MECHANICAL ENGINEERING

Scheme of Instruction,
Examinations and Syllabi

[First Year & Second Year B.Tech. Degree, w.e.f. 2020-21]

R.V.R. & J. C. COLLEGE OF ENGINEERING

(Autonomous)

Accredited by NBA and NAAC with "A" Grade

Chandramouli Puram :: Chowdavaram :: GUNTUR – 522019.

DEPARTMENT OF MECHANICAL ENGINEERING

B.TECH. MECHANICAL ENGINEERING

Program curriculum grouping based on course components

Course Component	Curriculum Content (% of total number of credits program)	Total number of credits
Basic Sciences (BS)	13.125	21
Engineering Sciences (ES)	12.185	19.5
Humanities and Social Sciences (HS)	6.25	9
Professional Core (PC)	33.75	54
Professional Electives (PE)	9.375	15
Open Electives (OE)	7.5	12
Humanities Electives (HE)	1.875	3
Project(s) (PR)	10.3125	16.5
Skill Development (SD)	6.25	10
Mandatory Course(s) (MC)	--	--
Total number of Credits		160

B.TECH. MECHANICAL ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2020-2021)

Three Weeks Orientation Programme is Mandatory before starting Semester I [First Year]

Semester I [First Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination		Credits	Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks			
			L	T	P	SES	EXT		
1	ME 111	Mathematics-I	2	1	-	30	70	3	BS
2	ME 112	Engineering Chemistry	2	1	-	30	70	3	BS
3	ME113	English for Communication Skills	3	-	-	30	70	3	HS
4	ME 114	Programming For Problem Solving	3	-	-	30	70	3	ES
5	ME 151	Chemistry Lab	-	-	3	30	70	1.5	BS
6	ME152	English Language Communication Skills Lab	-	-	3	30	70	1.5	HS
7	ME 153	Engineering Workshop Practice	1	-	4	30	70	3	ES
8	ME 154	Programming For Problem Solving			3	30	70	1.5	ES
9	MEMC 01	Environmental Science	2	-	-	100	-	-	MC
TOTAL			13	2	13	340	560	19.5	

Semester II [First Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination		Credits	Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks			
			L	T	P	SES	EXT		
1	ME 121	Mathematics-II	2	1	-	30	70	3	BS
2	ME122	Engineering Physics	3	-	-	30	70	3	BS
3	ME 123	Basic Electrical and Electronics Engineering	2	1	-	30	70	3	ES
4	ME124	Engineering Mechanics	2	1	-	30	70	3	ES
5	ME125	Engineering Graphics	1	-	4	30	70	3	ES
6	ME161	Physics Lab	-	-	3	30	70	1.5	BS
7	ME 162	Computer Aided Geometrical Modelling Lab	-	-	3	30	70	1.5	ES
8	ME163	Basic Electrical and Electronics Engineering Lab	-	-	3	30	70	1.5	ES
9	MEMC02	Constitution of India	2	-	-	100	-	-	MC
TOTAL			12	3	13	340	560	19.5	

Semester III [Second Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 211	Operations Management	2	1	-	30	70	3	PC
2	ME 212	Material Science & Metallurgy	3	-	-	30	70	3	BS
3	ME 213	Manufacturing Processes	3	-	-	30	70	3	PC
4	ME214	Basic Thermodynamics	2	1	-	30	70	3	PC
5	ME 215	Theory of Mechanisms & Machines	2	1	-	30	70	3	PC
6	ME 251	Machine Drawing Lab	-	-	3	30	70	1.5	PC
7	ME 252	Modelling Lab	-	-	3	30	70	1.5	PC
8	ME 253	Advanced programming lab	-	-	3	30	70	1.5	HS
9	**ME254**	**Data Structures and Algorithms**	1	-	2	100	-	2	SD
10	MEMC03	Professional Ethics & Human values	2	-	-	100	-	-	MC
TOTAL			15	3	11	440	560	21.5	

Semester IV [Second Year] COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	ME 221	Mathematics - III (PDE, Probability & Statistics)	2	1	-	30	70	3	BS
2	ME 222	Applied Thermodynamics	2	1	-	30	70	3	PC
3	ME 223	Strength of materials	3	-	-	30	70	3	PC
4	ME 224	Manufacturing Technology	3	-	-	30	70	3	PC
5	ME 225	Fluid Mechanics & Hydraulic Machines	2	1	-	30	70	3	PC
6	ME 261	Manufacturing Process Lab-I	-	-	3	30	70	1.5	PC
7	ME 262	FM & SM Lab	-	-	3	30	70	1.5	PC
8	ME 263	Communicative English Lab	-	-	3	30	70	1.5	ES
9	**ME 264**	**Numerical Techniques & Simulation**	1	-	2	100		2	SD
10	MEMC04	Design Thinking & Product Innovation	2	-	-	100	-	-	MC
TOTAL			15	3	11	440	560	21.5	
Honors/Minor courses			4		0			4	
SUMMER INTERNSHIP – 6 Weeks									

ME 111	MATHEMATICS-I	L	T	P	C	Int	Ext
	(Calculus & Matrix Theory)	2	1	-	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
2. To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Evaluate certain improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. Know fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. Understand Fourier series and deal with functions of several variables.
4. Do problems on matrices and linear algebra in a comprehensive manner.

COURSE CONTENT:

UNIT I [CO:1] **(15)**

Evolutes and Involutes, Evaluation of improper integrals: Integrals without infinite limits of integration, Beta function, Gamma function, Relation between beta and gamma functions (without proof), Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT II [CO:2] **(15)**

Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin series (without proof), Sequences, Series, Series of positive terms, Convergence tests: Comparision test (limit form) D'Alembert's ratio test, Raabe's test for convergence.

UNIT III [CO:3] **(15)**

Fourier series: Half range sine and cosine series, Parseval's formula. Multivariable Calculus: Limit, continuity and partial derivatives, total derivative, Maxima, minima and saddle points of two variables, Method of Lagrange multipliers. Scalar and vector point functions , Gradient, directional derivative divergence and curl, del applied twice to point and product of point functions(without proofs).

UNIT IV [CO:4] **(15)**

Rank of a matrix, Normal form, Inverse by Gauss Jordan method, System of linear equations: non homogeneous, Homogeneous systems, Rank-nullity theorem (without proof), Eigenvalues and eigenvectors, Cayley-Hamilton Theorem (without proof), Diagonalization of matrices, reduction of quadratic form to canonical form.

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. G.B. Thomas and R.L. Finney - Calculus and Analytic geometry, Pearson, 2002.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
3. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

ME 112	ENGINEERING CHEMISTRY	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To imparts concepts involved in molecular structure and intermolecular forces.
2. To Understands the chemistry behind electrochemical energy systems.
3. To understand the chemical concepts involved in Water treatment and Corrosion.
4. To understand the about the major organic reactions and end products like conducting polymers.
5. To learn the analytical methods useful in characterization of compounds.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Student can identify stable complexes and suitable electrochemical energy systems for end usage.
2. Apply his knowledge for effective water treatment and corrosion prevention.
3. identify chemical reactions that are used in the synthesis of molecules and polymers
4. Distinguish the ranges of the electromagnetic spectrum and characterize a given compound using analytical techniques..

COURSE CONTENT:

UNIT I [CO:1] **(15)**

Molecular structure, Intermolecular forces and Energy systems:

Crystal field theory-salient features, energy level diagrams-tetrahedral and octahedral complexes, crystal field stabilization energies and magnetic properties.

Ionic, dipolar, Vander Waal's interaction and Hydrogen bonding, critical phenomena-Andrew's isotherms of CO_2, derivation of critical constants from Vander Waal's equation.

Electrode potential, electrochemical series, Nernst equation and its applications. Batteries-Primary (Dry cell) and secondary (Lead acid), Lithium battery (Li-MnO2)- advantages, Fuel cell (H2 - O 2 cell).

UNIT II [CO:2] **(15)**

Water Chemistry and Corrosion :

Water Chemistry - WHO standards, Municipal water treatment-Removal of suspended impurities - Sedimentation, Co-agulation and Filtration-Disinfection of water by chlorine, Break point chlorination, Dechlorination, Purification by ion-exchange method and reverse osmosis.

Corrosion-Introduction, Electrochemical theory of corrosion, galvanic corrosion, differential aeration corrosion, Factors-temperature, pH, overvoltage. Cathodic protection by sacrificial anodic method and impressed current method. Electroplating (Cu), Electrolessplating (Ni).

UNIT III [CO:3] **(15)**

Organic reactions and Polymers :

Types of organic reactions-Substitution($SN^1$and SN^2), Elimination ($E^1$and E^2), Addition-Markownikoff's rule and anti-Markownikoff's rule, Cyclisation (Diel's Alder reaction), Synthesis of aspirin.

Polymers - Functionality, Degree of Polymerization, Tacticity-Addition and condensation polymerization, Relationship between Structure and Properties of polymers (Strength, Crystallinity, Elasticity, Plastic Deformation, Glass transition temperature (Tg)), Factors affecting Tg.

Conducting polymers: Introduction, Examples, General applications, Mechanism of conduction in polyacetylene.

UNIT IV [CO:4] **(15)**

Spectroscopic techniques and its applications :

Beer-Lambert's law, limitations, colorimetric determination of Fe(III) UV-VIS spectroscopy - electronic transitions, shifts-blue and red, Block diagram - brief introduction of components, Applications - purity and differentiation of conjugated and non-conjugated dienes.

IR Spectroscopy - condition to be IR active, vibrational modes of - AB_2 , Block diagram-brief introduction of components, IR spectrum of CO_2 and H_2O molecules, General applications. Fluorescence and its applications in medicine.

LEARNING RESOURCES:

TEXT BOOK(s):

1. P.C.Jain and Monica Jain- Engineering chemistry, 16th edition, Dhanpat Rai Publishing Company.
2. Wiley Engineering chemistry, 2nd edition, Wiley India Private Limited.

REFERENCE BOOK(s):

1. Bruce H. Mahan, University Chemistry, 3rd edition, Narosa Publishing House..
2. Shashi Chawla - A text book of Engineering chemistry, 3rd edition, Dhanpat Rai Publishing Company..

WEB RESOURCES:

1. Engineering Chemistry (NPTEL Web Book by B.L. Tembe, Kamaluddin & M.S. Krishnan).
2. http://www.powerstream.com/BatteryFAQ.html#lec
3. http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-ofAnalysis.

ME 113	ENGLISH FOR COMMUNICATION SKILLS	L	T	P	C	Int	Ext
		3	-	-	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To enable students improve their lexical and communicative competence and to equip students with oral and written communication skills.
2. To help students understand and learn the correct usage and application of Grammar principles.
3. To get them acquainted with the features of successful professional communication.
4. To enable students acquire various specific features of effective written communication.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Use vocabulary contextually.
2. Compose effectively the various forms of professional communication.
3. Apply grammar rules efficiently in spoken and written forms.
4. Improve clarity to locate and learn the required information.

COURSE CONTENT:

UNIT I [CO:1] **(8)**

Vocabulary Building

1.1 - Root words from foreign languages and their use in English.

1.2 - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.3 - Synonyms, antonyms, and standard abbreviations.

1.4 - One word substitutes.

UNIT II [CO:1,2,3] **(8)**

Writing Skills

2.1 - Proposal writing

2.2 - Letter-writing

2.3 - Techniques for writing precisely (precis writing)

2.4 - E-mail writing

UNIT III [CO:3] **(8)**

Identifying Common Errors in Writing

3.1 - Subject-verb agreement

3.2 - Noun-pronoun agreement

3.3 - Articles

3.4 - Prepositions

3.5 - Tenses

3.6 - Redundancies

UNIT IV [CO:1,2,3,4] **(8)**

Nature and Style of Sensible Writing

4.1 - Description & Narration (Paragraph Writing). [CO:1,2,3]

4.2 - Essay Writing (Expository Essay). [CO:1,2,3]

4.3 - Note-Making and Note-Taking. [CO:1,2,4]

4.4 - Methods of preparing notes. [CO:1,2,4]

LEARNING RESOURCES:

TEXT BOOK:

Communication Skills. Sanjay Kumar and Pushpa Lata.Oxford University Press.

REFERENCE BOOK(s):

1. Remedial English Grammar. F.T. Wood. macmillan.2007
2. On Writing Well. William Zinsser. Harper ResourceBook. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly.Cambridge University Press.2006.
4. Practical English Usage.Michael Swan. OUP. 1995Press

ME 114	PROGRAMING FOR PROBLEM SOLVING	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER I [FIRST YEAR]						

Course Objectives

At the end of the course, the student will understand the

- Basic problem solving process using Flow Charts and algorithms.
- Basic concepts of control structures in C.
- Concepts of arrays, functions, pointers and Dynamic memory allocation in C.
- Concepts of structures, unions, files and command line arguments in C.

Course Outcomes

At the end of the course, the student will be able to

- Develop algorithms and flow charts for simple problems.
- Use suitable control structures for developing code in C.
- Design modular programs using the concepts of functions and pointers .
- Develop code for complex applications using structures and file handling features.

COURSE CONTENT:

UNIT – I **(15 Periods)**

Introductory Concepts: Block Diagram of Computer, Computer Characteristics, Hardware vs Software, How to Develop a Program, Software Development Life Cycle, Structured Programming, Types of Programming Languages, Introduction to C program, Program Characteristics.

Introduction to C Programming: Character set, Identifiers and Keywords, Data types, Constants, type qualifiers, Declaration and Initialization of variables.

Operators & Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, Conditional Operator, Input/ Output functions.

UNIT – II **(15 Periods)**

Control Statements: Branching, Looping, Nested Control Structures, Switch Statement, Break Statement, continue Statement, and Goto Statement

Arrays: Defining an Array, Processing an Array, Multidimensional Arrays & Strings.

UNIT – III **(15 Periods)**

Functions: Defining a Function, Accessing a Function, Function prototypes, Passing Arguments to a Function, Passing Arrays to Functions, Recursion, Storage Classes

Pointers: Fundamentals, Pointer Declarations, Passing Pointers to a Function, Pointers and Arrays, Dynamic memory allocation, Operations on Pointers, Arrays of Pointers.

UNIT – IV **(15 Periods)**

Structures and Unions: Defining a Structure, Processing a Structure, User-Defined Data Types, Structures and Pointers, Passing Structures to Functions, Self Referential Structures, Unions.

Files Handling: Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data Files, Accessing the File Randomly.

Command line arguments, C-preprocessor directives.

Learning Resources:

Text Book:

1. Programming with C (Schaum's Outlines) by Byron Gottfried, Third Edition, Tata McGraw-Hill.

Reference Books:

1. Programming in C by Stephen G. Kochan, Fourth Edition, Pearson
2. C Complete Reference, Herbert Sheildt, TMH., 2000.
3. Programming with C by K R Venugopal & Sudeep R Prasad, TMH., 1997.

4. The C programming Language by Brian W. Kernighan & Dennis M. Ritchie, Second Edition, Prentice Hall.
5. A Structured Programming Approach Using C by Behrouz A. Forouzan, Richard F. Gilberg, Third Edition, Cengage 2007.

Web References:

http://cprogramminglanguage.net/

http://lectures-c.blogspot.com/

http://www.coronadoenterprises.com/tutorials/c/c_intro.htm

http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

ME 151	CHEMISTRY LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To learn the concepts of equivalent weight, molecular weight, normality, molarity, weight percent, volume percent.
2. To know the methods of determining hardness and chloride ion content of water sample.
3. To learn the redox methods to determine Fe2+ ions present in solution.
4. To know principles and methods involved in using instruments like conductivity bridge and potentiometer
5. To know the molecular properties like surface tension, viscosity.
6. To know synthetic methods for preparation of drugs and polymer

COURSE OUTCOMES:

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

1. estimate the Fe(II) content of a given solution and chloride/hardness content of water.
2. measure molecular properties such as surface tension, viscosity.
3. measure conductance of solutions, redox potentials of a cell.
4. synthesize a small drug molecule and polymer.

List of Experiments:

1. Estimation of Mohr's salt using $KMnO_4$.
2. Estimation of Mohr's salt using $K_2Cr_2O_7$.
3. Determination of chloride ion content of water.
4. Determination of Hardness of water using EDTA method.
5. Determination of Fe(II) strength using $K_2Cr_2O_7$ potentiometrically.
6. Determination on strength of NaOH using HCI conductometrically.
7. Determination of surface tension.
8. Determination of Viscosity.
9. Determination of Saponification / acid value of oil.
10. Preparation of p-bromo acetanilide.
11. Preparation of Phenol Formaldehyde resin.
12. Determination of partition co-efficient of I2 in water.
13. Determination of Rf value using TLC.
14. Verification of Freundlich isotherm using adsorption of acetic acid on activated charcoal.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 152	ENGLISH LANGUAGE COMMUNICATION SKILLS LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To Identify speaker's purpose and tone; make inferences and predictions about spoken discourse, discuss and respond to content of a lecture or listening passage orally and/or in writing.
2. To acquaint the students with the Standard English pronunciation, i.e., Receive Pronunciation (RP), with the knowledge of stress and intonation.
3. To develop production and process of language useful for social and professional life.
4. To develop in them communication and social graces necessary for functioning. Improve the dynamics of professional presentations.
5. To develop critical reading and comprehension skills at different levels.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

1. Comprehend relationships between ideas and make inferences and predictions about spoken discourse.
2. Speak English with a reasonable degree of accuracy in pronunciation.
3. Develop appropriate speech dynamics in professional situations.
4. Use effective strategies and social graces to enhance the value of communication.
5. Develop effective communication and presentation skills and using language effectively to face interviews with success.

List of Exercises / Activities:

Oral Communication

(This unit involves interactive practice sessions in Language Lab).

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Interviews.
5. Formal Presentations.
6. Reading Comprehension.

REFERENCE BOOK(S) :

1. Communication Skills. Sanjay Kumar and Pushpa Lata. Oxford University Press.
2. Practical English Usage. Michael Swan. OUP. 1995 Press
3. Exercises in Spoken English. Parts.I- III. CIEFL, Hyderabad. Oxford University
4. Technical English .M. Sambaiah, Wiley Publications, New Delhi

ME 153	WORKSHOP PRACTICE LAB	L	T	P	C	Int	Ext
		1	-	4	3	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

Engineers, whatever be their line of activity, must be proficient with all aspects of manufacturing, however it should not be forgotten that practice without theory is blind and the theory without practice is lame.

1. Students involved in acquiring manufacturing skills must have balanced knowledge of theory as well as practice.
2. Imparts basic knowledge of various tools and their use in different sections of manufacture such as fitting, carpentry, tin smithy, moulding, casting, welding, electrical wiring, PCB work on electronic circuits and practice with machine shop tools & equipments.

COURSE OUTCOMES:

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

1. will gain knowledge of the different manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

Lectures and Videos: [10 hours]

1. Manufacturing Methods: Introduction to various types of manufacturing methods - casting - forming - various machining operations such as turning, milling, shaping, drilling, slotting etc.,, - various joining methods such as welding, brazing, soldering etc.,- Advanced manufacturing methods (3 Lectures).
2. CNC machining and Additive manufacturing (1 Lecture).
3. Fitting operations and power tools (power hack saw, table mounted circular saw, wood turning lathe, bench grinder, concrete mixer, concrete vibrator etc.,) (1 Lecture).
4. Basic principles involved in electrical circuits and electronic PCB circuits(1 Lecture).
5. Carpentry (1 Lecture).
6. Welding(arc welding & gas welding) (1 Lecture).
7. Metal casting(1 Lecture).
8. Plastic moulding, glass cutting (1 Lecture).

Text book:

1. Hajra Choudhury S, K., Hajra Choudhury A.K and Nirjhar Roy S.K. - Elements of Workshop Technology, VolumeI and Volume II,2010, Media promoters and publishers private limited, Mumbai.

Reference books:.

1. Kalpakjian S and Steven S.Schmid. - Manufacturing Engineering and Technology, 4th edition, Pearson Education, India, 2002.
2. Rao P.N. - Manufacturing Technology, Volume I &II, Tata McGrawHill House, 2017.

Work shop Practice: (60 hours)

Objectives:

Students acquiring practical knowledge on various manufacturing techniques and will be able to fabricate components with their own hands.

Outcomes:

Up on completion of laboratory, students will be able to gain the manufacturing skills and get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

List of Exercises - Trade wise Experiments:

1. Welding shop(both arc &gas welding)
   - Square butt joint
   - Lap joint
   - Single v butt joint
   - Gas welding & Cutting
2. Fitting Shop& Casting
   - Inclined fit
   - Half round fit
   - V fit
   - Moulding and casting of Hand wheel
3. Practice on electrical wiring and Electronic circuit boards
   - One bulb controlled by one switch &one bulb controlled by two switches
   - Two bulbs controlled by one switch (Stair case connection)
   - Tube light connection
   - Measurement of resistance, voltage and current with the help of a multi-meter & soldering on an electronic PCB circuit.
4. Machine Shop
   - Practice of machining operations on Lathe, Milling, Shaping, Drilling and Slotting Machines.
5. Carpentry
   - Lap joint
   - Cross lap joint
   - Dovetail joint
   - Turning on wood turning Lathe
6. Tin Smithy
   - Rectangular tray
   - Funnel
   - Pipe joint
   - Rectangular Scoop

Plastic moulding and glass cutting

Note: A minimum of 2 (Two) from each trade - Total 12 (Twelve) experiments - have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 154	PROGRAMING FOR PROBLEM SOLVING LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

1. To understand the basic problem-solving process using Flow Charts and algorithms.
2. To understand the basic concepts of control structures in C.
3. To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. To use the concepts of structures, unions, files and command line arguments in C.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. develop algorithms and flow charts for simple problems.
2. use suitable control structures for developing code in C.
3. design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the givenproblem using the following statements]

Lab 1	Simple computations using arithmetic expressions.
Lab 2	if-then-else & switch statement
Lab 3	Iterative statements.
Lab 4	1D Array manipulation.
Lab 5	2D Arrays and Strings.
Lab 6	Function calling mechanisms(Call by value).
Lab 7	Function calling mechanisms(Call by reference).
Lab 8	Recursive functions.
Lab 9	Dynamic Memory Allocation.
Lab 10	Structures and Unions.
Lab 11	File Operations.
Lab 12	Command Line Arguments.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

MEMC01	ENVIRONMENTAL SCIENCE	L	T	P	C	Int	Ext
	[MANDATORY NON-CREDIT COURSE]	2	-	-	-	100	-
	SEMESTER I [FIRST YEAR]						

COURSE OBJECTIVES:

To enable the students to

1. Understand that humans are an integral part of environment and hence their activities reflect on the environment.
2. Realize and appreciate the importance of ancient practices and their importance in the present times
3. Appreciate the contribution of individuals for the upkeep of environmental standards, in turn help the humans live better.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Evaluate the implications of human activities and thereby promote ecofriendly technologies.
2. Promote awareness among the members of the society for a sustainable environment.
3. Include and give priority to environmental protection in all developmental projects.

A. AWARENESS ACTIVITIES - SMALL GROUP MEETINGS

I. Source of water for human consumption/activities:

- **a.** collection of information pertaining to water resources and consumption in Andhra Pradesh
- **b.** Water resource on campus: General / Laboratory use and
- **c.** Drinking water - understand the background and adopt judicious management.
- **d.** Recycled water for Gardening - Particularly Lawns.
- **e.** Cut down wastage of electricity in class rooms / labs / hostels etc. by avoiding misuse.

II. After the group meetings and exposure to the local issues and healthy practices, students motivated to make:

- **a.** Posters
- **b.** Slogans/One liners for promoting awareness

III. Lectures from Experts (at least 2 in the course duration)

IV. A walk in the neighborhood to promote a chosen theme on environmental consciousness.

B. ACTUAL ACTIVITIES

1. Plantation on Campus and on the sides of approach road.
2. Distribution of saplings to the local colony dwellers and encourage plantation.
3. Development of Kitchen garden on campus - Cultivation of atleast leafy vegetables and creepers like cucumber etc. for use in college canteen/hostels etc.
4. Adoption of "NO PLASTICS" on campus.
5. Field trip to gain knowledge of biodiversity, water shed, mining, pollution and other local issues.
6. Preparation of working models for energy generation/transformation etc.

C. THEORY SYLLABUS FOR ASSESSMENT

Part-I

1. Introduction to Environmental Studies, Scope and Importance.
2. Natural resources Renewable and Non-Renewable; Definition and importance of the following resources in detail: a. Forest b. Water c. Land d. Energy
3. Sustainable development - Concept and Measures.
4. Biodiversity - Definition, Types of Biodiversity, Values and threats to Biodiversity, Conservation of biodiversity, IUCN classification: Endangered, Threatened, Vulnerable, Rare

species; Endemic and Exotic species.

5. Climate change - Global warming, Ozone depletion and Acid rain.

Part-II

6. Water shed, water shed management in detail.
7. Solid wastes and Solid waste management.
8. Environmental Legislation, Environmental acts - Wild life protection act, Water act, Forest conservation act, Air act and Environmental protection act.
9. Case studies: Chernobyl nuclear disaster, Bhopal gas tragedy, Narmada bachao andolan, Silent valley, Story of Tuvalu, Story of Ganga.
10. Earth summit and Kyoto protocol; Measures at individual level for conservation of natural resources and sustainable development.

Text Books

1. Anubha Kaushik and C.P.Kaushik - Environmental Studies, 3rd Edition, New Age International Publishers, New Delhi., 2012.
2. R. Rajagopalan - Environmental studies from crisis to cure, 3rd Edition, Oxford University press, 2012.

ASSESSMENT

1. Two assessments each of 40 marks will be done in the semester. The split up of each assessment is as follows:
   a. Two internal theory examinations will be conducted for 18 marks each.
   b. Evaluation of the prepared activity sheets and working models will be done for 12M (continual evaluation) twice in the semester in line with the theory examination.
   c. 5 Marks for attendance and 5 marks for oral test.

Note: Weightages for a, b & c will be taken as per the assessment guidelines of the R-18 curriculum and projected to 100 marks.

ME/CE/EC 121	MATHEMATICS-II	L	T	P	C	Int	Ext
	(Calculus, Ordinary Differential Equations and Complex Variable)	2	1	-	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in Multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Solve differential equations which model physical processes..
2. Evaluate multiple integrals and their usage.
3. Integrate vector functions.
4. Understand differentiation and integration of functions of a complex variable and appy them in various engineering problems.

COURSE CONTENT:

UNIT I [CO:1] **(15)**

Differentials equations of first order-Linear equations, Bernoulli's equation, exact equations, equations reducible to exact equations.

Differentials equations of higher order - Second order linear differential equations with constant coefficients - Method of variation of parameters, Cauchy's homogeneous linear equation and Legendre's linear equation.

UNIT II [CO:2] **(15)**

Multiple Integrals - Double integrals (Cartesian and polar), Change of order of integration, Change of variables Cartesian to polar coordinates.

Area by double integrals, Triple integrals (Cartesian), Volume by triple integrals.

UNIT III [CO:3] **(15)**

Integration of vectors - Line integrals, surface integrals, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Volume integrals, Gauss divergence theorem (without proof).

Complex variables - Differentiation, Cauchy Riemann equations (Cartesian and polar-without proof), analytic functions.

UNIT IV [CO:4] **(15)**

Harmonic functions, finding harmonic conjugate - Milne Thomson method.

Complex integration - Cauchy Integral Theorem (without proof), Cauchy Integral Formula (without proof).

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

ME 122	ENGINEERING PHYSICS	L	T	P	C	Int	Ext
	(Waves and Optics)	3	-	-	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. To impart knowledge and understanding the basic principles of oscillators.
2. To understand about basic phenomena of mechanical waves in the medium.
3. To understand the basic phenomena of light waves and interference.
4. To understand about diffraction phenomena and basic principles of lasers.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Identify and illustrate physical concepts and terminology used in oscillations.
2. Identify the basic phenomena of mechanical waves in medium.
3. Identify the propagation of light and interference phenomena.
4. Identify the basic concepts of diffraction phenomena and lasers.

COURSE CONTENT:

UNIT I [CO:4] **(15)**

Simple harmonic motion, damped and forced simple harmonic oscillator:

Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator - heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance.

UNIT II [CO:4] **(15)**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion :

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves.

UNIT III [CO:4] **(15)**

The propagation of light :

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Brewster's angle, total internal reflection.

Wave optics : Interference introduction, Stoke`s principle, interference in thin films by reflected light(cosine law),theory of air wedge , Newton's rings, Michelson interferometer and its applications.

UNIT IV [CO:4] **(15)**

Diffraction and Lasers :

Farunhofer diffraction from a single slit, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

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

LEARNING RESOURCES:

TEXT BOOK:

M.N. Avadhanulu, P.G. Kshirasagar - A Text book of Engineering Physics, S. Chand & Company Ltd., 2018.

REFERENCE BOOK(s):

1. Ian G. Main, Oscillations and waves inphysics.
2. H.J. Pain, The physics of vibrations and waves .
3. E. Hecht,Optics.
4. A. Ghatak,Optics.
5. O. Svelto, Principles ofLasers.

WEB RESOURCES:

Online course:

ME 123	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER II [FIRST YEAR]						

Course Objectives:

The main objectives of this course are

1. To introduce fundamental laws, basic electrical elements, sources and their characteristics.
2. To develop the ability to apply circuit analysis to AC circuits.
3. To provide students with fundamental concepts on the construction and operation of transformers and electrical machines.
4. To know the principle of operation and characteristics of diode, transistors and oscillators.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Understand the basic electrical circuits and batteries.
2. Gain the knowledge on the concept of AC circuits.
3. Understand the operation of electrical machines.
4. Understand diodes, transistors and oscillators.

COURSE CONTENT:

UNIT – I [CO1] (15 Periods)

DC Circuits: Batteries: Lead-acid, Nickel-iron, Nickel-Cadmium batteries (Operation only). Elementary calculations for energy consumption. DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT-II [CO2] (15 Periods)

AC Circuits: Representation of sinusoidal waveforms, peak and rms values of sinusoidal waveform, phasor representation. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), real power, reactive power, apparent power, power factor. Three phase balanced circuits, voltage and current relations in star and delta connections (balanced loads only). Working principle of single phase transformer, ideal and practical transformer

UNIT-III [CO3] (15 Periods)

Electrical Machines: Construction, working principle of DC generator and motor (Elementary treatment only), torque-speed characteristic of separately excited dc motor. Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Construction and working of synchronous generators.

UNIT - IV [CO4] (15 Periods)

Semiconductor Diodes: Semiconductor diode, Zener diode, Half-Wave Rectifier, Full-Wave rectifier, Bipolar Junction Transistor: Transistor operation, Common base configuration, Common emitter configuration, Common collector configuration. Feedback and Oscillator Circuits: Feedback concepts, Barkhausen criteria, Phase-Shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator.

TEXT BOOKS:

1. A.Sudhakar and Shyam Mohan SP, Circuits and Networks: Analysis and Synthesis, 3rd Edition, TMH, 2006.
2. B.L.Theraja – Textbook of Electrical technology-S.Chand& Co.
3. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 6th Edition, PHI.

REFERENCE BOOKS:

1. Mahmood Nahvi and Joseph Edminister, Electric Circuits, 4th Edition, Schaum's outline series, TMH, 2004.
2. Jacob Millman, Christos C.Halkias, "Integrated Electronics", Tata McGrawHill Publishers.
3. S.Salivahanan, A.Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill Publishers

ME 124	ENGINEERING MECHANICS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. Learn and understand the basic principles of mechanics of rigid bodies, various types of force systems in plane and to analyze problems in a simple and logical manner.
2. Learn basic concepts of force systems in space and study centroids of various standard geometrical shapes as well as composite areas and centre of gravity of material bodies.
3. Study the concept of moment of inertia of areas & material bodies and learn computation deflections using virtual work.
4. Learn principles of dynamics and understand the kinematics and kinetics of rectilinear, curvilinear translation, rotation about fixed axis and general plane motion of rigid bodies.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Apply principles of mechanics, static equilibrium equations to various types of force systems in order to determine the resultant, unknown forces and moments.
2. Use vector analytical techniques for analysing forces and moments in spatial force systems and also determine the centroids and center of gravity of standard geometric shapes as well as composite areas.
3. Apply principle of virtual work to solve simple structures. Calculate the area moment of inertia and mass moment of inertia of standard shapes as well as composite sections.
4. Apply fundamental concepts of kinematics and kinetics of particles and rigid bodies to the analysis of simple and practical problems.

COURSE CONTENT:

UNIT I [CO:1] **(12)**

Basic Concepts & Force systems in a plane: Principles of statics, composition and resolution of forces, equilibrium of concurrent forces in a plane, method of projections, Method of moments, Couple, equilibrium of parallel forces in a plane, resultant and equillibrum of general case of forces in a plane, plane trusses-method of joints. Friction: Concept of friction, laws of friction, simple contact friction, wedge friction.

UNIT II [CO:2] **(12)**

Force systems in a space (Using vector notation): Position vector, unit vector, force vector, resultant and equilibrium of concurrent forces in space, moment of a force about a point, moment of a force about an axis. Centroid and Centre of Gravity: Centroids of simple shapes from first principles, centroids of composite plane figures, centre of gravity of three dimensional bodies (Right circular cone and Hemi sphere).

UNIT III [CO:3] **(12)**

Virtual Work: Introduction, principle of virtual work, Equilibrium of Ideal systems.Moment of Inertia: Area moment of inertia - Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections, Mass moment inertia of circular plate, Cylinder, Cone and Sphere.

UNIT IV [CO:4] **(12)**

Kinematics: Rectilinear translation, Curvilinear translation, Rotation about fixed axis, General Plane motion of rigid bodies.Kinetics: Rectilinear translation, Work and energy, Impulse momentum, Collision of elastic bodies-direct central impact, Curvilinear translation, Rotation about fixed axis, General plane motion of rigid bodies.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering mechanics by S. Timoshenko, D. H. Young, J V Rao and Sukumar Pati - 5th edition, McGraw Hill Education (India) Private Limited, (For concepts).
2. Engineering mechanics-statics and dynamics by A. K. Tayal - 14th edition, Umesh publications (For numerical problems).
3. Engineering Mechanics by S.S. Bhavikatti, 5th edition, New Age International Pvt Ltd Publishers.

REFERENCE BOOK(s):

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall.
2. J. L. Meriam and L. G. Kraige, Engineering Mechanics: Dynamics, Wiley, 2011.
3. Singers Engineering Mechanics: Statics and Dynamics, K.Vijaya Kumar Reddy and J Suresh Kumar, 3rd Edition SI Units - BSP Books Pvt. Ltd. Publications.
4. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.

WEB RESOURCES:

1. https://nptel.ac.in/courses/122104015/
2. https://nptel.ac.in/courses/112103109/

ME 125	ENGINEERING GRAPHICS	L	T	P	C	Int	Ext
		1	-	4	3	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Make them understand the concepts of orthographic and isometric projections.
3. Develop the ability of conveying the engineering information through drawings.
4. Make them understand the relevance of engineering drawing to different engineering domains.
5. Develop the ability of producing engineering drawings using drawing instruments.
6. Enable them to use computer aided drafting packages for the generation of drawings.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software..
3. Use the knowledge of orthographic projections to represent engineering information / concepts and present the same in the form of drawings.
4. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
5. Convert pictorial and isometric views of simple objects to orthographic views.

COURSE CONTENT:

UNIT I [CO1](12)

General: Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering.

Conic sections: Construction of Ellipse, Parabola, Hyperbola and Rectangular Hyperbola. (General method only)

Curves: Cycloid, Epicycloid, Hypocycloid and Involute and Scales

UNIT II [CO1, CO2](12)

Method of Projections: Principles of projection - First angle and third angle projection of points, Projection of straight lines inclined to both planes. Traces of lines.

Projections of planes: Projections of planes inclined to both the planes, projections on auxiliary planes.

UNIT III [CO3](12)

Projections of Regular Solids: Projections of solids (Prism, Pyramid, Cylinder and Cone) with varying positions.

Sections of Solids: Sections of Prisms, Pyramids, cylinders and Cones. True shapes of sections. (Limited to the cutting plane perpendicular to one of the principal plane).

Development of surfaces: Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT IV [CO4, CO5](12)

Isometric Projections: Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids

Orthographic Projections: Conversion of pictorial views into Orthographic views and Vice-versa. (Treatment is limited to simple castings).

Perspective Projections: Introduction to Perspective Projection

LEARNING RESOURCES:

TEXT BOOK:

Bhatt N.D., Panchal V.M. & Ingle P.R. - Engineering Drawing, Charotar Publishing House, 2014.

REFERENCE BOOK(s):

1. Shah, M.B. & Rana B.C. - Engineering Drawing and Computer Graphics, Pearson Education, 2008.
2. Agrawal B. & Agrawal C. M. - Engineering Graphics, TMH Publication, 2012.
3. Narayana, K.L. & P Kannaiah - Text book on Engineering Drawing, Scitech Publishers, 2008.
4. (Corresponding set of) CAD Software Theory and User Manuals

ME 161	PHYSICS LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. To give background in experimental techniques and to reinforce instruction in physical principles.
2. To find measurement, data, error, or graphical analysis in addition to illustrating a physical principle
3. To give skills that can transfer critical thinking into problem solving methods, how to identify what data is important, how to collect that data and then draw conclusions from it.

COURSE OUTCOMES:

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

1. use CRO, Function generator, Spectrometer for making measurements
2. test the optical instruments using principles of interference and diffraction
3. The concepts learned in the physics lab trained in carrying out precise measurements and handling sensitive equipment.
4. Draw conclusions from data and develop skills in experimental design.

List of Experiments:

1. Some basic measuring instruments: Screw gauge, Vernier Callipers, Spherometer, Travelling Microscope etc., & General instructions.
2. To determine the acceleration due to gravity and radius of gyration using compound pendulum.
3. To determine the rigidity modulus of the given wire material using Torsional pendulum.
4. To determine the young modulus of the given material by non uniform bending.
5. To study the characteristic curves of a given Photocell and determine the Planck's constant.
6. To determine the radius of curvature of a given Plano-convex lens by Newton's Rings experiment.
7. To calculate the frequency & amplitude of sinusoidal waves and calibration of a given audio oscillator - Lissajous' Figures.
8. To determine the magnetic field along the axis of circular current carrying coil.
9. To measure the a.c. supply frequency using A.C. sonometer.
10. To determine the quality factor of a given series resonance LCR circuit.
11. To determine Fill factor of a given photovoltaic cell.
12. To determine the wavelengths of spectral lines of mercury light using diffraction grating.
13. To determine the wavelength of laser using diffraction grating.
14. To find the dispersive power and resolving power of a grating.
15. To determine the magnetic field in Helmoltz coil.
16. To determine the refractive index of the material of a prism.

REFERENCE BOOKS :

1. Students reference manual : Department of physics, RVR & JC College of Engg.

2. Engineering Physics Lab Manual; Dr. C.V.Madhusudhana Rao, V. Vasanth Kumar, 3rd edition, Scitech publications(India) Pvt. Ltd. Chennai.

3. Engineering Physics Practical's: Dr.B. Srinivasa Rao, V.K.V.Krishna, K.S.Rudramamba University Science Press, Daryaganj, New Delhi.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

ME 162	COMPUTER AIDED GEOMETRICAL MODELLING LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Enable them to use computer aided drafting packages for the generation of drawings.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software..
3. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
4. Convert pictorial and isometric views of simple objects to orthographic views.

List of Experiments:

1. INTRODUCTION to CAD
2. AutoCAD – BASICS

2.1 Starting with AutoCAD
2.2 Layout and sketching
2.3 Drawing environment
2.4 Elements of drawing
2.4. Draw tool bar
2.5 Modify Tool bar
2.6 Dimension Tool bar
2.7 View tool bar

3. 2D drawings of various mechanical and structural components
4. Orthographic and Isometric views of mechanical castings and simple structures.
5. 3-D SOLIDS simple shapes, drafting
6. Sectioning of solids and sectional views.

Learning Resources:

1. Mastering AutoCAD 2019 and AutoCAD LT 2019, Book by Brian C. Benton and George Omura, Willey Publications,2018

ME 163	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB	L	T	P	C	Int	Ext
		-	-	3	1.5	30	70
	SEMESTER II [FIRST YEAR]						

Course Objectives:

The main objectives of this lab course are

1. To conduct experiments on electrical circuits.
2. To design experimental setups for theorems.
3. To learn Diode characteristics, and basic diode applications as rectifiers and regulators.
4. To learn BJT characteristics and Oscillators.

Course Outcomes:

Upon completion of this laboratory, the student will be able to:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings and Understand the usage of common electrical measuring instruments.
3. Verify the network theorems and Design Zener voltage regulator to meet the specifications.
4. Verify experimentally popular BJT applications such as Amplification.

List of experiments/demonstrations:

1. Familiarization of Electrical Installations and Electrical Testing Equipment: Miniature circuit breakers (MCBs), Moulded Case Circuit Breakers (MCCBs), Earth-leakage circuit breakers (ELCBs), Fuses, Types of Wires, Wire Gauges, continuity test, megger, Cables and Earthing.
2. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope, measurement of basic parameters.
3. Verification of KVL& KCL.
4. Verification of Superposition Theorem.
5. Verification of Thevenin's Theorem.
6. Verification of Norton's Theorem.
7. Determination of choke coil parameters.
8. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
9. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
10. Speed control of dc motor.
11. Torque-Slip Characteristics of an induction motor
12. Characteristics of Silicon, Germanium diodes.
13. Characteristics of Zener diode.
14. Half Wave Rectifier and Full Wave Rectifier.
1. 151. Transistor Characteristics in CE configuration.
15. Wein Bridge Oscillator.
16. Colpitt's Oscillator.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

MEMC02	CONSTITUTION OF INDIA	L	T	P	C	Int	Ext
	[MANDATORY NON-CREDIT COURSE]	2	-	-	-	100	-
	SEMESTER II [FIRST YEAR]						

COURSE OBJECTIVES:

To provide basic information about Indian Constitution.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.
2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws. It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).
3. Understand administration of a State, the doctrine of Separation of Powers.
4. Know how the State is administered at the State level and also the powers and functions of High Court.
5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.
6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			**2**							**1**			**1**	**1**
CO2												**1**	**1**	**1**
CO3						**2**			**1**				**1**	**1**
CO4								**1**						

UNIT I **[**CO:1] **(10)**

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT II [CO:2,3] **(10)**

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT III [CO:3,5] **(10)**

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT IV [CO:6] **(10)**

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

LEARNING RESOURCES:

TEXT BOOK:

Durga Das Basu: "Introduction to the Constitution of India" (student edition) Prentice - Hall EEE, 19th/20th Edition, 2001.

REFERENCE BOOK(s):

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI, Learning Pvt.Ltd., New Delhi, 2011.

ME 211	OPERATIONS MANAGEMENT	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To know the importance of forecasting and identify various methods available to forecast the sales/demand . Get the knowledge of choosing best location for plants and about and facilities layout
2. Understand types of production systems and about sequencing
3. To learn about the aggregate planning and its methods
4. Discuss the network techniques and features of project management

COURSE OUTCOMES:

1. Understand the role of forecasting, its importance in industry and apply the techniques to estimate the sales/demand and define about plant location and facilities layout
2. Differentiate different production systems and solve sequencing problems
3. Analyse aggregate production planning and determine a cost effective production plan
4. Understand and construct a network to determine project duration times

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**1**				**2**				**2**		**1**		**1**	**1**
CO2	**1**				**2**				**2**		**1**		**1**	**1**
CO3	**1**				**2**				**2**		**1**		**1**	**1**
CO4	**1**				**2**				**2**		**2**		**1**	**1**

COURSE CONTENT:

UNIT-1	CO1	12
Forecasting: Forecasting variables, forecasting procedure, methods of forecasting: moving average, least squares, simple exponential smoothing, linear regression, correlation coefficient, problems. **Plant Location and Facilities layout:** Necessary factors governing plant location, principles of plant layout, types of layouts.		
UNIT-2	**CO2**	**12**
Production systems: Continuous and intermittent production. Mass and flow production, batch production, job order production, production functions. **Sequencing problem :** Introduction, Processing n jobs through 2 machines, Processing n jobs through 3 machines, processing 2 jobs through m machines, problems		
UNIT-3	**CO3**	**12**
Aggregate planning and scheduling : Long range, intermediate range and short range plans, the aggregate planning problem, aggregate planning methods, mathematical planning models, theoretical planning models (LDR) and heuristic and computer search models, problems. **Master scheduling:** Master scheduling formation: inputs and outputs, Master scheduling methods		
UNIT-4	**CO4**	**12**
Project Planning through networks: Arrow (Network) diagram representation, rules for constructing an arrow diagram, PERT, CPM, Critical path calculations, Determination of critical path, Determination of floats, Probability considerations in project. Introduction to Crashing.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Operations Management – Joseph G.Monks, Tata McGraw Hill

2. Production and Operations Management by Stevenson , Irwin Professional Publishing

REFERENCE BOOK(S):

1. Operations Research – R.Pannerselvem, PHI, 2nd edition,2006.
2. PERT and CPM : Principles and applications- L.S.Srinath.
3. Production and Operations Management by S.N.Chary, TMH

ME 212	MATERIAL SCIENCE AND METALLURGY	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To understand of the correlation between the internal structures of materials, their mechanical Properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams
3. To learn about heat treatment methods to tailor the properties of Fe-C alloys.
4. To introduce various materials related to properties and applications

COURSE OUTCOMES:

1. Gain the knowledge about various crystal structures and their importance in Mechanical Properties and Testing
2. Differentiate various phase diagrams in a binary systems.
3. Recognize the purpose of heat treatment and various heat treatment processes.
4. Familiar with various materials in terms of its properties and applications.

CO – PO MATRIX:

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

COURSE CONTENT:

UNIT-1	CO1	12
Crystal structure Unit cells, Crystal structures, Atomic Packing Factors, Coordination Numbers, Imperfection in solids: Point, line, interfacial and volume defects; Slip and Twinning, critically resolved shear stress. Materials and Properties Classification of materials and their usage in various fields, Testing and evaluation of properties Mechanical Properties of materials. Tensile Testing, Compression Testing, Hardness Testing, Impact Testing and an introduction to Non Destructive Testing (NDT)		
UNIT-2	**CO2**	**12**
Constitution of Alloys and Phase diagrams, Necessity of Alloying, Types of Solid Solutions ,Gibbs Phase Rule , Hume-Rothery's Rules, Lever rule, Phase Diagrams - Isomorphous, Eutectic, Eutectoid , Partial eutectic , peritectic and Monotectic systemsIron –carbon system Iron transformations in the solid state – allotropy and Iron-Iron Carbide Phase Diagram and related phases,		
UNIT-3	**CO3**	**12**
Heat Treatment of Steels: TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformation. Heat Treatment methods: Introduction and purpose of heat treatment, Annealing, Normalizing, Hardening, Tempering, Austempering , Martempering, Age hardening and Surface Hardening of Steels.		
UNIT-4	**CO4**	**12**
Ferrous Alloys: Types, Properties, applications of Steels & Cast irons. Non-ferrous alloys: Properties and applications of Copper, Aluminium and its alloys, Super alloys Composite Materials: Properties and applications of Particulate reinforced composites, fibre reinforced composites, laminar composites and metal matrix composites Powder Metallurgy: Powder metallurgy process, preparation of powders, Applications.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Material Science and Metallurgy - Dr.V.D.Kodgire, Everest Publishers , 2008.

2. Introduction to Physical Metallurgy - Avner, McGrawHill , 2nd Edition ,1997
3. Material Science and Metallurgy - V. Raghavan, Pearson Education / PHI, 5th Edition , 2004.

REFERENCE BOOK(S):

1. Material Science and Metallurgy - R.B.Choudary - Khanna Pub , 1st Edition.
2. A Text Book of Material Science and Metallurgy , O.P. Khanna , Dhanapat Rai Publiacations, 2012.

WEB REFERENCE:

1. http://nptel.ac.in/courses/113106032/
2. http://freevideolectures.com/Subject/Metallurgy-and-Material-Science
3. https://www.freedu.in/courses/sub/47

ME 213	MANUFACTURING PROCESS	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

To motivate and challenge students to understand and develop an appreciation of the processes

1. To impart basic knowledge and understanding about casting processes
2. To impart basic knowledge for various bulk metal forming processes
3. To impart basic knowledge for various sheet metal forming and HERF processes
4. To understand various welding processes and additive manufacturing techniques.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand the Fundamentals of casting process
2. Understand the fundamentals of bulk deformation process
3. Understand the varieties of sheet metal forming operations
4. Understand various joining and additive manufacturing techniques.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**											**2**	**3**	**3**
CO2	**3**	**2**										**2**	**3**	**3**
CO3	**3**	**2**										**2**	**3**	**3**
CO4	**3**											**2**	**3**	**3**

COURSE CONTENT:

UNIT-1	CO1	12

Metal Casting: Casting and moulding: Introduction to Casting, terminology, Pattern-types, materials and allowances, moulding sand properties. Elements of gating system for castings, Riser design- Caine's method, and modulus method-Problems. Melting furnace: Cupola and its Zones

Special casting processes: Centrifugal casting, Die Casting-Types with related equipment, Investment Casting, Casting defects and Remedies.

UNIT-2	CO2	12

Introduction to bulk metal forming: Fundamentals of hot and cold working processes. Rolling-types of roll mills and passes, load estimation for rolling simple problems.

Extrusion: Characteristics, Types of extrusion, Impact extrusion, Hydrostatic extrusion- load estimation and simple problems.

Forging: Types of forging, forging operations, load estimation..

UNIT-3	CO3	12

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, shear, die deign – simple problems. Drawing, number of draws, drawing dies design – simple problems. Stretch forming, Bending, Spring back effect, types of bending, Coining, Spinning, Types of presses and press tools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT-4	CO4	12

Joining/fastening processes: Welding, Classification of welding processes, types of welded joints and their characteristics. Arc welding, TIG,MIG, submerged arc welding, electro slag welding. Gas welding, and resistance welding process and types -Simple problems. Solid-liquid state joining processes- Brazing, soldering and adhesive bonding.

Ultrasonic welding, laser beam welding, friction stir welding, explosive welding, welding

defects and remedies

Additive manufacturing:

Introduction to Rapid prototyping-Need, types- SLS, FDM, advantages, limitations and applications.

LEARNING RESOURCES:

TEXT BOOK(S):

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014.
2. Workshop Technology by Hazra Chaudhary vol I & vol II , Media Publishers & Promoters,India
3. Production Technology Vol 1 and 2 by R.K. Jain , Khanna Publishers , Edn. 19 , Delhi

REFERENCE BOOK(S):

1. Degarmo, Black &Kohser, Materials and Processes in Manufacturing.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.

WEB REFERENCE:

1. https://nptel.ac.in/courses/112104195/1
2. https://nptel.ac.in/courses/112107144/13

ME 214	BASIC THERMODYNAMICS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To learn about Thermodynamic system types and examples, work and heat interactions, and balance of energy between system and its surroundings.
2. To learn about I law of thermodynamics applied to closed and open systems and application to various engineering devices.
3. To understand the concepts of heat engine, refrigerator and heat pump and know the rate of conversion of heat into work and calculate Thermal Efficiency and COP.
4. To learn about II law of thermodynamics and Entropy concepts and to understand how much amount of energy can be Available for conversion into useful work and the concepts of Irreversibility and know about the concept of air standard efficiency and working of different important air standard cycles.

COURSE OUTCOMES:

1. Apply energy balance to systems and control volumes, and able to calculate heat and work transfers.
2. Apply I law of thermodynamics to systems and engineering devices and can evaluate heat, work, internal energy and enthalpy.
3. Evaluate the performance of energy conversion devices like heat engine, refrigerator and heat pump and also able to evaluate entropy changes for various systems.
4. Differentiate between high grade and low-grade energies and able to evaluate exergy and irreversibility for different systems and also evaluate air standard thermal efficiency, mean effective pressure of air standard cycles.

CO – PO MATRIX:

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

COURSE CONTENT:

UNIT-1	CO1	12

FUNDAMENTALS: System & Control volume; Property, State & Process; Exact & Inexact differentials; Temperature, Definition of thermodynamic equilibrium and Zeroth law; Temperature scales; Various Thermometers-Temperature measurement.

WORK & HEAT: Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, gravitational, spring and shaft work-- Definition of heat; examples of heat/work interaction in systems.

UNIT-2	CO2	12

FIRST LAW OF THERMODYNAMICS FOR NON-FLOW PROCESSES: First law applied to a cycle and to a process, Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

FIRST LAW FOR FLOW PROCESSES: Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; I law applications for system and control volume.

UNIT-3	CO3	12

SECOND LAW OF THERMODYNAMICS: Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

ENTROPY: Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy change for different non flow processes- Principle of increase of entropy; Illustration of processes in T-s coordinates.

UNIT-4	CO4	12
AIR STANDARD CYCLES: Otto, Diesel and Dual cycles- Analysis for thermal efficiency and mean effective pressure, comparison between Otto, Diesel and Dual cycles. **AVAILABILITY AND IRREVERSIBILITY:** Available and Unavailable energies, Irreversibility and Availability, Availability function for systems and Control volumes, Lost work.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Engineering Thermodynamics- Nag, P.K, 2005, Tata McGraw-Hill Publishing Co. Ltd.
2. Thermal Engineering- M.M. Rathore, McGrawHill, 2010.

REFERENCE BOOK(S):

1. Thermal Engineering - Er. R.K. Rajput, Lakshmi Publications, 2010.
2. Treatise on Heat Engineering - V.P.Vasandhani and D.S. Kumar, 4th Edition Metropolitan Book Co. Pvt Ltd.

WEB REFERENCE:

1. https://nptel.ac.in/courses/112/105/112105123/
2. https://www.coursera.org/learn/thermodynamics-intro
3. http://web.mit.edu/16.unified/www/FALL/thermodynamics/thermo.pdf

ME 215	THEORY OF MECHANISMS & MACHINES	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide basic concepts on mechanisms, machines and analyze the velocities of various links in mechanisms.
2. To introduce various mechanisms and motion transmission elements used in Mechanical Engineering.
3. Brief study on synthesis of mechanisms and working principles of CAM power elements.
4. To introduce various concepts on gears and gear trains.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand the basic principles of mechanisms in mechanical engineering.
2. Apply the kinematic analysis in subsequent courses in the design and analysis of various machine components.
3. Understand the concepts of synthesis a mechanism and working of cam drives.
4. Understand the Gear terminology and able to analyze gear trains

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2			2	3	3		3	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**			**2**	**3**	**3**		**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**2**			**2**	**3**	**2**		**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**2**			**3**	**3**	**2**		**3**	**3**	**3**

COURSE CONTENT:

UNIT-1	CO1	12

Introduction: Mechanisms and machines, Rigid and resistant bodies, Link, Kinematic pair, Degrees of Freedom, Classifications of Kinematic pairs, kinematic-chain, Linkage, Mechanism, and structure, Classification of mechanisms, Equivalent Mechanisms, Four - Link (bar) Mechanism, Inversions of Slider - Crank Chain, Double - Slider Chain. Straight Line Mechanisms: Hart Mechanism, Scott Russel Mechanism, Grass Hoper Mechansim.

Velocity Analysis: Introduction, Absolute and Relative Motion, Addition and subtraction of Vectors, Motion of a Link, Four Link Mechanism, Angular Velocity of Links, Velocity of Rubbing, Slider – Crank Mechanism, Crank and Slotted Lever Mechanism.

UNIT-2	CO	12

Instantaneous centre: Notation, Number of I - Centers, Arnold Kennedy's theorem, Locating I - Centres, Angular velocity by I - Centre Method.

Acceleration Analysis: Acceleration, Four-Link Mechanism, Angular acceleration of Links, Acceleration of Intermediate and offset points, slider- Crank Mechanism, Coriolis component acceleration, Crank and slotted lever Mechanism.

UNIT-3	CO3	12
Kinematic Synthesis: Stages of synthesis-Concepts of type, Number and dimensional synthesis - Tasks of dimensional synthesis, Concepts of function generation, Rigid body guidance and path generation, Freudenstein's equation for function generation using three precision points. **Cams:** Introduction, Types of cams, Types of Followers, Definitions, Graphical synthesis of cam profile. (Knife Edge, Roller and Flat faced Followers).		
UNIT-4	**CO4**	**12**
Gears: Introduction, Classification gear terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of contact, Number of pairs of Teeth in contact, Interference in Involute Gears, Minimum number of Teeth, Interference between Rack and Pinion, Undercutting, Comparison of Cycloidal and Involute tooth forms. **Gear Trains:** Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train, Torques in Epicyclic Trains: Tabular Methods.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Theory of Machines of by S.S.Rattan. TMH, second re print , 2009.
2. Theory of Mechanisms and Machines by Ghosh and Mallik , East West Press, New Delhi,Re print 2000.

REFERENCE BOOK(S):

1. Theory of Mechanisms and Machines by C.S.Sharma, Kamlesh Purohit, PHI , 2006.
2. Theory of Mechanism and Machine by J.E. Shigley, MGH , 2nd Edition.

WEB REFERENCE:

1. http://nptel.iitk.ac.in
2. http://ptumech.loremate.com/tom1/node/1
3. http://www.youtube.com/watch?v=6coD3oOuhr8

ME 251	MACHINE DRAWING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To make the students understand the concepts of sectioning & method of representing full & half sectional views of various symmetrical & asymmetrical components.
2. To make the students understand the nomenclature associated with screw threaded fasteners, methods to represent and drawing of internal as well as external screw threads.
3. To make the students understand the uses of keys, cotters & pins temporary joints possible between two shafts or shaft & hub.
4. To make the students understand and draw assemblies of machine parts and to draw their sectional views and also to make them familiar with the part drawings and views of assembled component.

COURSE OUTCOMES:

After the successful completion of the course, students are able to

1. Student can identify and apply sectional views for different drawings
2. Student can identify different types of threaded fasteners and their applications
3. Students can apply their knowledge on keys and joints in practical situations
4. Students can able to assemble parts of different machines and produce their drawings

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2					3	3		3	**3**	**2**
CO2	**2**	**3**	**2**						**3**	**2**		**3**	**3**	**2**
CO3	**3**	**3**	**2**						**3**	**2**		**3**	**3**	**2**
CO4	**3**	**3**		**2**					**3**	**2**		**3**	**3**	**2**

LIST OF EXPERIMENTS:

1. Sectional views: Introduction, full & half section
2. Screwed fasteners: Screw thread nomenclature - types & classification of screw threads, Square & Hexagonal headed bolted joints.
3. Keys, Cotters and Pin joints: Saddle & Sunk Keys, Cotter Joint with sleeve , Knuckle Joint
4. Assembly Drawings and Part Drawings : Stuffing Box , Screw Jack , Eccentric , Pipe – Vice (Assembly), Plummer Block, Tail Stock and Tool Post (Part Drawing).

LEARNING RESOURCES:

TEXT BOOK(S):

1. Machine Drawing by K.L.Narayana, P.Kannaiah & K.Venkata Reddy, New Age International , 3rd Edition
2. Machine Drawing- N. Siddeswar, K. Kannaiah & V.V.S. Sastry- TMH.

REFERENCE BOOK(S):

1. Machine Drawing by K.R.Gopala Krishnan, Subhas Publications, 20th Edition, 2007.
2. A Text book on Machine Drawing by R.K.Dhawan, S. Chand & Company Pvt. Ltd. 2014 edition.

WEB REFERENCE:

1. https://nptel.ac.in/courses/112106075/

ME 252	MODELLING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide the students with the knowledge and techniques of the research and application of CAD/CAM.
2. To create 3D part geometry using the design module of the modeling
3. To develop the skills in CAD operations to visualize and create three dimensional part models of mechanical components and assemblies.
4. Student will be able to produce CAD drawings which communicate the appropriate manufacturing details, standards, and specifications

COURSE OUTCOMES:

1. The students will be able to model the given 2D and 3D components, Assemblies etc
2. Has ability to layout an efficient production area and industrial facility using Computer-Aided Design (CAD) software.
3. Has ability to plan the process and utilization of equipment.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**1**	**2**										**2**	**1**	**1**
CO2	**1**		**2**	**3**								**1**	**1**	**1**
CO3	**1**	**2**			**2**								**1**	

COURSE CONTENT:

EXPERIMENTS:

1. Sketcher: Creation of sketch profile with constraints, Transformations, Project 3DElements, Sketch Analysis, Practice of different sketches
2. Part Modeling: Creating Sketch Based features, Creating Dress-up based features, Draft & Draft Analysis
3. Assembly Modeling: Assembly Constraints, Engineering Connections, Insert new product or part, BI Essentials, Interference Analysis
4. Generative Shape Design: Creation of 3DElements, Creation of offset, Creation technique of Multi section, Sweep and Blend. Split and Trim operations, Join, Extract.
5. Process Planning: Creating Systems & operations, Apply flow between Operations. Plant Equipment allocation: Creating Manufacturing Cells and Stations, Insert storage Transpiration and industrial resources

Note: 3D modeling using any of the modeling packages like 3D Experience/CATIA, Pro/ ENGINEER, Uni-Graphics, Solid Works, Ideas, Auto Desk Inventor etc.

**Parts and Assemblies can be chosen from Textbook

LEARNING RESOURCES:

TEXT BOOK(S):

4. Bhatt N.D., Panchal V.M. & Ingle P.R. - Engineering Drawing, Charotar Publishing House, 2014.
5. "Machine Drawing" by K. L. Narayana, P. Kannaiah, K. Venkata Reddy , New Age International , 2007.
6. “CAD Modeling Essentials in 3DEXPERIENCE 2016x Using CATIA Applications”, Nadar Zamani, 2017

WEB REFERENCE:

4. https://edu.3ds.com/en/learn-online

ME 253	ADVANCED PROGRAMMING LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER III [SECOND YEAR]						

COURSE OBJECTIVES:

The course is designed to

1. To illustrate operations of linear and non-linear data structure
2. To demonstrate computational problems using suitable data structures
3. To familiarize design strategies to solve complex problems

COURSE OUTCOMES:

After the successful completion of the course, students are able to

1. Apply operations on linear and non-linear data structures
2. Analyze the algorithm using various data structures
3. Develop solution for the given problem.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		3								2
CO2	3			3								2
CO3	3	2										2

List of Experiments to implement:

1. List ADT
2. Applications of List
3. Single Circular List ADT
4. Doubly Linked List ADT
5. Stack ADT
6. Applications on Stack
7. Queue ADT
8. BST ADT
9. Graph traversal techniques
10. Divide and Conquer strategy
11. Greedy Strategy
12. Dynamic Programming
13. Backtracking Strategy
14. Branch and Bound

Note:**

Not limited to these programs only, if necessary, the teacher can include some more applications based on his/her perception.

ME 254	DATA STRUCTURES AND ALGORITHMS	L	T	P	C	Int	Ext
	SKILL DEVELOPMENT COURSE	1	0	2	2	100	--
	SEMESTER III [SECOND YEAR]						

Course Objectives:

1. To introduce fundamental concepts of data structures.
2. To emphasize importance of data structures to solve real world problems.
3. To familiarize various design strategies to solve complex problems.

Course Outcomes:

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

1. Define structure of any mathematical model.
2. Use appropriate data structures to provide solution to given problem.
3. Analyze efficiency of algorithms by determining the time and space complexity.
4. Develop solutions for complex problems using algorithm design strategies.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**3**		**3**								**2**	**2**	**2**
CO2	**3**			**3**								**2**	**2**	**2**
CO3	**3**	**2**										**2**	**2**	**2**
CO4	**3**	**3**	**3**	**3**								**2**	**2**	**2**

COURSE CONTENT:

UNIT-1	**Text Book-1**	**CO1**	**12**
Analysis of an Algorithm, Asymptotic Notations, Abstract Data Types (ADTs) - singly linked lists, doubly linked lists and circularly linked lists.			
UNIT-2	**Text Book-1**	**CO2**	**12**
Stack ADT, representation using array and linked list, Applications - Infix to Postfix expression conversions, Evaluation of postfix expressions. Queue ADT, representation using array and linked list.			
UNIT-3	**Text Book-1**	**CO3**	**12**
Basic Tree Terminology, Different types of trees: Binary Tree, Binary Search Tree, tree representation and traversals. Graph representation and traversals. Divide and Conquer - Quick sort, Merge sort.			
UNIT-4	**Text Book-2**	**CO4**	**12**
Greedy Method - General Method, Knapsack Problem. Dynamic Programming - General Method, Multistage graph, 0/1 Knapsack Problem, The Travelling Sales Person Problem. Backtracking - General Method, The 8-Queens Problem, Knapsack Problem. Branch and Bound - General Method, 0/1 Knapsack Problem.			

LEARNING RESOURCES:

TEXT BOOK(S):

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.
2. E. Horowitz, S.Sahni and S.Rajsekaran, "Fundamentals of Computer Algorithms", Galgotia Publication.

REFERENCE BOOK(S):

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

MEMC03	PROFESSIONAL ETHICS & HUMAN VALUES	L	T	P	C	Int	Ext
	MANDATORY COURSE	2	0	0	0	100	--
	SEMESTER III [SECOND YEAR]						

Course Objectives:

1. To create awareness to specific set of morals, values and ethics the professional must know and abide by, including work ethics, integrity and commitment etc.
2. To realize the importance of moral autonomy, professional ideals and Ethical theories
3. To study safety/risk aspects, welfare of the public and about employee rights
4. Know about the global issues and code of ethics of professional bodies

Course Outcomes

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

2. Have basic understanding of how a prospective engineer should behave in his chosen field and society.
3. Realize the importance of moral autonomy, professional ideals and Ethical theories.
4. Know about the safety/ risk, welfare of the public and employee rights.
5. Gain exposure to global issues and codes of some professional bodies.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2		3		2			2	2
CO2	2					2		3		2			2	2
CO3	2					2		3		2			2	2
CO4	2					2		3		2			2	2

COURSE CONTENT:

UNIT-1	CO1	12
Human Values : Morals, Values And Ethics - Integrity- Work Ethics- Service Learning - Civic Virtue Respect For Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time -Co-Operation - Commitment - Empathy - Self-Confidence - Character - Spirituality.		
UNIT-2	**CO2**	**12**
Engineering Ethics: Senses of Engineering Ethics- Variety of Moral Issues - Types of Inquiry - Moral Dilemmas - Moral Autonomy - Kohlberg's Theory - Gillian-s Theory - Consensus and Controversy **Professions and Professionalism:** The nature and characteristics of Professions, Professionalism, the foundation and norms of Professional ethics, the need for separate code of conduct for Professionals, Professional Rights, Theories about Right Action, Uses of Ethical Theories. Case studies like The Space Shuttle Challenger, Bhopal gas tragedy, Chernobyl disaster etc.		
UNIT-3	**CO3**	**12**
Engineering as Social Experimentation: Engineering As Experimentation - Engineers As Responsible Experimenters Safety, Responsibilities and Rights: Safety and Risk - Assessment of Safety And Risk - **Risk Benefit Analysis and Reducing Risk.** Collegiality And Loyalty - Respect For Authority –Collective Bargaining - Confidentiality - Conflicts Of Interest - Occupational Crime - Employee Rights – Intellectual Property Rights (IPR) - Discrimination.		
UNIT-4	**CO4**	**12**
Multinational Corporations - Environmental Ethics - Computer Ethics - Business ethics - Engineers As Managers - Consulting Engineers - Engineers As Expert Witnesses and Advisors - Codes Of Ethics - Sample Code Of Ethics Like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management Etc.,		

LEARNING RESOURCES:

TEXT BOOK(S):

4. Mike martin and Ronald Schinzinger, "Ethics in Engineering" McGraw-Hill, New York 1996
5. Govindarajan M, Natarajan S, Senthil Kumar V.S., "Engineering Ethics", PHI, New Delhi

6. Bayles.M.D, Professional ethics, California, Wardsworth publishing company,1981
7. Koehn.D, The ground of Professional Ethics, Routledges, 1995

REFERENCE BOOK(S):

1. Charles D,Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint)
2. Charles E Harris, Michael S.Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases" Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the conduct of business" Pearson, New Delhi, 2003.
4. Edmund G.Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers" Oxford University Press, Oxford, 2001.

ME 221	MATHEMATICS - III (PDE, Probability & Statistics)	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

Course Objectives:

1. To provide knowledge on partial differential equations and its applications in engineering.
2. To provide knowledge on numerical methods including solving systems of linear equations and interpolation.
3. To provide knowledge on numerical integration, numerical solution of ordinary and partial differential equations.
4. To provide knowledge on probability distributions and testing of hypothesis.

Course Outcomes:

After successful completion of the course, the students are able to

1. Solve first and second order partial differential equations in engineering applications.
2. Solve system of equations and evaluate derivatives using numerical techniques.
3. Solve integrals, ordinary and partial differential equations using numerical techniques.
4. Apply knowledge of distribution theory and testing of hypothesis for engineering problems.
   1. and fundamentals of air conditioning methods and systems used for summer and winter seasons.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**3**										**1**	**2**	**2**
CO2	**3**	**3**										**1**	**2**	**2**
CO3	**3**	**3**										**1**	**2**	**2**
CO4	**3**	**3**		**2**								**1**	**2**	**2**

COURSE CONTENT:

UNIT-1	CO1	12
Partial Differential Equations and Applications: Definition, Linear equation of the first order, classification of second order linear equation and its solution by method of separation of variables, Solution of one dimensional wave equation. Solution of one dimensional heat equation, Solution of two dimensional heat equation in steady state (Cartesian only).		
UNIT-2	**CO2**	**12**
Numerical Solution of Equations, Interpolation and Numerical differentiation: Newton-Raphson method, Gauss Seidel iteration method, forward and backward differences, differences of a polynomial, Newton's Forward and Backward Interpolation formulae (without proof). Lagrange's Interpolation formula (without proof), Inverse interpolation. Newton's forward and backward differences formula to compute first and second order derivatives.		
UNIT-3	**CO3**	**12**
Numerical Integration, Numerical Solution of Ordinary and Partial Differential Equations: Trapezoidal rule, Simpson's one-third rule and three-eight rules (without proof) Euler's method, Runge-Kutta method of fourth order, Laplace's equation and Poisson's equation.		
UNIT-4	**CO4**	**12**
Probability Distributions & Testing of Hypothesis: Binomial distribution, Poisson distribution, Normal distribution and their applications. Test for single mean (t-test), test for two means (t-test), Test for ratio of variances (F-test), Chi-square test for goodness of fit for Binomial and Poisson distributions and independence of attributes.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43nd edition, 2015.
2. Richard A. Johnson., Miller & Freund's, Probability and Statistics for Engineers, PHI, 6th Edition.

REFERENCE BOOK(S):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
3. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th edition, 2012.
4. S. Ross, A First Course in Probability, 6th Edition, Pearson Education India, 2002.

WEB REFERENCE:

http://nptel.iitm.ac.in/courses/

ME 222	APPLIED THERMODYNAMICS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To enable the student to understand what is a pure substance what are its properties and know the working of different high pressure boilers, mountings and accessories & steam power plant and methods of improving efficiency of plant
2. To enable the students to understand working of various nozzles and calculate the exit velocity and areas of nozzle and the working principles of steam condensers and their analysis.
3. To enable the students to understand the basic principles of steam turbines and analysis of both impulse and reaction turbines.
4. To enable the student to understand the basic principles of refrigeration and air conditioning systems and to understand the various Psychrometric processes and summer and winter air conditioning systems.

COURSE OUTCOMES:

1. Able to estimate the various properties of Steam by using the steam tables, Mollier chart and able to understand the working of high pressure boilers and their mountings and accessories and also able to understand the working principle of steam power plant and variable affecting it's performance and methods to improve it's performance.
2. Able to estimate the maximum discharge from steam nozzles and areas of nozzle at various locations. Able to estimate the vacuum efficiency and condenser efficiency and cooling water requirements of steam condensers.
3. Able to estimate the blade angles, various velocities and efficiencies by using velocity diagram and analytical methods for both impulse and reaction turbines.
4. Able to understand the working of air refrigeration and vapour compression refrigeration systems and fundamentals of air conditioning methods and systems used for summer and winter seasons.

CO – PO MATRIX:

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

COURSE CONTENT:

UNIT-1	CO1	12
Pure Substance: Definition, process of steam generation, P-v, T-s and h-s diagrams, properties of Wet, Dry Saturated and Superheated steam, Use of Steam Tables, Mollier chart. **Steam Boilers**: Function, classification, working of Benson &La Mont boilers, Mountings & Accessories. **Vapor Power Cycles:** Rankine cycle, Effect of pressure and temperature on the Rankine cycle performance, reheat cycle, regenerative cycle.		
UNIT-2	**CO2**	**12**
Steam Nozzles: Types of nozzles, isentropic flow through nozzles, Effect of friction, Nozzle efficiency, Critical pressure ratio and maximum discharge, calculation of throat and exit areas using Mollier diagram. **Steam Condensers:** Jet and Surface condensers, importance of condenser vacuum, Vacuum efficiency, Condenser efficiency, Thermodynamic analysis, Air pumps, Capacity of air extraction pump.		
UNIT-3	**CO3**	**12**
Steam Turbines: Types of steam turbines, Impulse turbines, pressure and velocity compounding, velocity diagrams, work output, power, blade efficiency and stage efficiency, Reaction turbines,		

velocity diagrams, degree of reaction, work output, power, blade efficiency and stage efficiency, Governing of turbines, Overall efficiency and reheat factor.		
UNIT-4	**CO4**	**12**
Refrigeration: Need for Refrigeration, Definitions, Methods of refrigeration, Working of Refrigerator and Heat pump, Bell-Coleman cycle, Refrigerating effect, COP, Vapour compression refrigeration system, Influence of various parameters on cycle performance, Vapour Absorption cycle. **Psychrometry and Air conditioning:** Introduction, Psychrometric properties, Psychrometric chart, Psychrometric processes, Summer and Winter air conditioning systems		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Thermodynamics An Engineering Approach Y. A. Cengel & M. A. Boles, TMH, 6th Edition, New Delhi,2010.
2. Thermal Engineering- M.M. Rathore, TMH, New Delhi,2010
3. Thermal Engineering ---Rajput, Laxmi Publ, New Delhi , 2012

REFERENCE BOOK(S):

1. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, New Delhi, 4th Edition
2. Refrigeration and Air Conditioning- R. S. Khurmi and Gupta

WEB REFERENCE:

1. IIT Video Lectures (NPTEL)
2. http://www.iscid.org/encyclopedia/Tthermodynamics
3. http://www.transtutors.com/

ME 223	STRENGTH OF MATERIALS	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide the concept of stresses and strains including thermal stresses, elastic constants and relations among them.
2. To discuss basic principles of torsion in shafts and shear force & bending moment in beams.
3. To make the students understand the theory of simple bending, stresses and deflections of beams.
4. To establish an understanding of the two-dimensional stresses, strains and analysis of thin and thick pressure vessels.

COURSE OUTCOMES:

At the end of completion of the course, the student will be able to:

1. Calculate the stresses and strains in axially loaded members.
2. Analyse shafts subjected to torsion and draw shear force & bending moment diagrams for the beams.
3. Estimate bending, shear stresses, slope and deflections in beams.
4. Compute principal stresses and strains for plane stress and plane strain problems using analytical & Mohr s circle methods, determine the stresses in thin and thick pressure vessels.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2									2	2
CO2	3	3		2									2	2
CO3	3	3		2									2	2
CO4	3	3		2									2	2

COURSE CONTENT:

UNIT-1	CO1	12
Simple Stresses & Strains: Introduction, Normal Stress and Strain, Stress- Strain Diagrams, Elasticity, Plasticity and creep, Linear Elasticity, Hooke's Law and Poisson's ratio, Shear Stress and Strain, Bulk Modulus, shear modulus, Young's modulus, Relation between elastic constants, factor of safety and allowable stresses, Bars of uniform and varying cross sections, composite bars, temperature stresses and Strain energy.		
UNIT-2	**CO**	**12**
Torsion: General equation of torsion for circular members, torsion in solid circular, hollow circular and stepped bars. Torsion in bars fixed at both the ends **Shear Force and Bending Moment:** Types of Beams, Shear Force and Bending Moment, Relationships between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams for cantilever, Simply supported, Over hanging beams subjected to Point loads, Uniformly distributed loads, Uniformly varying loads and combination of these loads, Point of contraflexure.		
UNIT-3	**CO3**	**12**
Stresses in beams: Theory of simple bending, bending equation, determination of flexural stresses for simple cases, Shear stress formula, Shear stress distribution in beams having I-Section, T-Section, rectangular and Circular sections.		

Beam deflections: Basic differential equation of deflection curve, determination of slopes and deflections of cantilever, simply supported and overhanging beams by double integration method and Macaulay's method.		
UNIT-4	**CO4**	**12**
Two-dimensional state of Stress and Strain: Plane Stress, Principal Stresses and Maximum Shear Stress, Mohr's Circle for Plane Stress, Plane Strain, Principal Strains and Maximum Shear Strain, Mohr's Circle for Plane Strain. **Pressure Vessels:** Thin Spherical and Cylindrical Pressure Vessels, Thick Cylinders: Lame's theory, thick cylinders under internal fluid pressure.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Mechanics of Materials by James M. Gere and Barry J. Goodner, Published by Cengage Learning, 8th edition.
2. Strength of materials by Sadhu Singh, Khanna Publishers, 11th Edition

REFERENCE BOOK(S):

1. Engineering Mechanics of Solids by E.P.Popov, PHI, 2nd Edition.
2. Strength of Materials by S. Ramamrutham, DhanpatRai Publishing Company (P) Ltd, 18th Edition
3. Introduction to Solid Mechanics by I.H. Shames, PHI, 3rd Edition.
4. Strength of Materials by R.K.Bansal, LaxmiPublications, 6th Edition.

WEB REFERENCE:

1. http://nptel.iitm.ac.in/
2. www.learnerstv.com/Free-Engineering-video-lecture-courses.html

ME 224	MANUFACTURING TECHNOLOGY	L	T	P	C	Int	Ext
		3	0	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide the fundamental knowledge regarding the working principle, specifications, parts and various operations performed lathe and drilling machine tools .
2. To provide the fundamental knowledge regarding the working principle, specifications, parts and various operations performed milling and grinding machine tools.
3. To provide basic information regarding the way of formation of chips, deformation of work piece, generation of temperature, cutting forces. cutting tool materials
4. To develop knowledge in design considerations, principles and related devices used in Jigs and Fixtures
5. Understand Unconventional manufacturing methods employed for making different products.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Gain the knowledge of operating the machines and their mechanisms.
2. Gain the knowledge of Unconventional manufacturing methods employed for making different products.
3. Ability to identify the functions of location, clamping devices and applications of JIGS & FIXTURES
4. To get familiar with the nomenclature of tool and the parameters in the selection of tools and learn the various forces acting on tooling

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**										**2**	**3**	**3**
CO2	**3**	**2**			**2**							**2**	**3**	**3**
CO3	**3**	**2**										**2**	**3**	**3**
CO4	**3**	**2**		**3**								**2**	**3**	**3**

UNIT-1	CO1	12
Lathe: Constructional details, specifications, classification of lathes. Lathe accessories - various work holding devices, Lathe operations including taper turning and thread cutting. Drilling Machines: Types and specifications, spindle feed mechanism, drilling operations.		
UNIT-2	**CO2**	**12**
Grinding Machines: Working principle of cylindrical, center less and surface grinding machines. Grinding Operations, Glazing, loading, Truing and dressing. Surface Finishing Operations: Honing and lapping operations.		
UNIT-3	**CO3**	**12**
Theory of Metal Cutting: Introduction, Nomenclature of single point cutting tool, Tool Geometry, Mechanics of chip formation, types of chips. Determination of shear angle and chip thickness ratio, stress and strain in the chip, velocity relations, Merchant's theory of orthogonal cutting forces, related simple problems. Tool wear, tool life and tool life criteria related simple problems, cutting fluids-types and required characteristics. Requirements of tool materials and types		
UNIT-4	**CO4**	**12**
Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters. Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, wire cut EDM; Electro-chemical machining (ECM). Plasma Arc Machining (PAM). Jigs & Fixtures: Introduction, design considerations in jigs& fixtures. The principle of six point location, locating pins, Clamping and clamping devices.		

LEARNING RESOURCES:

TEXT BOOK(s):

1. Elements of Workshop Technology Vol. II by Hazra Chowdary , Media Promoters & Publishers, 1983
17. Production Engineering by P.C. Sharma, S.Chand &Co , 2007.

REFERENCE BOOK(s):

1. Manufacturing Engineering & Technology by Kalpak Jain, PHI , 5th Edition , 2005.
2. Materials and Processes in Manufacturing by E.Paul De Garmo, J.T.Black and Ronald A.Kohser , John Wiley & Sons, 2003.
3. Manufacturing Science by A. Ghosh & A.K.Mallik , Affiliated East-West Press (P) Ltd., New Delhi ,RePrint 1998

WEB RESOURCES:

1. www.mini-lathe.com/links.htm,machinedesign.com/.../designer-sguidetometalcutting-machinery-0608
2. www.metalwebnews.com/wc.html
3. www.americanmachinist.com
4. www6.conestogac.on.ca/~ffulkerson/J&F%20Notes.pdf

ME 225	FLUID MECHANICS & HYDRAULIC MACHINES	L	T	P	C	Int	Ext
		2	1	-	3	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To learn about the application of mass and momentum conservation laws for fluid flows.
2. To understand the importance of dimensional analysis.
3. To obtain the knowledge to draw velocity triangles in various types of rotodynamic machines and analyze the flow in water turbines.
4. To analyze the flow in water pumps.

COURSE OUTCOMES:

1. The students are able to mathematically analyze the simple flow situation problems.
2. The students are able to gain experience with boundary layer concepts.
3. The students are able to evaluate the performance of turbines.
4. The students are able to evaluate the performance of Pumps.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**3**	**2**	**2**								**2**	**2**	**1**
CO2	**2**	**1**	**3**	**2**		**1**		**1**				**1**	**2**	**1**
CO3	**2**	**1**	**3**	**1**	**1**							**1**	**2**	**2**
CO4	**2**	**1**	**3**	**1**	**1**	**1**						**1**	**1**	**2**

COURSE CONTENT:

UNIT-1	CO1	12

Definition of fluid, Newton law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension-Simple numerical problems.
Control volume-application of continuity equation, Incompressible flow, Euler's equation, Bernoulli's equation and simple numerical problems. Applications on Bernoulli principle (working principle and derivations on Pitot tube, venturimeter and orifice meter only, numerical problems not included).

UNIT-2	CO2	12

Fluid flow Types, Reynolds experiment, laws of fluid friction, Darcy-Wiesbach equation, Laminar flow through a circular conduits, Hagen-Poiseulle law, concept of boundary layer, measures of boundary layer thickness.
Need for dimensional analysis,methods of dimension analysis, Buckingham Pi theorem-simpler problems, Similitude , types of similitude, dimensionless parameters, application of dimensionless parameters, model analysis.

UNIT-3	CO3	12

Basics of turbo machinery:Impact of jets on stationary and moving flat plates, inclined and curved vanes, Jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial curved vanes.
Hydraulic turbines:Classification of water turbines, working principle of Pelton wheel, Francis turbine and Kaplan turbines,work done and efficiencies, performance characteristic curves, draft tube theory.

UNIT-4	CO4	12
Reciprocating Pumps: Types, Working principle, Power required by a Reciprocating pump, Coefficient of discharge, Slip and negative slip, Effect of Acceleration of piston on velocity and pressure in suction and delivery pipes, Indicator diagram and Air vessels. Centrifugal Pumps: Types, Working principle, Reciprocating vs. Centrifugal pump, Work done by impeller, Head of a pump, losses and efficiencies, Minimum starting speed, Specific speed, Multistage pumps, Pumps in parallel, Performance characteristic curves, limitation of suction lift, NPSH.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. Hydraulics and Fluid Mechanics --P.N.Modi & S.M. Seth, Standard Book House, New Delhi,Fourteenth edition, 2002
2. Fluid Mechanics & Hydraulic Machines - R.K.Bansal, Laxmi Publications, revised Ninth edition, reprint 2015.
3. Fluid mechanics andHydraulic Machines –R.K.Rajput, S. Chand and Company Limited, Sixthedition 2015.

REFERENCE BOOK(S):

1. Fluid Mechanics & Fluid Power Engineering - D.S.Kumar, SK Kataria &sons, New Delhi, RePrint edition2012.
2. Introduction to Fluid Mechanics &Fluid Machines - S K Som, Gautam Biswas, Suman Chakraborty, Tata McGraHill Publications, 3rd edition 2017.
3. Fluid Mechanics & Hydraulic Machines - K.Subramanya, McGraHill Publications, Second edition 2018.

WEB REFERENCE:

1. www.hydraulicspneumatics.com
2. http://www.efluids.com/
3. http://fluid.power.net/
4. www.pumps.org/

ME 261	MANUFACTURING PROCESS LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To provide an understanding of advanced manufacturing methods
2. To get an idea of the dimensional & form accuracy of products
3. To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications
4. To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries.

COURSE OUTCOMES:

Course outcomes: After the successful completion of the course, students are able to

1. Select appropriate Manufacturing Processing to manufacture any component
2. Gain knowledge of various machine tools and its operations.
3. To apply some of the manufactures process directly in the industry for preparation of complicated jobs.
4. The student will be trained to implement similar features in preparation of jobs can be extended to implement in the preparation of complicated jobs

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**		**2**					**2**				**2**	**1**
CO2	**3**	**2**		**2**					**2**				**1**	**1**
CO3	**2**	**1**		**2**					**2**				**1**	**1**
CO4	**2**	**1**		**2**					**2**				**1**	**1**

EXPERIMENTS:

1. Taper turning and external thread cutting using lathe
2. Internal Taper turning and internal thread cutting using lathe
3. Contour milling using vertical milling machine
4. Spur gear cutting in milling machine
5. Measurement of cutting forces in Milling/ Turning process
6. Drilling of a small hole using wire EDM
7. Grinding single point cutting tool on Tool and Cutter Grinder
8. Machining Key way on Shaping Machine
9. Machining a spline on Slotting Machine

Note:**

ME 262	FM & SM LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. Apply fundamental principles of fluid mechanics for the solution of practical Mechanical engineering problems of water conveyance in pipes, pipe networks, and open channels.
2. Describe the operating characteristics of hydraulic machinery (pumps and turbines), and the factors affecting their operation and specifications, as well as their operation in a system.
3. Understanding the basic strength of materials principles by conducting experiments
4. Learn to analyze and synthesize test results, write individual and group reports incorporating experimental data, graphs, assessment of results, and conclusions 3. To give more understand in basic of structural field

COURSE OUTCOMES:

After the successful completion of the course,students are able to

1. Apply fundamental knowledge of fluid mechanics in solving problems and making design of pressure-pipe in mechanical engineering
2. Understand the basics of hydraulic machinery and their operation design in water systems.
3. Conduct experiments in flow measurement, hydraulic machinery and interpreting data from experiments, as well as documenting them in engineering reports
4. Ability to design and conduct experiments, acquire data, analyze and interpret data
5. Physical insight into the behavior materials and structural elements, including distribution of stresses and strains, deformations and failure modes

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**		**2**					**2**				**2**	**1**
CO2	**3**	**2**		**2**					**2**				**1**	**1**
CO3	**2**	**1**		**2**					**2**				**1**	**1**
CO4	**2**	**1**		**2**					**2**				**1**	**1**
C05	**2**	**1**		**2**					**2**				**1**	**1**

EXPERIMENTS:

1. Orifice - Determination of coefficient of discharge
2. Venturi meter - Determination of coefficient of discharge
3. Pipe friction - Determination of friction factor and size of roughness of a given pipe
4. Single - stage centrifugal pump - To draw the operating characteristics of the pump and to determine the designed discharge and designed head from it.
5. Single - acting reciprocating pump - To draw the operating characteristic curves at constant speed and determination of efficiency.
6. Gear pump - To draw the operating characteristic curves and determination of overall efficiency of a pump
7. Pelton turbine - To draw the performance characteristic curves and determination of overall efficiency
8. Francis turbine - To draw the performance characteristic curves and determination of overall efficiency.
9. Kaplan turbine - To draw the performance characteristic curves and determination of overall

efficiency

10. (a) Rockwell Hardness test - Determination of Hardness Number for different metal specimens such as mildsteel, cast iron, Brass, Aluminum .
    (b) Brinnell's Hardness Test - Determination of Hardness Number for different metal specimens such as mildsteel, cast iron, Brass, Aluminum
11. Impact Test - (a) Charpy and (b) lzod: Determination of impact strength of mild steel and cast iron specimens
12. Tension Test on UTM - Determination of mechanical properties of mild steel and cast iron specimens
13. Tests on helical spring - Determination of stiffness of helical springs
14. To find the modulus of rigidity by conducting torsion test on solid circular shaft

ME 263	COMMUNICATIVE ENGLISH LAB	L	T	P	C	Int	Ext
		0	0	3	1.5	30	70
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. To build confidence and enable students speak better English.
2. To motivate students to use English in different situations and contexts.
3. To enable students understand the importance of preparation and practice in presentations.
4. To enable them to understand the basic nuances for efeective language communication.
5. Practice comprehensible pronunciation of English.

COURSE OUTCOMES:

Upon completion of the course students shall.

1. Recognise the need of good comunication skills for professional courses.
2. Understand the basic tenets of communication.
3. Articulating syllables clearly, speaking fluently with correct pronunciation.
4. Develop their self awareness.
5. Understand the importance of group dynamics.

CO – PO MATRIX:

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

UNIT I [CO:4] **(7)**

Basics of Presentations

Ice breaking session

Student Presentation-I

Learning about Presentations

Presentation structure

Managing nerves in a presentation

Mini Presentations

Feedback on presentations

UNIT II [CO:4] **(7)**

Professional and Personal Grooming

Functional English

Non Verbal Communication

Stage Manners

Understanding and preparing a Presentation

Team presentations

UNIT III [CO:4] **(7)**

Speech Nuances

Pronunciation

MTI-Mother Tongue Influence

Stress in English

Tempo of Speech

Indianisms and Often Made

Mistakes Idioms & Phrasal

verbs

UNIT IV [CO:4] **(7)**

Free Talk

Dilemma Questions

Paraphrasing an article or a video in student's own words(Team task) Impromptu

speeches

Introducing TED TALKS

Movie based Learning-Karate Kid Movie-Understanding Life Skills

LEARNING RESOURCES:

REFERENCE BOOK(s):

1. Making Successful Presentations :A Self-Teaching Guide-Terry C. Smith,19846
2. Professional Presentations -Malcom Goodale
3. Giving Presentations -Jo Billingham
4. APA ART Speak Well I
5. HANDOUTS

ME 264	NUMERICAL TECHNIQUES & SIMULATION	L	T	P	C	Int	Ext
	SKILL DEVELOPMENT COURSE	1	0	2	2	100	--
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. Help Students to feel justifiably confident of their ability to write small programs.
2. Solve real world problems using MATLAB
3. Understand the principles of Programming and MATLAB environment.
4. To understand MATLAB graphic feature and its applications.

COURSE OUTCOMES:

1. Use MATLAB Built in functions to carry out matrix operations and use of arrays.
2. Learn to manipulate your own calculations and comparisons
3. Learn about the Functions used along with plotting, creating figures etc.
4. Find numerical solution of ordinary differential equations using MATLAB code

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**2**	**2**			**3**				**3**			**2**	**2**	**2**
CO2	**3**	**3**			**3**				**3**			**2**	**2**	**2**
CO3	**3**	**3**			**3**				**3**			**2**	**2**	**2**
CO4	**2**	**2**			**3**				**3**			**2**	**2**	**2**

COURSE CONTENT:

UNIT-1	**CO1**	**6**
Defining Variables – functions – Matrices and Vectors –Strings – Input and Output statements -Script files – Arrays in Mat lab – Addressing Arrays – Dynamic Array – Cell Array – Structure Array – File input and output – Opening & Closing – Writing & Reading data from files.		
UNIT-2	**CO2**	**6**
Relational and logical operators – Control statements IF-END, IF-ELSE – END, ELSEIF, SWITCH CASE – FOR loop – While loop – Debugging – miscellaneous MAT lab functions & Variables.		
UNIT-3	**CO3**	**6**
Basic 2D plots – modifying line styles – markers and colours – grids – placing text on a plot – Various / Special Mat Lab 2D plot types– Examples. Linear algebraic equations – elementary solution method – matrix method for linear equation – random number generation – Interpolation – Analytical solution to differential equations – Numerical methods for differential equations- Programs.		
UNIT-4	**CO4**	**12**
MATLAB Programming for Engineering Applications. Simulink – Introduction -Simulink model for a Spring Mass system.		

LEARNING RESOURCES:

REFERENCE BOOK(S):

1. "A Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, (2006).
2. "Essentials of MATLAB Programming", 2nd Ed., Stephen J. Chapman, Cengage Learning, (2009).
3. "MATLAB Demystified", David McMahon, The McGraw-Hill Companies, (2007).
4. "MATLAB® for Engineers", 3rd Ed., Holly Moore, Pearson Education, Inc., (2012).
5. "Engineering computation with MATLAB", 2nd Ed., David M. Smith, Pearson Education, Inc., (2010).

WEB REFERENCE:

https://www.mathworks.com/products/matlab.html

MEMC04	DESIGN THINKING AND PRODUCT INNOVATION	L	T	P	C	Int	Ext
	MANDATORY COURSE	2	0	0	0	100	--
	SEMESTER IV [SECOND YEAR]						

COURSE OBJECTIVES:

1. Identify the design thinking processes and methods.
2. Plan research activities to gather and empathize from a user's viewpoint.
3. Ideate techniques to help arrive at the best solution and evaluation.
4. Identify design thinking approaches for business challenges.

COURSE OUTCOMES:

1. Interpret the concepts of Design thinking.
2. Investigate a problem to determine its root cause.
3. Take part in group thinking and experiment with different solutions.
4. Develop innovative thinking and creative problem solving.

CO – PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								2	3	3
CO2		3	3	2				2				2	3	3
CO3		3	3	2				2				2	3	3
CO4				3	3	3	3					2	3	3

COURSE CONTENT:

UNIT-1	CO1	12
Introduction to Design Thinking – Origin of Design Thinking, Features & Principles of Design Thinking, Applications of Design Thinking, Role of Research in Design Thinking.		
UNIT-2	**CO2**	**12**
Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.		
UNIT-3	**CO3**	**12**
Modules of Design Thinking – Ideation & Implementation – methods & tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity.		
UNIT-4	**CO4**	**12**
Design Thinking applied in Business & Strategic Innovation – Ten Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization, Creative Culture, Strategy & Organization – Design Thinking approaches.		

LEARNING RESOURCES:

TEXT BOOK(S):

1. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress. [UNIT -1]
2. "Change by design", Tim Brown, Harper Collins, 2009 [UNIT -1]
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan. [UNIT –II & III]
4. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). [UNIT - IV]

REFERENCE BOOK(S):

1. "Design Thinking Business Innovation", Rio de Janeiro – 2012 1st edition, MJV press.

2. "Design Thinking- Understanding How Designers Think and Work" by Nigel Cross, Berg publishers.

WEB REFERENCE:

- IDEO: Design Thinking for Educators toolkit https://designthinkingforeducators.com/.
- https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking
- https://dschool-old.stanford.edu/groups/designresources/wiki/4dbb2/ (wallet Project)