – Lighting of Bends – Lighting of Dual Carriageways – Lighting of Roads Carrying Only Local Traffic – Lighting Bridges – Tunnel Lighting – Maintenance of Lighting Installation

**UNIT – IV**

**Traffic Signs:** Importance of Traffic Signs – Need for International Standardization – The Situation in India – General Principles of Traffic Signing – Types of Traffic Signs – Danger Signs (Warning Signs or Cautionary Signs) – Prohibitory Signs – Mandatory Signs – Informatory Signs – Indication Signs – Direction Signs, Advance Direction Signs & Place Identification Signs – Overhead Signs – Route Marker Signs – Location, Height & Maintenance of Traffic Signs

**UNIT – V**

**Traffic Signals:** Advantages & Disadvantages of Traffic Signals – Signal Indications – Signal Face – Illustration of the Signals – Number & Location of Signals Faces – Amber Period, Red/Amber Period & Inter Green Period – Fixed Time Signals & Vehicle Actuated Signals – Determination of Optimum Cycle Length & Signal Settings for an Intersection with Fixed Time Signals – Warrants for Signals – Co-ordinated Control of Signals – Signal Approach Dimensions – Area Traffic Control – Delay at Signalized Intersection

**TEXT BOOKS**

1. L.R.Kadiyali and Lal, *Traffic Engineering and Transportation Planning*, Khanna Publications, 9<sup>th</sup> edition, 1999
2. S.K.Khanna & C.E.G.Justo, *Highway Engineering*, Published by Nemchand & Bros, 10<sup>th</sup> edition, 2012

**REFERENCES**

1. L.R.Kadiyali and Lal, *Principles and Practice of Highway Engineering Design*, Khanna Publications, 7<sup>th</sup> edition, 2013
2. R.Srinivasa Kumar, *A Text book of Highway Engineering*, Universities Press
3. James H Banks, *Introduction to Transportation Engineering*, Tata McGraw hill Publications, 2<sup>nd</sup> edition

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**(20EE0237) ELECTRICAL ENERGY CONSERVATION AND AUDITING  
(Open Elective-III)**

**COURSE OBJECTIVES:**

The objective of the course is to

1. *Learn about energy consumption and situation in India*
2. *Learn about Energy Auditing.*
3. *Learn about Energy Measuring Instruments.*
4. *Understand the Demand Side Management*
5. *Understand the payback and depreciation calculations*

**COURSE OUTCOMES:**

On successful completion of this course, the student will be able to

1. *Conduct energy auditing and evaluate energy audit results*
2. *Carry out motor energy audit*
3. *Understand Different types of energy instruments*
4. *Understand the good lighting system design and practice*
5. *Analyze demand side management concepts through case study*
6. *Calculate depreciation and payback calculation*

**UNIT -I**

**INTRODUCTION TO ENERGY AUDITING**

Energy Situation – World and India Energy Audit- Definitions, Concept, Types of Audit, Energy Index, Cost Index, Pie Charts, Sankey Diagrams, Load Profiles, and Energy Conservation Schemes. Measurements in Energy Audits, Presentation of Energy Audit Results.

**UNIT –II**

**ENERGY EFFICIENT MOTORS AND POWER FACTOR IMPROVEMENT**

Energy Efficient Motors , Factors Affecting Efficiency, Loss Distribution , Constructional Details , Characteristics - Variable Speed , Variable Duty Cycle Systems, RMS Hp-Voltage Variation-Voltage Unbalance- Over Motoring- Motor Energy Audit.Power Factor – Methods of Improvement, Power factor With Non Linear Loads.

**UNIT –III**

**LIGHTING AND ENERGY INSTRUMENTS FOR AUDIT**

Good Lighting System Design and Practice, Lighting Control, Lighting Energy Audit - Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tong Testers, Application of PLC's

**UNIT –IV****INTRODUCTION TO DEMAND SIDE MANAGEMENT**

Introduction to DSM, Concept of DSM, Benefits of DSM, Different Techniques of DSM – Load Management, Load Priority Technique, Peak Clipping, Peak Shifting, Valley Filling, Strategic Conservation, Management and Organization of Energy Conservation Awareness Programs.

**UNIT –V****ENERGY ECONOMIC ANALYSIS**

Basic payback calculations, Methods of Determining Depreciation - Straight line method, Sum of years and digits method, Diminishing value method and Sinking fund method - Numerical Problems. Net present value calculations. Taxes and Tax Credit.

**TEXT BOOKS:**

1. Arry C. White, Philip S. Schmidt, David R. Brown, *Industrial Energy Management Systems*, Hemisphere Publishing Corporation, New York, 1994.
2. Albert Thumann, *Fundamentals of Energy Engineering*, Prentice Hall Inc, Englewood Cliffs, New Jersey, 1984.
3. Jyothi Prakash, *Demand side management*, TMH Publishers, 2004

**REFERENCE BOOKS:**

1. *Economic Analysis of Demand Side Programs and Projects - California Standard Practice Manual, June 2002 – Free download available online*  
[http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)
2. W.R. Murphy & G. Mckay Butter worth, *Energy management*, Heinemann publications, 2007.
3. John .C. Andreas, *Energy efficient electric motors*, Marcel Dekker Inc Ltd-2nd edition, 1995.
4. *Energy management and good lighting practice: fuel efficiency-booklet12-EEo, 1993*

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**(20EC0453) INTRODUCTION TO IOT  
(Open Elective-III)**

**COURSE OBJECTIVES**

The objectives of this course are:

1. *To provide an overview on the ICT ecosystem and enabling environment to foster Internet of Things (including technology, standards, system management and applications) deployments.*
2. *Define the infrastructure for supporting IoT deployments.*
3. *To provide an understanding of the technologies and the standards relating to the Internet of Things.*
4. *Understand various case studies related to IoT domain.*

**COURSE OUTCOMES**

On successful completion of this course, student will be able to

1. *Understand the technology and standards relating to IoTs.*
2. *Understand where the IoT concept fits within the broader ICT industry and possible future trends.*
3. *Understand the key components that make up an IoT system.*
4. *Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.*
5. *Configure Raspberry Pi, Understand Sensors, Actuators & get started with python on Raspberry Pi.*
6. *Apply the knowledge and skills acquired during the course to design, build and test a complete, working IoT system involving prototyping, programming and data analysis.*

**UNIT – I**

**IoT Introduction & Concepts:** Introduction to Internet of Things - Physical Design of IoT - Logical Design of IoT - IoT Enabling Technologies - IoT Levels & Deployment Templates.

**UNIT – II**

**Domain Specific IoTs:** Home Automation – Cities – Environment – Energy – Retail – Logistics - Agriculture – Industry - Health & Lifestyle.

**UNIT – III**

**IoT and M2M:** Introduction – M2M – Difference between IoT an M2M - Software Defined Networking - Network Function Virtualization for IoT.

**Developing Internet of Things:** IoT Design Methodology – Motivation for using Python

**UNIT – IV**

**IoT Physical Devices & Endpoints:** IoT Device – Raspberry Pi Board - Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming raspberry Pi with Python – Other IoT devices.

**UNIT – V**

**Case Studies Illustrating IoT Design:** Home Automation – Cities – Environment – Agriculture – Productivity applications.

**TEXT BOOKS**

1. Vijay Madiseti – Arshdeep Bahga, *Internet of Things a Hands-on Approach*, Arshdeep Bahga & Vijay Madiseti ,1<sup>st</sup> Edition, 2014.
2. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press,1<sup>st</sup> Edition, 2014.

**REFERENCES**

1. Raj Kamal, *Embedded Systems*, Tata Mc Graw-Hill Education, 2<sup>nd</sup> Edition, 2011.
2. Adrian McEwen & Hakim Cassimally, *Designing of Internet of Things*, John Wiley and sons Ltd, 1<sup>st</sup> Edition, 2014,
3. Daniel Kellmerit - Daniel Obodovski, *The Silent Intelligence: The Internet of Things*, DnD Ventures, 1<sup>st</sup> Edition, 2013.

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**(20CS0511) PYTHON PROGRAMMING  
(Open Elective-III)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Introduce Scripting Language*
2. *Exposure to various problem solving approaches of computer science*
3. *Introduce function-oriented programming paradigm*
4. *Exposure to solve the problems using object oriented concepts, exceptional handling*
5. *Exposure to solve the problems using Files, Regular Expressions and, Standard Libraries*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Solve the problems using control structures, input and output statements.*
2. *Summarize the features of lists, tuples, dictionaries, strings and files*
3. *Experience the usage of standard libraries, objects, and modules*
4. *Solve the problems using Object Oriented Programming Concepts*
5. *Build the software for real time applications using python*
6. *Install various Python packages*

**UNIT I**

**Introduction:** History of Python- Python features- Applications-Programming Using the REPL-Running Python Scripts-Variables – Assignment- Keywords- Input-Output- Indentation.

**Data Types: Single-Value data types** - int, float, Complex and Boolean.

**Multi-Valued Data types** - Lists, Tuples, Sets, Dictionaries, Strings- indexing and slicing.

**UNIT II**

**Operators and Expressions:** Operators-Arithmetic Operators, Comparison Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators- Expressions and order of evaluations

**Control Flow:** Branching- simple if, if-else, if-elif-else, nested if, looping-while and for- jumping – break- continue and pass

**UNIT III**

**Functions:** Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions- Nested functions, Recursive functions- Scope of the Variables in a Function.

**Object Oriented Programming in Python:** Classes and Objects- self-variable- Methods – Constructor- Inheritance-polymorphism- Method Overloading- Method Overriding.

**UNIT IV**

**Modules:** Creating modules, import statement, from...import statement and name spacing. **Python packages:** Introduction to PIP- Installing Packages via PIP (Numpy, Pandas, Matplotlibetc.)- Using Python Packages.

**Exception Handling:** Introduction to Errors and Exceptions, Handing Exceptions, Raising Exceptions, User Defined Exceptions, Regular Expressions-Searching and Matching.

**UNIT – IV**

**Functional Programming:** Iterators and Generators - Maps and Filters.

**Files:** Text files- Reading and Writing files- Command line arguments.

**Brief Tour of the Standard Library:** Dates and Times- Data Compression- Python Runtime Services- Data Management and Object Persistence.

**GUI Programming** - Turtle Graphics

**TEXT BOOKS**

1. Reema Thareja, *Python Programming: Using Problem Solving Approach*, First Edition, Oxford University Press.
2. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson.

**REFERENCES**

1. Mark Lutz , *Learning Python*, O Reily, 4th Edition, 2009.
2. Tim Hall and J-P Stacey , *Python 3 for Absolute Beginners*, 2009.
3. Magnus Lie Hetland , *Beginning Python: From Novice to Professional*, 2nd Edition,2009.

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**(20HS0861) BUSINESS ETHICS  
(Open Elective-III)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. Define basic knowledge of business ethics, personal ethics and values in modern context
2. Identify the best ethical practices in management disciplines to become good managers
3. Interpret the role of corporate culture and corporate governance
4. Analyze the organizational and cultural variables that impact ethical judgment
5. Learn various ethical codes in corporate governance

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. Describe various ethical principles in business and corporate social responsibility practices
2. Explain how personal ethics can influence behavior and apply in decision making
3. Examine the ethical challenges facing the various functional departments
4. Evaluate the organizational and cultural variables that impact ethical judgment
5. Justify various ethical codes in corporate governance
6. Formulate organizational policies and systems that employ ethical conduct

**UNIT I**

**Business Ethics and Corporate Ethics** – Meaning, Importance, functions, Unethical Practices and ethical dilemma, Ethical theories and Approaches, Modern Ethical Models for Decision Making, Indian Ethos, Ethics for manager, ethics in business competition.

**UNIT II**

**Ethical Aspects in Organization I:-** Marketing ethics and consumer ethics- ethical issues in advertising, criticisms in Marketing ethics, Ethics in HRM: Selection, Training and Development – Ethics at work place – Ethics in performance appraisal.

**UNIT III**

**Ethical Aspects in Organization II:-** Ethics in Finance: Insider trading - ethical investment - combating Frauds. Ethical issues in Information Technology: Information Security and Threats – Intellectual Property Rights – Cyber crime

**UNIT IV**

**Corporate Governance:** Purpose – Theories and global types of Corporate Governance.

**UNIT V**

**Corporate Governance Structures:** Directors, committees, Institutional investors – Auditors. Corporate Social Responsibility: Stakeholders – Environment – social Development.

**TEXT BOOKS**

1. M.G. Velasquez, *Business Ethics*, Prentice Hall India Limited, New Delhi, 7<sup>TH</sup> Edition, 2012
2. Murthy CSV: *Business Ethics and Corporate Governance*, HPH, 2007

**REFERENCES**

1. BholanathDutta, S.K. Podder – *Corporation Governance*, VBH.
2. Dr. K. Nirmala, KarunakaraReddy :*Business Ethics and Corporate Governance*, HPH
3. H.R.Machiraju: *Corporate Governance*, HPH, 2013
4. K. Venkataramana, *Corporate Governance*, SHBP, 2018
5. S.K. Chakraborty, *Ethics in Management- Vedantic Perspectives*, oxford India paper backs, New Delhi, 2007

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**(20CE0171) PROJECT PLANNING AND CONTROL  
(Open Elective-IV)**

**COURSE OBJECTIVES**

The objectives of this course are

1. To describe various elements of an engineering project and to draw the network
2. To perform PERT & CPM calculations and to identify the critical path
3. To perform various operations on the network

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. Differentiate various tools for planning and controlling the project
2. Construct the network for a project
3. Analyze PERT network to find various time estimates
4. Perform PERT computations and evaluate the critical path
5. Perform CPM computations and identify the critical activities and critical path
6. Optimize time and cost for a project and work with network during the progress of a project by updating the network and allocating the resources

**UNIT – I**

**Project Management:** Project planning – Project scheduling – Project controlling – Project monitoring and control – Project monitoring and information cell – Decision making in project management –Project life cycle

**Basic Techniques of Project Management:** Bar charts – Steps for the construction of a bar chart –Limitations of bar charts – Milestone charts – Velocity diagrams – Development of Network – CPM/PERT Networks – Advantages of network over milestone chart

**UNIT-II**

**Elements of Network:** Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles

**Development of Network:** Planning for network construction – Modes of network construction – Steps in development of network – Work breakdown structure – Hierarchies

**UNIT – III**

**PERT: Time Estimates:** Uncertainties: Use of PERT – Time estimates – Frequency distribution – Mean, variance and standard deviation – Probability distribution – Beta distribution – Expected time

**PERT: Time Computations & Network Analysis:** Earliest expected time – Formulation for TE – Latest allowable occurrence time – Formulation for TL – Combined tabular computations for TE and TL – Slack – Critical path – Probability of meeting scheduled date

#### UNIT – IV

**CPM: Network Analysis:** CPM Process – CPM Network – Activity time estimate – Earliest event time – Latest allowable occurrence time – Combined tabular computations for TE and TL – Start and finish times of activity – Float – Critical activities and critical path

#### UNIT – V

**CPM: Cost Model:** Project cost – Indirect project cost – Direct project cost – Slope of direct cost curve – Total project cost and optimum duration – Contracting the network for cost optimization – Steps in time cost optimization

**CPM: Updating:** Updating process – Data required for updating – Steps in the process updating – When to update

**Resources Allocation:** Resources usage profiles: histograms – Resources smoothing – Resources levelling

#### TEXT BOOKS

1. Dr.B.C. Punmia, K.K. Khandelwal, *Project Planning and Control with PERT AND CPM*, Laxmi Publications (P) Ltd., 4<sup>th</sup> Edition, Reprint 2006
2. Dr.P.N. Modi, Sanjeev Modi and Rajeev Modi, *Program Evolution and Review Technique and Critical Path Method*, Standard Book House, 5<sup>th</sup> Edition, 2012

#### REFERENCES

1. L.S. Srinath, *PERT and CPM Principles and Applications*, Affiliated East-West Press (Pvt.) Ltd
2. S.K. Bhattacharjee, *Fundamentals of PERT/CPM and Project Management*, Khanna Publishers
3. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, Pearson, 2<sup>nd</sup> edition, 2015

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**(20EE0239) NEURAL NETWORKS AND FUZZY LOGIC  
[Open Elective -IV]**

**COURSE OBJECTIVES**

The objectives of this course are

1. *To introduce the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks.*
2. *To have knowledge on Associate Memories, Fuzzy sets and Fuzzy Logic system components.*
3. *To know Fuzzy Network system application to Electrical Engineering*

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

1. *Understand the basic concept of artificial neural networks*
2. *Understand different learning mechanism in artificial neural networks*
3. *Able to design Pattern recognition tools through Associative memories.*
4. *Analyse the performance of Associative Memories.*
5. *Understand the basic concepts of fuzzy sets and fuzzy logic.*
6. *Create Fuzzy models for electrical engineering*

**UNIT - I**

**FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS**

Neural networks- introduction, Organization of human brain, Biological neuron, artificial neuron, McCulloch- Pitts neuron model, Characteristics and Applications of artificial neural networks Architectures of artificial neural networks-activation functions , learning strategies- supervised , unsupervised, reinforced learning.

**UNIT - II**

**SUPERVISED NETWORKS**

Perceptron networks-Perceptron learning, Limitations of Perceptron, back propagation networks-architecture, Computations in each layer, Error calculation in Back propagation networks, Gradient descent method in learning, back propagation algorithm, learning factors - initial weights, leaning constant, momentum coefficient, Application of Neural Networks to Electric load forecasting.

**UNIT - III**

**ASSOCIATIVE MEMORIES**

Introduction, Associative Memories- Auto associative Memory, Bidirectional Associative Memory (BAM), Architectures, Storage and Recall Phases, Recognition of noisy patterns, Hamming distance and Energy functions. Discrete Hopfield network architecture and storage and recall algorithm.

**UNIT - IV****CLASSICAL AND FUZZY SETS**

Introduction to classical sets- properties Fuzzy vs crisp Fuzzy sets ,Membership functions, basic fuzzy set operation, properties of fuzzy sets- Fuzzy relations Fuzzy Cartesian product, operations on fuzzy relations.

**UNIT -V****FUZZY LOGIC SYSTEMS**

Fuzzification-Fuzzy quantifiers, fuzzy inference, fuzzy rule-based system-development of rule base and decision-making system-Defuzzification to crisp sets-Fuzzification and Defuzzification methods. Greg Viot's fuzzy cruise controller.

**TEXT BOOKS**

1. Laurene Fausett, *Fundamentals of Neural Networks: Architectures, Algorithms and Applications*, Pearson Education India,2004
2. S. Rajasekaran, G.A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications* PHI, 2012

**REFERENCE BOOKS**

1. Jacek M. Zurada, *Introduction to Artificial Neural Networks*, Jaico Publishing House.1994
2. Simon Haykin *Neural Networks - A Comprehensive Foundation*, Prentice- Hall Inc,1999.
3. S.N. Sivanandam, S.N. Deepa, *Principles of Soft computing*, Wiley India private Ltd., 2nd edition, 2013.

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**(20EC0454) MATLAB PROGRAMMING  
[Open Elective –IV]**

**COURSE OBJECTIVES**

The objectives of this course:

1. To understand the MATLAB working environment.
2. To develop programming skills and techniques to solve mathematical problems.
3. To understand MATLAB graphic features and its applications.
4. To use MATLAB as a simulation tool that is essential in solving engineering problems

**COURSE OUTCOMES (COs)**

On successful completion of this course, student will be able to

1. Understand the basic concepts of working with MATLAB.
2. Demonstrate understanding and use of fundamental programming structures.
3. Understand memory and file management in MATLAB.
4. Program scripts and functions using the MATLAB development environment.
5. Create and control simple plot and user-interface graphics objects in MATLAB.
6. Apply numeric techniques and computer simulations to solve engineering-related problems using MATLAB.

**UNIT-I**

**Introduction to MATLAB:** MATLAB Interactive Sessions, Menus and the toolbar, computing with MATLAB, Script files and the Editor Debugger, MATLAB Help System, Programming in MATLAB, Need for MATLAB, Importance of MATLAB and C Programming.

**UNIT-II**

**Arrays:** Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays.

**UNIT-III**

**Functions:** Elementary Mathematical Functions User Defined Functions, Advanced Function Programming

**Files:** M-Files, Script M-Files, Function M-Files, Variables in Script M-Files, Variables in Function M-Files, Structure of Function of M-Files, Working with Data Files.

**UNIT-IV**

**Programming Techniques:** Relational Operators and Logical Variables, Logical Operators and Functions, Conditional Statements, Loops, the Switch Structure, Debugging MATLAB Programs. Program Design and Development.

**Plotting:** XY- plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots.

#### **UNIT-V**

**Linear Algebraic Equations:** Elementary Solution Methods, Matrix Methods for Linear Equations, Cramer Method, Undetermined Systems, Order Systems.

**Simulink:** Introduction to Simulink, Simulation Diagrams, Graphical User Interfaces (GUIs).

#### **TEXT BOOKS**

1. G. H. Golub and C. F. Van Loan, *Matrix Computations*, 3rd Ed., Johns Hopkins University Press, 1996.
2. B. N. Datta, *Numerical Linear Algebra and Applications*, Brooks/Cole, 1994 (out of print)

#### **REFERENCES**

1. William J Palm, *Introduction to MATLAB for Engineers*, 3rd edition, Mc GRAW HILL.
2. Brian R. Hunt Ronald L. Lipsman Jonathan M. Rosenberg, *A Guide to MATLAB for Beginners and Experienced User*, Cambridge University Press.
3. Amos Gilat, *MATLAB: An Introduction with Applications*, 4<sup>th</sup> edition, WILEY.

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**(20CS0552) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING  
[Open Elective -IV]**

**COURSE OBJECTIVES**

The Objectives of this Course is to

1. *Understand the various characteristics of Intelligent agents*
2. *Learn the different search strategies in AI*
3. *Investigate various Supervised Learning models of machine learning*
4. *Investigate various Unsupervised Learning models of machine learning*
5. *Investigate various Reinforcement Learning models of machine learning*
6. *Expose students to the Dimensionality Reduction*

**COURSE OUTCOMES (COs)**

On successful completion of the course students will be able to

1. *Understand the basic concepts and characteristics of Artificial Intelligence*
2. *Implement various problem solving methods and searching algorithms*
3. *Analyze various Learning Techniques*
4. *Implement the concept of supervised learning techniques*
5. *Analyze various Learning models and Probabilistic models*
6. *Infer theoretical and practical aspects of unsupervised learning*

**UNIT - I**

**Introduction to Artificial Intelligence:** Introduction, History of Artificial Intelligence, Working process of Artificial Intelligence, Types of Artificial Intelligence, Future of Artificial Intelligence, Agent in Artificial Intelligence, Characteristics of Intelligent Agents, Types of Intelligent Agents, Problem Solving Approach to Typical AI problems.

**UNIT - II**

**Artificial Intelligence-Problem Solving:** Problem Solving Methods-Applications of AI in Real World, Heuristic Function, Uninformed Search Strategies, Informed Search Strategies-Greedy search, A\* search, AO\* search, Constraint Satisfaction Problem, Game Playing, Optimal Decisions in Games, Alpha – Beta Pruning.

**UNIT - III**

**Introduction To Learning:** Introduction to Machine learning, Different kinds of Machine Learning-Supervised Learning, Unsupervised Learning, Designing a Learning Systems.

**Supervised Learning:** Classification, Decision Trees, Constructing Decision Trees, Regression and Classification, Linear Discriminants, Perceptron, Linear Regression.

**UNIT - IV:**

**Learning Models:** Introduction to Multilayer Perceptron, Deriving Back-Propagation, Radial Basis Function, Support Vector Machine.

**Tree and Probabilistic Models:** Classification and Regression Trees (CART), Ensemble Learning, Boosting, Bagging, Gaussian Mixture Models-Expectation Maximization, Information Criteria.

**UNIT -V:**

**Nearest Neighbor Methods-** Nearest neighbor smoothing, Efficient Distance Computations: KD-Tree, Distance measures,

**Unsupervised Learning:** clustering- Introduction, k-Means Algorithm, Vector Quantization, Self Organizing Map-SOM Algorithm.

**TEXT BOOKS**

1. A.Lakshmi Priya, G.S. Uthaya kumar, B.Geethavani, Harsha J.SarodeAlpaydin, *Introduction to AI and ML*, Scientific International Publishing House.

**REFERENCES**

1. Tom M Mitchell, *Machine Learning*, First Edition, McGraw Hill Education, 2013
2. Richard S. Sutton and Andrew G. Barto: *Reinforcement Learning: An Introduction*, MITPress.
3. Jiawei Han and Micheline Kamber, *Data Mining Concepts and Techniques*, Third Edition,Elsevier, 2012.

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**(20HS0862) STRATEGIC MANAGEMENT  
[Open Elective -IV]**

**COURSE OBJECTIVES**

The Objectives of this Course is to

1. Define the basic knowledge of concepts underlying in strategic management, its process
2. Describe an insight to the tools and techniques used in analyzing and choosing strategies
3. Find the principles of strategy formulation, implementation, evaluation and control of strategy
4. Evaluate basic concepts, principles and practices associated with strategy formulation and implementation
5. Choose various strategies and appropriate strategic implementation at business and corporate levels

**COURSE OUTCOMES (COs)**

On successful completion of the course students will be able to

1. Recognize major theoretical concepts, background work and research output in the field of strategic management.
2. Identify an understanding of the strategic management process and the functional strategies
3. Apply various tools and frameworks to make strategic decisions
4. Estimate the basic concepts, principles and practices associated with strategy formulation and implementation
5. Justify various strategies and explore appropriate strategic implementation at business and corporate levels
6. Formulate and evaluate critically real life company situations and develop creative solutions, using a strategic management perspective

**UNIT - I**

**Introduction to Strategic Management** – Definition, significance and components- Strategic Management as a process –Developing a strategic vision, Mission, Objectives, Policies, Environmental Scanning -Concepts of Core Competence.

**UNIT - II**

**Strategic Analysis and Choice:** Tools and techniques- Porter's Five Forces Model -BCG Matrix, GE Model, TOWS Matrix, Market Life Cycle Model and Mc Kinsey 7'S framework - Organisation Analysis – VRIO frame work, Value Chain Analysis, Quantitative and Qualitative analysis.

**UNIT - III**

**Strategy Formulation:** - Formulation of strategy at corporate and business level - Strategy Alternatives-Stability Strategy, Growth Strategy, Retrenchment Strategy, and Combination Strategy.

**UNIT – IV**

**Strategy Implementation:** Types of Strategies: Offensive strategy, Defensive strategy, vertical integration, horizontal strategy- Strategy and Leadership - Strategy and Culture - Organization Structure - Resource Allocation as a vital part of strategy - Management of change.

**UNIT -V**

**Strategy Evaluation and control** – Establishing strategic controls - Role of the strategist - benchmarking to evaluate performance - strategic information systems – Guidelines for proper control- Strategic surveillance -strategic audit - Strategy and Corporate Evaluation and feedback in the Indian and international context.

**TEXT BOOKS**

1. P. SubbaRao, *Strategic Management*, Himalaya Publications, New Delhi 2010
2. R. Duane Ireland, *Strategic Management* Cengage Publications, New Delhi, 2014

**REFERENCES**

1. V.S.P. Rao, *Strategic Management – Text and Cases*, Excel books,2009
2. Fred R. David, *Strategic Management A competitive approach Concepts and Cases* , Pearson, 16<sup>th</sup> edition,2019
3. R. Srinivasan, *Strategic Management: the Indian context*, 5<sup>th</sup> edition, PHI,2014
4. N.Chandrasekharan. PS Ananthanarayanan, *Strategic Management*, Oxford publications, 2011
5. Charles L Hill, *Strategic Management an Integrated approach*, Cengage learning, 10<sup>th</sup> edition, 2007.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR(AUTONOMOUS)****IV B. Tech.- I Sem.**

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**(20ME0368) COMPUTER SIMULATION LAB****COURSE OBJECTIVES**

The objectives of this course is to

1. *Make students understand and learn about the analysis and simulation of simple mechanical parts.*
2. *Explain the different kinds of analysis and apply the basic principles to find out the stress of bars and beams loaded with loading conditions.*
3. *Learn the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beam.*
4. *Develop the student's skills in proper modeling, meshing, and setting up material properties, loads, and constraints for computer simulation and analysis.*
5. *Get knowledge on the heat transfer conductive mechanism for the 2DComponents.*
6. *Have the proper knowledge on analysis and plotting results.*

**COURSE OUTCOMES**

On successful completion of this course the student will be able to

1. *Use the modern tools to formulate the problem, and create geometry, discretize, apply boundary conditions.*
2. *Solve problems of bars, truss, beams, plate and to find stress with different loading conditions.*
3. *Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads, further to use the available results*
4. *Draw shear force and bending moment diagrams.*
5. *Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions*
6. *Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function*

**LIST OF EXPERIMENTS:**

1. Introduction to simulation software's
2. Structural Analysis of a Truss Member
3. Analysis of Simply Supported Beam
4. Stress Analysis of Cantilever Beam
5. Stress Analysis of A Plate With Circular Hole
6. Stress Analysis of Rectangular L Bracket
7. Bars of Tapered Cross Section Area
8. Conductive Heat Transfer Analysis in Rectangular 2DComponent.
9. Conductive Heat Transfer Analysis in Different Geometry 2DComponents.
10. Conductive Heat Transfer Analysis in 2DComponents of composite materials.

Note: Software used for simulation: ANSYS / ABAQUS

Note: Any 8 experiments out of the above 10 experiments are to be done