COURSE STRUCTURE & SYLLABUS

For

B.Tech.

MECHANICAL ENGINEERING

(*Applicable for batches admitted from 2020-21*)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Permanently Affiliated to JNTUK, Kakinada, Accredited by NAAC with "A" Grade
Recognized by UGC 2(f) and 12(b) under UGC act, 1956
1-378, ADB Road, Surampalem – 533 437
Near Peddapuram, E.G.Dist, Andhra Pradesh

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

⇨ Ragging within or outside any educational institution is prohibited.

⇨ Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

LET US MAKE PRAGATI RAGGING FREE COLLEGE

ABSOLUTELY NO TO RAGGING

1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

LET US MAKE PRAGATI RAGGING FREE COLLEGE

VISION AND MISSION OF THE COLLEGE

VISION

To Emerge as a Premier Institution for Technical Education in the Country through Academic Excellence and to be Recognized as a Centre for Excellence in Research & Development, Catering to the needs of our Country.

MISSION

To realize a strong Institution by consistently maintaining State-of-art-Infrastructure and building a cohesive, World Class Team and provide need based Technical Education, Research and Development through enhanced Industry Interaction.

VISION AND MISSION OF THE DEPARTMENT

VISSION:

To be a globally renowned school of mechanical engineering in transforming individuals into professional engineers with world class competency and state-of-the-art research to fulfil the technological needs of the society.

MISSION:

The department of mechanical engineering strives.
M1: To prepare, educate and guide students by the faculty from all domains of mechanical engineering in enhancing their skills.
M2: To establish and utilize world class resources and infrastructure to impart quality education and promote Research aptitude among faculty and students to pursue higher education in diverse fields.
M3: To explore the students' knowledge gradually through industrial interaction for increasing their placement potential to fulfil the basic needs of the society with ethical and social responsibility.

PROGRAM EDUCATIONAL OBJECTIVES

PEO-1: Apply technical knowledge in the domain of core engineering and allied disciplines contributing to society through interdisciplinary expertise.

PEO-2: Strengthen technical competence by enhancing their self-learning capacity throughout their professional career as well as to pursue higher education.

PEO-3: Explore their artistry in emerging areas of engineering flourishing their leadership qualities pertaining to ethical innovation with social responsibility.

PROGRAM OUTCOMES (POs)

After successful completion of the program, the graduates will be able to

PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
PO2	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO-1	To solve engineering problems through delineation and perusal relating to mechanical systems and other allied engineering streams with / without advanced software tools.
PSO-2	To work solitary / array in developing core and multidisciplinary concepts for effective utilization of resources ensuring the best practices in the relevant.

Bloom's Taxonomy Knowledge Level	**Knowledge Level Representation**
Remember	K1
Understand	K2
Apply	K3
Analyze	K4
Evaluate	K5
Create	K6

Mapping/correlation levels
1: Low
2: Medium
3. High

COURSE STRUCTURE

Zero Semester

Induction program (mandatory)	**3 weeks duration**
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch and Innovations

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.2 The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

I YEAR – I SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	20HE1T01	Professional Communicative English	3	0	0	3
2	BSC	20BM1T01	Differential Equations and Numerical Methods	3	0	0	3
3	BSC	20BP1T01	Engineering Physics	3	0	0	3
4	ESC	20CS1T01	Programming for Problem Solving using C	3	0	0	3
5	PCC	20ME1T02	Engineering Drawing	1	0	4	3
6	BSC	20HE1L01	Professional Communicative English Lab	0	0	3	1.5
7	BSC	20BP1L01	Engineering Physics Laboratory	0	0	3	1.5
8	ESC	20CS1L01	Programming for Problem Solving using C Laboratory	0	0	3	1.5
9	BSC	20BE1T01	Environmental Science	3	0	0	0
Total Credits							**19.5**

I YEAR – II SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	20BM2T02	Linear Algebra and Partial Differential Equations	3	0	0	3
2	BSC	20BC2T01	Engineering Chemistry	3	0	0	3
3	PCC	20ME2T01	Engineering Mechanics	3	0	0	3
4	ESC	20EE2T01	Basic Electrical and Electronics Engineering	3	0	0	3
5	PCC	20ME2L03	Computer Aided Engineering Drawing	2	0	2	3
6	PCC	20ME2L01	Engineering Workshop Laboratory	0	0	3	1.5
7	BSC	20BC2L01	Engineering Chemistry Laboratory	0	0	3	1.5
8	ESC	20EE2L01	Basic Electrical and Electronics Engineering lab	0	0	3	1.5
9	BSC	20HE2T05	Constitution of India	2	0	0	0
Total Credits							**19.5**

II YEAR I SEMESTER

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	20BM3T03	Transforms and Vector Calculus	3	0	0	3
2	PCC	20ME3T04	Thermodynamics	3	0	0	3
3	PCC	20ME3T05	Metallurgy and Material Science	3	0	0	3
4	PCC	20ME3T06	Mechanics of Solids	3	0	0	3
5	PCC	20ME3T07	Fluid Mechanics & Hydraulic Machines	3	0	0	3
6	PCC	20ME3L04	Metallurgy and Material Science Laboratory	0	0	3	1.5
7	PCC	20ME3L05	Mechanics of Solids Laboratory	0	0	3	1.5
8	PCC	20ME3L06	Fluid Mechanics and Hydraulic Machinery Laboratory	0	0	3	1.5
9	SOC	20ME3S01	Basics of Applied Robot Control	0	0	4	2
10	MC	20HM3T06	Essence of Indian Traditional Knowledge	2	0	0	0
Total Credits							**21.5**

II YEAR II SEMESTER

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	BSC	20BM4T04	Complex Variables and Statistical Methods	3	0	0	3
2	PCC	20ME4T08	Applied Thermodynamics	3	0	0	3
3	PCC	20ME4T09	Kinematics of Machinery	3	0	0	3
4	PCC	20ME4T10	Production Technology	3	0	0	3
5	PCC	20ME4T11	Machine Drawing	3	0	0	3
6	PCC	20ME4L07	Drafting and Modelling Laboratory	0	0	3	1.5
7	PCC	20ME4L08	Thermal Engineering Laboratory	0	0	3	1.5
8	PCC	20ME4L09	Production Technology Laboratory	0	0	3	1.5
9	SOC	20CS4S05	Numerical Methods through Python	0	0	4	2
Total Credits							**21.5**
Internship 2 Months (Mandatory) during summer vacation							

I Year I Semester
Professional Communicative English
(Common to CE, EEE, MECH, ECE, CSE, CSE (DS), CSE (AI&ML), & IT)

Course Category	Basic Sciences	**Course Code**	20HE1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Emphasizes that the ultimate aim of Education is to enhance wisdom and inspires the readers to serve their nation with their self-enrichment.	K2
CO2	Enables the learners to promote peaceful co-existence and universal harmony in society and empowers them to initiate innovation.	K2
CO3	Imparts the students to manage different cultural shock due to globalization and develop multiculturalism to appreciate diverse cultures and motivate them to contribute to their nation.	K3
CO4	Arouses the thought of life to lead in the right path by recognizing the importance of work besides enhancing their LSRW skills.	K2
CO5	Inspires the learners at the advancement of software by the eminent personalities and motivates the readers to think and tap their innate talents.	K2

K1- Remembering, K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT 1:

1. ‘The Greatest Resource- Education' from Professional Communicative English.
   Objective: Schumacher describes the education system by saying that it was mere training, something more than knowledge of facts.
   Outcome: Underscores that the ultimate aim of Education is to enhance wisdom.
2. 'War' from ‘Panorama: A Course on Reading'
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 2:

1. 'A Dilemma' from Professional Communicative English.
   Objective: The lesson centres on the pros and cons of the development of science and

technology.
Outcome: Enables the students to promote peaceful co-existence and universal harmony among people in society.

2. 'The Verger' from 'Panorama: A Course on Reading'
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 3:

1. 'Cultural Shock': Adjustments to new Cultural Environments from Professional Communicative English.
   Objective: Depicts of the symptoms of Cultural Shock and the aftermath consequences
   Outcome: Enables the students to manage different cultural shocks due to globalization.
2. 'The Scarecrow' from Panorama: A Course on Reading
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 4:

1. 'The Secret of Work' from Professional Communicative English.
   Objective: Portrays the ways of living life in its real sense.
   Outcome: Arouses the thought to lead life in a right path by recognizing the importance of work.
2. 'A Village Lost to the Nation' from Panorama: A Course on Reading
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

UNIT 5:

1. 'The Chief Software Architect' from Professional Communicative English.
   Objective: Supports the developments of technology for the betterment of human life.
   Outcome: Pupil gets inspired by eminent personalities who toiled for the present-day advancement of software development.
2. 'Martin Luther King and Africa' from Panorama: A Course on Reading
   Objective: To develop extensive reading skill and comprehension for pleasure and profit.
   Outcome: Acquisition of LSRW skills

DETAILED TEXTBOOK:

1. **PROFESSIONAL COMMUNICATIVE ENGLISH** Published by Maruthi Publishers.

NON-DETAILED TEXTBOOK:

2. **PANORAMA: A COURSE ON READING**, Published by Oxford University Press India

The course content, along with the study material, is divided into six units.

I Year I Semester
Differential Equations and Numerical Methods
(Common to CE, EEE, ME, ECE, CSE, CSE-DS, CSE-AI&ML& IT)

Course Category	Basic Sciences	**Course Code**	20BM1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	solve first order differential equations and its applications	K3
CO2	solve the linear differential equations with constant coefficients by appropriate method	K3
CO3	apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data.	K3
CO4	find the approximate roots of transcendental equations by using different numerical methods	K2
CO5	solve initial value problems by using different numerical schemes	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I
CRYSTALLOGRAPHY & X-RAY DIFFRACTION

Introduction-Basis and lattice – Unit cell - Coordination number -Packing fraction - Bravais lattice-Crystal Systems – packing fractions of SC, BCC and FCC-Crystal directions and planes-Miller indices – Separation between successive (h k l) planes – Bragg's law - Bragg's X-ray spectrometer.

UNIT II
MAGNETIC PROPERTIES

Introduction-Magnetic-dipole-moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials(Analytical) – Wiess Domain theory - Hysteresis-B-H Curve- soft and hard magnetic materials - applications

DIELECTRICS

Introduction - Dielectic polarization– Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations- Electronic Ionic and Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation -Applications of dielectrics.

UNIT III
ACOUSTICS

Introduction –Conditions for a good Hall- Reverberation - Reverberation time - Sabine's formula (Jaggers' Method using Eyrings approximation)–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.

ULTRASONICS

Introduction-Production of ultrasonic's by Magneto-striction and piezoelectric methods – Detection of ultrasonic's- Non-Destructive Testing- pulse echo system through transmission and reflection modes - Applications.

UNIT IV
LASERS

Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Mechanisms - Ruby laser – Helium Neon laser –Semiconductor laser– Applications

SENSORS (Qualitative description only):

Introduction-Strain and Pressure sensors-Piezoelectric-Magnetostrictive sensors- Temperature sensor-smoke and fire detectors-Applications.

UNIT V
PHYSICS OF NANOMATERIALS

Introduction to Basics of Nano materials, Properties - Preparation methods (Sol Gel Technique, Ball Milling) and characterization Methods Scanning tunneling Microscopy, Atomic Force Microscopy – CNTs Preparation (Arc Discharge method) and properties - Applications of NanoMaterials (CNTs).

TEXT BOOKS

1. "A text book of Engineering Physics" by P G Kshirsagar & M N Avadhanulu, S Chand & Company Ltd
2. **"**Solid State Physics" by SO Pilai., - New age International Publishers
3. "Engineeing Physics by P.K.Palanisamy, Scitech publications (New Edition 2019)

REFERENCE BOOKS

1. "Sensor and Transducers" by Ian R Sinclair, Elsevier (Newnes) 3rd Eds
2. Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition
3. "Engineering Physics" by M.R.Srinivasan, New Age international publishers

WEB RESOURCES

1. https://nptel.ac.in/courses/113/104/113104014/
2. https://nptel.ac.in/courses/113106032/15%20-%20Magnetic%20Properties.pdf
3. https://nptel.ac.in/courses/113/104/113104090/
4. https://www.svce.ac.in/departments/physics/downloads/Notes/UnitIV/UNIT%20IV%20Acoustics.pdf
5. https://nptel.ac.in/courses/124/105/124105004/
6. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cy13/
7. http://engineering.nyu.edu/gk12/amps-cbri/pdf/Intro%20to%20Sensors.pdf
8. https://nccr.iitm.ac.in/2011.pdf
9. https://nptel.ac.in/courses/118/104/118104008/

I Year I Semester
Programming for Problem solving using C
(Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML), CSE(DS), IT)

Course Category	Engineering Science	**Course Code**	20CS1T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2	To gain knowledge of the operators, selection, control statements and repetition in C
3	To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage.
4	To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
5	To assimilate about File I/O and significance of functions

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the fundamentals of C Programming for Problem solving.	K3
CO2	Identify the appropriate Decision statement and Loops for a given Problem.	K2
CO3	Make use of Arrays and Strings to solve the problems in C.	K3
CO4	design and implement programs to analyze the different pointer applications	K3
CO5	Develop solutions for problems using Files and Functions.	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	0	0	0	0	0	0	0	1	1	0
CO2	3	3	3	3	1	0	0	0	0	0	0	0	1	1	0
CO3	3	3	3	2	1	0	0	0	0	0	0	0	2	1	0
CO4	2	3	3	3	1	0	0	0	0	0	0	0	2	2	0
CO5	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0

COURSE CONTENT

UNIT I

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

UNIT II

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions.

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples.

UNIT III

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application.

UNIT IV

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value

Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application.

Processor Commands: Processor Commands.

UNIT V

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions

Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

TEXT BOOKS	
1.	Programming for Problem Solving, Beerhouse A. Forouzan, Richard F.Gilberg, CENGAGE.
2.	The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson.
REFERENCE BOOKS	
1.	Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill.
2.	Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson.
3.	Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD.
WEB RESOURCES	

1.	http://nptel.ac.in/courses/106104128/
2.	http://students.iitk.ac.in/programmingclub/course/#notes
3.	http://c-faq.com/~scs/cclass/cclass.html
4.	http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu
5.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/

I Year I Semester

ENGINEERING DRAWING

(Common for EEE, ECE & ME)

Course Category	Engineering Science	**Course Code**	20ME1T02
Course Type	Theory	**L-T-P-C**	1-0-4-3
Prerequisites	Nil	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce the students to use drawing instruments and to draw polygons, Engineering Curves and Scales.
2	To introduce the students to use orthographic projections, projections of points and lines.
3	To make the students draw the projections of the planes.
4	To make the students draw the projections of the various types of solids.
5	To represent the object in 3D view through isometric views.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Construct polygons, scales and engineering curves.	K3
CO2	Identify the position of points and lines with use of orthographic projections.	K3
CO3	Analyze the location and position of plane figures through orthographic projections.	K4
CO4	Analyze the location and position of solid bodies through orthographic projections.	K4
CO5	Develop 2D and 3D objects by converting their views.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Introduction to Engineering Drawing.

Polygons: Constructing regular polygons by general method.

Curves: Parabola, Ellipse and Hyperbola by general methods tangent & normal for the curves. Cycloid and Involutes.

Scales: Vernier and Diagonal scales.

UNIT II

Orthographic Projections: Introduction, importance of reference lines, projections of points in various quadrants. Projections of straight lines inclined to both the planes, determination of true lengths and angle

of inclination.

UNIT III

Projections of planes: Regular planes perpendicular/parallel to one plane. Regular planes inclined to one plane and parallel to other, inclined to both the planes.

UNIT IV

Projections of Solids: Simple positions of Prisms, Pyramids, Cones and Cylinders. Solids inclined to both the planes.

UNIT V

Isometric Projections: Introduction, Conversion of isometric views to orthographic views, Conversion of orthographic views to isometric views. Introduction to AutoCAD (Demo only)

TEXT BOOKS

1. Engineering Drawing by N.D. Bhatt, Chariot Publications, 56th Edition.
2. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age International (P) Limited (2008).

REFERENCE BOOKS

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers, 3rd Edition.
2. Engineering Graphics for Degree by K.C. John, PHI Publishers.
3. Engineering Graphics by PI Varghese, Mc Graw Hill Publishers, 2013.
4. Engineering Drawing by Basant Agarwal, Tata McGraw Hill Publishers, 2014.
5. B.V.R. Gupta & M. Raja Roy, Engineering Drawing, I.K. International Publishing House Pvt. Ltd., 2009

WEB RESOURCES

1. http://nptel.ac.in/courses/112103019/
2. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_health_science_stu dents/engineeringdrawing.pdf

I Year I Semester

ENGINEERING PHYSICS LABORATORY

(Common to CE & ME)

Course Category	BASIC SCIENCES	**Course Code**	20BP1L01
Course Type	Lab	**L-T-P-C**	0 -0-3-1.5
Prerequisites	Intermediate Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	The student will have exposure to various experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental methods to correlate with the Theoretical Physics.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basics of Mechanics, Elasticity, Diffraction using instruments like Fly wheel, Stewart Gee's, Grating	K2
CO2	Understand the basics of Waves and Oscillations in Physics using instruments like Volume Resonator, Sonometer.	K3
CO3	Determine the Magnetic and Dielectric constants of materials	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT: (Any 10 of the following listed 15experiments) **8 experiments in Regular mode and any two experiments in Virtual Mode(Virtual Lab)**	
1.	Determination of Rigidity modulus of a material- Torsional Pendulum.
2.	Determination of Young's modulus by method of single cantilever oscillations.
3.	Determination of Acceleration due to Gravity and Radius of Gyration - Compound Pendulum.
4.	Verification of laws of transverse vibrations in a stretched strings – Sonometer.
5.	Determination of ultrasonic velocity in liquid (Acoustic grating)
6.	Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus

7.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
8.	Determination of dielectric constant by charging and discharging method
9.	Newton's rings – Determination of Radius of Curvature of Plano - Convex Lens.
10.	Determination of wavelength of Laser by diffraction grating
11.	Determination of particle size using Laser.
12.	Determination of Moment of Inertia of a Fly Wheel.
13.	Determination of Velocity of sound –Volume Resonator.
14.	Determination of Numerical Aperture and acceptance angle of an Optical Fiber
15.	Determination of wavelength of a light using Diffraction Grating-Normal incidence.

TEXT BOOKS	
1.	College customized manual
WEB RESOURCES	
1.	www.vlab.co.in (virtual lab link)

I Year I Semester
Professional Communicative English Lab
(Common to CE, EEE, MECH, ECE, CSE, CSE (DS), CSE (AI&ML), & IT)

Course Category	Basic Sciences	**Course Code**	20HE1L01
Course Type	Theory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

CO	**Description**	COGNITIVE LEVEL
CO1	Understand different speech sounds and maintain proper pronunciation and rhythm in day to day conversations.	K2
CO2	Interpret and respond appropriately in various day to day contexts and improves technics in group discussions.	K5
CO3	Develop the required communication skills to deliver effective presentations and interviews with clarity and impact.	K6

K1- Remembering, K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

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

PRESCRIBED LAB MANUAL FOR SEMESTER I:

'**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills' Published by Maruthi Publications.

OBJECTIVES: To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

OUTCOME: A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content, along with the study material, is divided into six units.

UNIT 1:
Introduction
Consonant Sounds
Vowel Sounds

UNIT 2:
Rhythm and Pronunciation
Weak/strong and contrasted forms
Practice of Rhythm

UNIT 3:
Dialogues

UNIT 4:
Group Discussions

UNIT 5:
Presentations & Public Speaking

UNIT-6: Interviews

I Year I Semester
Programming for Problem solving using C Lab
(Common to CE, ME, EEE, ECE, CSE, CSE (AI&ML), CSE(DS), IT)

Course Category	Engineering Science	**Course Code**	20CS1L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	Apply the principles of C language in problem solving.
2	To design flowcharts, algorithms and knowing how to debug programs.
3	To design & develop of C programs using arrays, strings pointers & functions.
4	To review the file operations, preprocessor commands.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Knowledge on various concepts of a C language.	K3
CO2	Draw flowcharts and write algorithms.	K3
CO3	Design and development of C problem solving skills.	K3
CO4	Design and develop modular programming skills.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0
CO2	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0
CO3	3	3	3	3	1	0	0	0	0	0	0	0	2	2	0

COURSE CONTENT	
1.	**Exercise 1:** 1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters. 2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches. 3. Write a C program to display multiple variables.
2.	**Exercise 2:** 1. Write a C program to calculate the distance between the two points. 2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values",

	otherwise print "Wrong values".
3.	**Exercise 3:** 1. Write a C program to convert a string to a long integer. 2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape. 3. Write a C program to calculate the factorial of a given number.
4.	**Exercise 4:** 1. Write a program in C to display the n terms of even natural number and their sum. 2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms. 3. Write a C program to check whether a given number is an Armstrong number or not.
5.	**Exercise 5:** 1. Write a program in C to print all unique elements in an array. 2. Write a program in C to separate odd and even integers in separate arrays. 3. Write a program in C to sort elements of array in ascending order.
6.	**Exercise 6:** 1. Write a program in C for multiplication of two square Matrices. 2. Write a program in C to find transpose of a given matrix.
7.	**Exercise 7:** 1. Write a program in C to search an element in a row wise and column wise sorted matrix. 2. Write a program in C to print individual characters of string in reverse order.
8.	**Exercise 8:** 1. Write a program in C to compare two strings without using string library functions. 2. Write a program in C to copy one string to another string.
9.	**Exercise 9:** 1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation 2. Write a program in C to demonstrate how to handle the pointers in the program.
10.	**Exercise 10:** 1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator. 2.Write a program in C to add two numbers using pointers
11.	**Exercise 11:** 1. Write a program in C to add numbers using call by reference. 2. Write a program in C to find the largest element using Dynamic Memory Allocation.
12.	**Exercise 12:** 1.Write a program in C to swap elements using call by reference. 2.Write a program in C to count the number of vowels and consonants in a string using a pointer.
13.	**Exercise 13:** 1.Write a program in C to show how a function returning pointer. 2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.
14.	**Exercise 14:** 1.Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs 2. Write a program in C to convert decimal number to binary number using the function.

15.	**Exercise 15:** 1. Write a program in C to check whether a number is a prime number or not using the function. 2. Write a program in C to get the largest element of an array using the function.
16.	**Exercise 16:** 1. Write a program in C to append multiple lines at the end of a text file. 2. Write a program in C to copy a file in another name. 3. Write a program in C to remove a file from the disk.

I Year I Semester
ENVIRONMENTAL SCIENCES
(Common to CE, ME, ECE, CSE, CSE(DS & AI), IT)

Course Category	Basic Sciences	**Course Code**	20BE1MC01
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 0
Prerequisites	Basic Knowledge in Environment and protection.	**Internal Assessment**	100 marks

COURSE OBJECTIVE:	
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century
CO4	Recognize the interconnectedness of human dependence on the earth's ecosystems
CO5	Influence their society in proper utilization of goods and services.
CO6	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	1	0	0	1	2	0	0	0	1	0	0	0
CO2	0	1	0	0	0	0	1	0	0	0	0	0	0	0
CO3	0	0	0	0	2	0	1	0	0	0	0	0	0	0
CO4	0	0	0	0	1	1	3	0	0	0	0	0	0	0
CO5	0	0	0	0	0	0	3	1	0	0	0	0	0	0

Course contents:

UNIT – I
Multidisciplinary nature of Environmental Studies
Definition, Scope and Importance-*International Efforts & Indian Environmentalists*
Natural Resources
Forest resources : deforestation – Mining, dams and other effects on forest and tribal people.
Water resources :Use and over utilization of surface and groundwater.
Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems.
Energy resources: renewable and nonrenewable energy sources.
Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.

LEARNING OUTCOMES:
Students will be able to
Articulate the basic structure, functions, and processes of key social systems affecting the environment
Explain why renewable and non-renewable energy resources are important.
Explain how water resources should be used.

UNIT- II
Ecosystems, Biodiversity and its conservation
Definition of Ecosystem and its structure, Functions
Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity, *Endangered and endemic species of India*.

LEARNING OUTCOMES:
Students will be able to
Get a clear picture of structure and functions of ecosystems.
Demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematic in the broad sense.
Explain endangered and endemic species of India.

UNIT III
Environmental Pollution and Solid Waste Management
Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution.
Solid Waste Management: Sources, effects and control measures of urban and industrial waste, *e-waste management*

LEARNING OUTCOMES
Students will be able to
Understand Cause, effects and control measures of air pollution.
Understand solid waste management.

UNIT IV
Social Issues and the Environment
Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act-Issues involved in enforcement of environmental legislation, Rain water harvesting, Global Environmental challenges-*case studies*

LEARNING OUTCOMES:
Students will be able to
Explain the enforcement of Environmental legislations
Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities.
Explain the reasons for global warming

UNIT-V
Human population and the Environment
Population growth, Women and child welfare, Role of Information technology in environment and human health. *Impact Assessment and its significances, stages of EIA*
Field work:
A mini project related to Environmental issues / to visit a local polluted site (Submission of project by every student)
LEARNING OUTCOMES

Students will have

Explain various types of information technologies

Explain the theories of population explosion

Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities

TEXT BOOKS	
1.	Environmental Studies for undergraduate courses by ErachBharucha,UGC.
2.	A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company.
3.	Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai
REFERENCE BOOKS	
1.	Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning.
2.	Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P.
3.	Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
4.	Environmental Studies by PiyushMalaviya, Pratibha Singh, Anoopsingh: Acme Learning, New Delhi.
5.	An Introduction to Environmental Pollution by Dr.B.k.Sharma AND Dr.(Miss)H.kaur,Goel publishing House ,a unit of Krishna Prakasham Media (p) LH,Meerut –India
WEB RESOURCES	
1.	**UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES** http://www.defra.gov.uk/environment/climatechange https://www.climatesolutions.org https://en.wikibooks.org/wiki/Ecology/Ecosystems
2.	**UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION** http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity
3.	**UNIT-3: ENVIRONMENTAL POLLUTION** https://www.omicsonline.org/environment-pollution-climate-change.php and https://www.britannica.com/technology/solid-waste-management
4.	**UNIT-4: SOCIAL ISSUES AND THE ENVIRONMENT** http://www.publichealthnotes.com/solid-waste-management/
5.	**UNIT-5: HUMANPOPULATION AND THE NVIRONMENT**http://www.ecoindia.com/education/water-conservation.html https://thewaterproject.org/water_conservation\ https://legalcareerpath.com/what-is-environmental-law/

I B. Tech II Semester
Linear Algebra and Partial Differential Equations
(Common to CE, ME, ECE, CSE, IT, CSE-DS, CSE-AI&ML)

Course Category	Basic Sciences	**Course Code**	20BM2T02
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of Matrices, Differentiation, Integration	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	solve systems of linear equations, determine the rank, find the eigenvalues and eigenvectors, diagonalization of a matrix.	K3
CO2	identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.	K2
CO3	find areas and volumes using double and triple integrals	K2
CO4	find partial derivatives of multivariable functions and apply them to find extreme values of a function.	K3
CO5	apply a range of techniques to find solutions of standard PDEs	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT	
UNIT I	**Solving system of linear equations, Eigen Values and Eigen vectors** Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method, Gauss Jacobi and Gauss Seidel for solving system of equations – Eigenvalues and Eigen vectors and their properties.
UNITII	**Cayley-Hamilton Theorem and Quadratic forms** Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Quadratic forms-Reduction to canonical form by congruent transformations- nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation.
UNITIII	**Multiple integrals** Multiple integrals: Double and triple integrals – Change of variables -Polar coordinates - Cylindrical coordinates– Change of order of integration. **Applications:** Finding Areas and Volumes.
UNITIV	**Partial differentiation** Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor's and Maclaurin's series expansion of functions of two variables – Jacobian – Functional dependence. **Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).
UNITV	**Partial Differential Equations and Applications** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. **Applications:** One dimensional wave and heat equations.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**T. Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications
WEB RESOURCES	
1.	**UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors** https://en.wikipedia.org/wiki/System_of_linear_equations https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
2.	**UNIT II: Cayley-Hamilton Theorem and Quadratic forms**

	https://www.math.hmc.edu/calculus/tutorials/eigenstuff/ https://en.wikipedia.org/wiki/Quadratic_form
3.	**UNIT III: Multiple Integrals** https://en.wikipedia.org/wiki/Multiple_integral http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx
4.	**UNIT V: Partial Differentiation** https://en.wikipedia.org/wiki/Partial_derivative https://www.whitman.edu/mathematics/calculus_online/section14.03.html
5.	**UNIT V:Partial Differential Equations and Applications** https://en.wikipedia.org/wiki/Partial_differential_equation

I Year II Semester
Engineering Chemistry
(Common to CE, ME)

Course Category	Basic Sciences	**Course Code**	20BC2T01
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites	Intermediate Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn about the hardness of water, boiler troubles, Drinking water standards and methods of removal of hardness of water.
2	To get knowledge on Electrochemical cells, Batteries, fuel cells and fuels and their applications.
3	To study about the factors affecting corrosion and their controlling methods.
4	To learn about Cement, its setting and hardening and about Polymers, Plastics and Elastomers.
5	To study about Nano materials, their preparation, and applications and to create awareness on surface chemistry.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Compare the quality of drinking water with BIS and WHO Standards	K2
CO2	Illustrate the principles and applications of Batteries, Fuel cells and fuels.	K3
CO3	Identify different types of corrosion and their controlling methods.	K3
CO4	Illustrate the principles of setting and hardening of cement and explain about polymers and their engineering applications.	K2
CO5	Analyze the importance of nano materials and surface chemistry.	K4

Contribution of Course Outcomes towards achievement of Program : Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	2	1	2	-	3	3	-	-	-	2	1	1	-	1
CO2	2	1	-	-	2	-	1	-	-	-	2	2	-	-	-
CO3	1	-	2	-	2	-	1	-	-	-	1	-	-	1	-
CO4	3	-	1	2	-	1	1	-	-	-	2	-	1	-	-
CO5	2	-	3	-	-	2	2	-	-	-	1	1	-	-	-

COURSE CONTENT	**ENGINEERING CHEMISTRY SYLLABUS**
UNIT I	**WATER TECHNOLOGY** **8 hrs** Introduction –Hard and Soft water, Estimation of Hardness by EDTA Method - Boiler troubles - Scale and Sludge- Specifications for Drinking water, Bureau of Indian Standards (BIS) and World Health Organization (WHO) standards, Zeolite and Ion-Exchange processes- Desalination of Brackish water, Reverse Osmosis (RO) and Electro Dialysis. **Learning Outcomes:** The student will be able to List the differences between temporary and permanent hardness of water (L1) Explain the Principles of Reverse Osmosis and Electro dialysis. (L2) Compare quality of Drinking water with BIS and WHO standards. (L2)

	Illustrate Disadvantages associated with hard water. (L2)
UNIT II	**ENERGY SOURCES AND APPLICATIONS 10hrs** **Electrodes:** Electrode potential, Determination of Single Electrode Potential –Nernst's equation, Reference electrodes: Hydrogen and Calomel electrodes **Batteries:** Primary cell- Dry or Leclanche cell, Secondary cell- Lithium batteries (Lithium-MnO_2); **Fuel cells:** H_2-O_2 fuel cell, Methanol fuel cell **Fuels-** Types of fuels, Calorific value, Numerical problems based on Calorific value; Analysis of Coal, Liquid fuels : Refining of Petroleum, Cracking: Catalytic cracking- Fixed bed and Moving bed methods, Knocking and Anti knocking agents, Octane and Cetane Values. **Biofuels** – Bio Diesel, Power Alcohol. **Learning Outcomes:** At the end of this unit, the students will be able to Apply Nernst equation for calculating electrode and cell potentials (L3) Compare different batteries and their applications (L2) Explain calorific values, octane number, refining of petroleum and cracking of oils (L2)
UNIT III	**CORROSION AND ITS CONTROLLING METHODS 6+6 hrs** **III-A: Corrosion:** Definition – Theories of Corrosion-Dry corrosion: Metal oxide formation - Pilling Bed Worth ratio; Electro Chemical Corrosion: Mechanism, Factors affecting the Corrosion rate (pH, temperature, DO). **III-B: Corrosion Controlling Methods:** Sacrificial and Impressed Current Cathodic Protection. Metallic Coatings – Galvanizing and Tinning- Electro Plating and Electroless Plating. **Learning Outcomes:** At the end of this unit, the students will be able to Apply Pilling Bedworth rule for Corrosion and Corrosion Prevention (L3) Demonstrate the corrosion prevention methods and factors affecting corrosion (L2)
UNIT IV	**POLYMER CHEMISTRY AND CEMENT 10 hrs** **Polymers**: Introduction- Functionality of Monomers, Chain (Addition) Polymerization, Step (Condensation) Polymerization, Co-Ordination Polymerization, Co Polymerization with examples and Mechanism. Conducting Polymers – Mechanism of Conduction in Poly acetylene, Poly aniline and their Applications, **Plastics**: Thermoplastics and Thermo Setting Resins; Preparation, Properties and Applications of Polystyrene and Bakelite. **Elastomers**: Preparation, Properties and applications of Buna-S and Thiokol. **Cement:** Portland Cement, Constituents, Manufacture of Portland Cement, Chemistry of Setting and Hardening of Cement. **Learning Outcomes:** At the end of this unit, the students will be able to Explain different types of polymers and their applications (L2) Demonstrate the mechanism of conduction in conducting polymers (L2) Identify the constituents of Portland cement and explanation of the manufacturing of cement(L2) Enumerate the reactions at different temperatures in the Manufacture of Cement (L2)
UNIT V	**NANOMATERIALS AND SURFACE CHEMISTRY 8 hrs** **Nanomaterials:** Introduction, Preparation of Carbon Nano Tubes (CNTs) by Arc discharge and Chemical Vapor Deposition Methods. Fullerenes -Preparation, Properties and Applications. Chemical synthesis of Nanomaterials: Sol-gel method, Applications of Nanomaterials in Wastewater treatment, Medicine and ***in Lubricants*.** **Surface Chemistry:** Introduction to Surface Chemistry, Colloids, Nanometals and

	Nanometal Oxides, Functionalization of Surface of Nanomaterials, Applications of Colloids and Nanomaterials in Catalysis and Sensors. **Learning Outcomes:** At the end of this unit, the students will be able to Classify Nanomaterials. (L-2) Explain the Synthesis and applications of Nanomaterials. (L-2) Identify the application of Colloids and Nanomaterials in Medicine, Sensors and Catalysis (L2)
TEXT BOOKS	
1	P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014).
2	Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition .
REFERENCE BOOKS	
1	Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2	S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010)
3	N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014)
WEB RESOURCES	
1	**Water Technology**
	1.https://www.scribd.com/document/.../Engineering-Chemistry-Unit-I-Water-Treatment 2.www.lenntech.com/applications/process/boiler/boiler-water-treatment.htm
2	**Energy Sources and Applications**
	https://en.wikipedia.org/wiki/Electrochemical_cell
3	**Corrosion and its controlling methods**
	https://en.wikipedia.org/wiki/Corrosion
4	**Polymer Chemistry and Cement**
	https://en.wikipedia.org/wiki/Polymer_chemistry
5	**Nano Materials and surface Chemistry**
	https://en.wikipedia.org/wiki/Nanomaterials

I Year II Semester
ENGINEERING MECHANICS
(Mechanical Engineering)

Course Category	Engineering Science	**Course Code**	20ME2T01
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Physics and Applied Mathematics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study forces, free body diagrams & equations of equilibrium of coplanar systems and its applications.
2	To study Trusses, friction and its applications.
3	To learn about centroid and moments of Inertia of simple and composite figures.
4	To learn various paths of velocity and acceleration computation.
5	To study about work, energy and particle motion for engineering applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the Forces, Free Body Diagrams & Equations of Equilibrium of Coplanar Systems.	K4
CO2	Analyze the trusses, friction and its applications.	K4
CO3	Evaluate the centroid and moments of Inertia of Composite Figures.	K5
CO4	Determine the paths of velocity and acceleration computation.	K5
CO5	Adapt the concepts of work, energy and particle motion for engineering applications.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Introduction to Engineering Mechanics: Basic Concepts of mechanics, System of Forces.

Resultant System of Forces: Resultant of Coplanar Concurrent Force System - Moment of a Force, Couple, Varignon's Theorem, Resultant of Coplanar Non-Concurrent Force System.

Equilibrium System of Forces: Equations of Equilibrium of Coplanar Systems, Free Body Diagrams, Lami's Theorem, Equilibrium of Connected Bodies.

UNIT II

Friction: Introduction**,** types of friction, Coulomb‟s laws of dry friction, coefficient of friction, cone

of friction.
Trusses: Introduction, Assumptions and Equilibrium analysis of plane trusses by using method of joints.

UNIT III
Centroid: Introduction**,** Centroids of simple and composite sections.
Centre of Gravity: Simple bodies and Composite bodies, Pappus Theorem.
Moment of Inertia: Definition – Transfer Theorem, Perpendicular Theorem, Polar Moment of Inertia, Moment of Inertia of Simple and Composite Figures, mass moment of inertia of simple bodies.

UNIT IV
Kinematics: D'Alembert"s Principle, Rectilinear Motion and curvilinear motion, Motion with Uniform Velocity, Motion with Uniform Acceleration.
Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation, Equations of Plane Motion– Fixed Axis Rotation.

UNIT V
Work – Energy Method: Equations for Translation, Motion of Connected Bodies Fixed Axis Rotation and Plane Motion. Impulse momentum method.

TEXT BOOKS

1. Engineering Mechanics - S.Timoshenko, D.H.Young., 5th Edition - , Mc Graw Hill.
2. Engineering Mechanics - S. S. Bhavikatti, K G Rajasekharappa, Revised Edition, New Age International.

REFERENCE BOOKS

1. Engineering Mechanics, N.H.Dubey, McGraw Hill, 2013.
2. Engineering Mechanics, A.K.Tayal, 14th edition, 2nd reprint, Umesh Publications, 2012
3. Engineering Mechanics, R.K.Bansal, 3rd edition, Laxmi Publications, 1996.
4. Engineering Mechanics: Statics & Dynamics, A. Nelson, Tata McGraw-Hill Education, 2009.
5. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.

WEB RESOURCES
1. http://nptel.ac.in/courses/Webcourse-contents/IITKANPUR/engg_mechanics/ui/Course_home_3.htm
2. http://nptel.ac.in/courses/122104015/
3. https://nptel.ac.in/courses/122104015/
4. https://freevideolectures.com/course/2264/engineering-mechanics
5. https://nptel.ac.in/courses/112103108/3
6. https://nptel.ac.in/courses/115104094/54

I Year II Semester

Basic Electrical and Electronics Engineering

(Only for ME)

Course Category	Engineering Sciences	**Course Code**	20EE2T01
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NA**	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To learn the basic principles of electrical circuit analysis.
2	To understand constructional details and operating principle of DC machines & Transformers.
3	To understand constructional details and operating principle details of alternator and 3-Phase induction motor
4	To study operation of PN junction diode, half wave, full wave rectifiers, PNP and NPN transistors and various semiconductor devices.
5	To study the operation of OP-AMPs.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze various electrical circuits	K4
CO2	Understand constructional details and operating principle of DC machines, single phase transformer, tests and analyze their performance.	K4
CO3	Explain operation of Three phase AC machines.	K2
CO4	Analyze operation of half wave, full wave bridge rectifiers and Explain single stage CE amplifier and concept of various semiconductor devices.	K4
CO5	Analyze operation of OP-AMPs.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	1	-	-	-	-	-	-	-	-	-	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	1	3	2	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT 1	**Electrical Circuits** Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations
UNIT 2	**DC Machines** Constructional details and operating principle – EMF equation –DC motor – torque equation – applications - speed control methods of DC motor – Swinburne's Test.

UNIT 3	**Transformers** Constructional details and operating principle of single phase transformers – EMF equation – equivalent circuit – Losses – OC & SC tests – efficiency. **3 Phase Induction Motors** Principle of operation of 3-Phase squirrel cage induction motor – electromagnetic torque equation - power flow - brake test - efficiency calculation – applications.
UNIT 4	**Alternators** Constructional details and operating principle of alternators – types –Regulation of alternator by synchronous impedance method.
UNIT 5	**Semiconductor Devices** PN junction diodes – characteristics – half wave and full wave rectifiers - PNP and NPN junction transistor, transistor as an amplifier – transistor amplifier – frequency response of CE amplifier – concepts of feedback amplifier – SCR – MOSFET - IGBT. **Operational Amplifiers** Introduction to operation amplifiers (Ideal OP-AMP) – Characteristics – applications (inverting, non- inverting, integrator and differentiator).

TEXT BOOKS	
1	William Hayt and Jack E. Kemmerley, Engineering Circuit Analysis, Mc Graw Hill Company, 6th Edition.
2	Surinder Pal Bali, Electrical Technology, Vol-I, Vol-II, Pearson Publications, 1st Editiom.
3	Basic Electrical and Electronics Engineering by M.S. Sukhija and T.K. Naga Sarkar, Oxford University Press.
4	R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, PEI/PHI 2006, 9th Edition.
REFERENCE BOOKS	
1	John Bird, Electrical Circuit Theory and Technology, Routledge Taylor and Francis Group, 5 th Edition.
2	M.S.Naidu and S.Kamakshiah, Basic Electrical Engineering, TMH Publications, 1 st Edition
3	Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publications, 2nd edition.
4	R. S. Sedha, A Text Book of Electronic Devices and Circuits, S.Chand & Co. 2 nd Edition
5	David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5 th Edition.
WEB RESOURCES (Suggested)	
1	www.nptel.ac.in/courses/108108076/
2	https://nptel.ac.in/courses/122106025/

I Year II Semester

COMPUTER AIDED ENGINEERING DRAWING

(Mechanical Engineering)

Course Category	Professional Core	**Course Code**	20ME2L03
Course Type	Theory and Laboratory	**L-T-P-C**	2-0-2-3
Prerequisites	Engineering Drawing	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To enhance the skills in drawing of projections of solids.
2	To impart the knowledge of sectioning and development of surfaces of solids.
3	To learn the Interpenetration of solids and also methods of Perspective views.
4	To introduce various commands in AutoCAD and to create 2D wire frame models.
5	To create 3D wire frame models and geometrical model of simple solids and machine parts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level***
CO1	Draw the auxiliary projections of the various types of solids.	K3
CO2	Develop the sections of solids.	K3
CO3	Create perspective views of a given 3D object/part.	K3
CO4	Understand the AutoCAD commands.	K2
CO5	Create 3D views using AutoCAD.	K3

*K1- Remembering, K2- Understanding, K3- Applying, K4- Analyzing, K5- Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Projections of Solids: Projections of Regular Solids - Auxiliary Views.

UNIT II

Sections of Solids: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

Development of Solids: Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid, Cone and their parts.

UNIT III

Interpenetration of Right Regular Solids: **Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.**

Perspective Projections: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

UNIT IV

Introduction to Computer Aided Drafting: Generation of points, lines, curves, polygons, dimensioning. Types of modeling: object selection commands – edit, zoom, hatching, layers, pattern filling, utility commands, 2D wire frame modeling and other commands like view points and view ports, examples to exercise different options like save, restore, delete, joint, single option.

UNIT V

Computer Aided Solid Modeling: Isometric projections, orthographic projections of isometric projections, perspective views, modeling of simple solids, 3D wire frame modeling, Boolean operations.

TEXT BOOKS

1. Engineering Graphics, K.C. john, PHI Publications, 2009
2. Engineering Drawing by N.D Bhatt , Charotar Publications,53rd Edition.

REFERENCE BOOKS

1. Engineering Graphics using AutoCad ,T Jeyapoovan, Vikas Publications, 7th Edition.
2. Engineering Drawing and Graphics + Auto CAD ,K Venugopal, New age international publications, 4th Edition.
3. Engineering Drawing, RK Dhawan, S.Chand Publications, Revised Edition.
4. Engineering Drawing ,KL Narayana,Scitech Publications, 2013
5. Engineering Drawing – Basant Agarwal and C.M. Agarwal, Mc Graw Hill Education, 2nd Edition.

WEB RESOURCES

1. http://nptel.ac.in/courses/112103019/
2. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html
3. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/env_health_science_stu dents/engineeringdrawing.pdf

I Year II Semester
ENGINEERING WORKSHOP
(For ME and CE)

Course Category	Engineering Science	**Course Code**	20ME2L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Nil	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To familiarize with the basic material removal/shaping processes.
2	To study the various tools and equipment used in different hands on sessions.
3	To develop a skill in dignity of labor, precision, safety at work place.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Practice on manufacturing of components using workshop trades including fitting and carpentry.	K3
CO2	Design different types of models by using workshop trades including black smithy and tin smithy.	K4
CO3	Apply basic electrical engineering knowledge for house wiring practice.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

LIST OF EXPERIMENTS

A. Carpentry:
1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tenon Joint

B. Fitting:
1. V Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

C. Black Smithy:
1. Round rod to Square
2. S-Hook
3. U- Hook
4. Round Rod to Flat Ring

D. House Wiring:

1. Parallel Connection of three bulbs
2. Series Connection of three bulbs
3. Stair Case wiring
4. Florescent Lamp Fitting

E. Tin Smithy:

1. Square Box without lid
2. Open Scoop
3. Taper Tray
4. Funnel

Note: At least two exercises to be done from each trade.

I Year II Semester

ENGINEERING CHEMISTRY LAB

Course Category	Basic sciences	**Course Code**	20BC2L01
Course Type	Lab	**L-T-P-C**	0-0-3-1.5
Prerequisites	Basic Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OUTCOMES		
Upon successful completion of this course, the student will be able to:		**Cognitive Level**
CO1	estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of polymers and nano particles	K3
CO2	determine the concentration of different metal ions present in water by compelxometric titrations.	K2
CO3	evaluate the accurate value of P^H and conductivity of given solutions and to estimate the viscosity and surface tension of given solutions.	K5

Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low, 2-Medium,3–High)

	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**P010**	**P011**	**P012**	**PS01**	**PSO2**
CO1	2	1	2											
CO2	2	1		1										
CO3	2	1												

COURSE CONTENT

(Any 10 of the following listed 13 experiments)

LIST OF EXPERIMENTS:

Introduction to chemistry laboratory –Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis

1. Estimation of HCI using standard Na_2CO_3 solutions
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH
3. Estimation of $KMnO_4$ using standard Oxalic acid solution.
4. Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution
5. Determination of Temporary and permanent Hardness of water using standard EDTA solution.
6. Determination of pH of the given sample solution using pH meter
7. Determination of Fe (III) using Colorimetric method
8. *Estimation of HCl using standard NaOH by Conductometric titration.*
9. Estimation of Vitamin – C
10. Preparation of Phenol - Formaldehyde Resin
11. Determination of viscosity of a liquid
12. Determination of surface tension of a liquid
13. Preparation of Nano particles.(Cu/Zn)

TEXTBOOKS

1. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

REFERENCEBOOKS

[1] College designed manual

WEB-RESOURCES
www.bsauniv.ac.in/UploadImages/Downloads/Estimation%20of%20Hardness https://pubs.acs.org/doi/abs/10.1021/i560133a023

I Year II Semester

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Only for ME)

Course Category	Engineering Sciences	**Course Code**	20EE2L01
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**15** **35** **50**

COURSE OBJECTIVES	
1	To determine the voltage, current and power in star and delta connected loads
2	To predetermine the efficiency of DC shunt machine using Swinburne's test
3	To predetermine the efficiency and regulation of 1-phase transformer with O.C and S.C tests.
4	To obtain performance characteristics of DC shunt generator & 3-phase induction motor.
5	To find out regulation of an alternator with synchronous impedance method.
6	To control speed of dc shunt motor using Armature voltage and Field flux control methods.
7	To find out the characteristics of PN junction diode & transistor
8	To determine the ripple factor of half wave & full wave rectifiers.
9	To find out the band width of transistor CE amplifier.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine the voltage, current and Power in Star and Delta Connected loads.	K3
CO2	Compute the efficiency of DC shunt machine without actual loading of the machine	K3
CO3	Estimate the efficiency and regulation at different load conditions and power factors for single phase transformer with OC and SC tests.	K5
CO4	Analyze the performance characteristics to determine critical speed and resistance of DC shunt generator & efficiency of 3-Phase induction motor.	K4
CO5	Pre-determine the regulation of an alternator by synchronous impedance method.	K4
CO6	Control the speed of DC shunt motor using Armature voltage and Field flux control methods.	K3
CO7	Draw the characteristics of PN junction diode & transistor	K2
CO8	Determine the ripple factor of half wave & full wave rectifiers	K3
CO9	Analyze the frequency response of to find the bandwidth of CE amplifier	K4

Contribution of Course Outcomes towards achievement of Program

Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	-	2	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	2	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	2	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	2	-	-	-	-

CO6	2	-	-	-	-	-	-	-	-	2	-	-	-	-
CO7	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO8	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO9	2	-	-	-	-	-	-	-	-	2	-	-	-	-

LIST OF EXPERIMENTS:	
Section A: Electrical Engineering(Any 6 of the following experiments are to be conducted)	
Experiment 1	Measurement of voltage, current and Power in Star and Delta Connected loads
Experiment 2	Magnetization characteristics of DC Shunt Generator
Experiment 3	Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working as motor and generator).
Experiment 4	Speed control of D.C. Shunt motor by a) Armature Voltage control b) Field control method.
Experiment 5	OC and SC tests on single phase transformer (predetermination of efficiency and regulation at given power factors).
Experiment 6	Load Test on Single Phase Transformer
Experiment 7	Brake test on 3-phase Induction motor (determination of performance characteristics)
Experiment 8	Regulation of alternator by Synchronous impedance method.
Section B: Basic Electronics(Any 4 of the following experiments are to be conducted)	
Experiment 9	PN junction diode characteristics a) Forward bias b) Reverse bias
Experiment 10	Transistor CE characteristics (input and output)
Experiment 11	Half wave rectifier with and without filters.
Experiment 12	Full wave rectifier with and without filters.
Experiment 13	CE amplifiers.
Experiment 14	OP- amp applications (integrator and differentiator).

I Year II Semester
CONSTITUTION OF INDIA

Course Category	Humanities including Management	**Course Code**	20HE2T05
Course Type	Theory	**Lecture-Tutorial-Practice**	2 -0 -0-0
Prerequisites		**Total Marks (Internal Assessment)**	100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the evolution of Constitution of India	Understanding
CO 2	Make use of one's Fundamental rights.	Application
CO 3	Understand the functioning of the Union Government	Understanding
CO 4	Understand the functioning of the State and local self Government.	Understanding
CO 5	Understand the value of Indian Constitution in functioning of the country.	Understanding

Contribution of Course Outcomes towards achievement of Program												
Outcomes: 1 – Low, 2 - Medium, 3 – High												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	0	0	0	0	3	0	3	0	1	0	2
CO2	0	0	0	0	0	1	0	2	1	1	0	1
CO3	0	0	0	0	0	1	0	1	1	1	0	0
CO4	0	0	0	0	0	1	0	1	1	1	0	0
CO5	0	0	0	0	0	1	1	1	1	1	0	2

COURSE CONTENT:

UNIT – I

Introduction to Indian constitution: Meaning of the term constitution - History and development - Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.

UNIT –II

Fundamental Rights: Individual and Collective Rights – Limitations of the fundamental Rights - Fundamental Rights Vs Duties

UNIT –III

Union Government: Union Legislature – Lok Sabha and Rajya Sabha (powers and functions) - President of India (powers and functions) – Prime minister of India (powers and functions) –Union Judiciary (supreme court powers and functions).

UNIT – IV

State and Local self Government:

State Government: State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council/Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions)

Local Self Government: Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)

UNIT – V

Working of the Indian Constitution

The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

REFERENCE BOOKS :

1. 'Indian Polity' byLaxmikanth
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti

WEB RESOURCES:

1. https://www.clearias.com/historical-background-of-indian-constitution/
2. https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of- the-union-and-the-states.html
3. https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works

II Year I Semester

TRANSFORMS AND VECTOR CALCULUS

(Common to CE, ME, ECE, CSE, IT, CSE-DS & CSE-AI&ML and CSE-AI branches)

Course Category	Basic Sciences	**Course Code**	20BM3T03
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2	The skills derived from the course will help the student form a necessary base to develop analytic and design concepts.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	examine the properties of Laplace transformation	K3
CO2	solve ordinary differential equations by using Laplace transformation technique	K2
CO3	expand a periodic function as a Fourier series and find Fourier transform of a given function.	K3
CO4	understand vector differential properties of scalar and vector point functions and their applications.	K2
CO5	apply Green's, Stokes and Divergence theorem to evaluate line, surface and volume integrals.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

COURSE CONTENT

UNIT I	**Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function.
UNIT II	**Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof). **Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms.
UNIT III	**Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms.
UNIT IV	**Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities.
UNIT V	**Vector Integration:** Line integral – Work done – Potential function – Area, Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

TEXT BOOKS	
1.	**B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2.	**Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India
REFERENCE BOOKS	
1.	**Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn
2.	**Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press
3.	**Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning.
4.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
5.	**T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications.
6.	**Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline.
7.	**Shanti Narayan**, Integral Calculus – Vol. 1 & II
WEB RESOURCES	
1.	**UNIT I: Laplace transforms** https://en.wikipedia.org/wiki/Laplace_transform https://web.stanford.edu/~boyd/ee102/laplace.pdf
2.	**UNIT II: Inverse Laplace transforms** https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php
3.	**Unit – III: Fourier Analysis** https://www.mathsisfun.com/calculus/fourier-series.html https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html
4.	**UNIT IV: Vector Differentiation** https://en.wikipedia.org/wiki/Vector_calculus
5.	**UNIT V: Vector Integration** https://en.wikipedia.org/wiki/Divergence_theorem http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx

II Year I Semester
THERMODYNAMICS

Course Category	Professional Core	**Course Code**	20ME3T04
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Engineering Physics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the basic concepts like thermodynamic system, its boundary and related fundamental definitions.
2	To learn the first law for different thermodynamic systems and apply steady flow energy equation for various mechanical components.
3	To understand the second law statements and the associated terms to apply the principles to heat engines.
4	Analyze the process of steam formation with various changes & mixture of perfect gases.
5	To understand various types of Thermodynamic cycles.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate basic concepts of thermodynamics and thermometry.	K2
CO2	Apply first law of thermodynamics for different thermodynamic systems.	K3
CO3	Analyze various concepts associated with second and third laws of thermodynamics.	K4
CO4	Analyze the mixture of perfect gases using property diagram with the use of steam tables and charts & analyze the mixture of perfect gases.	K4
CO5	Understand various types of Thermodynamic cycles	K2

K1: Remembering, K2: Understanding, K3: Applying, K4: Analysing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Introduction: Basic Concepts: System, Boundary, Surrounding, Control Volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, reversibility and Irreversibility, Cycle –Quasi – static Process, Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas thermometer.

UNIT II

First law of Thermodynamics: Joule's Experiment – Corollaries – First law applied to a Process – applied to a flow system– PMM-I, Steady Flow Energy Equation. Throttling and free expansion processes –Ideal Gas Equations, deviations from perfect gas model – Vander Waals equation of state.

UNIT III

Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties. Thermodynamic scale of Temperature, concept of entropy, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations, Joule Thompson coefficient – Definition: Third Law of Thermodynamics.

UNIT IV

Pure Substances: P-V-T- surfaces, T-S and h-s diagrams, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction, Mixtures of perfect Gases ,Dalton's Law of partial pressure, Avogadro's Laws of additive volumes.

UNIT V

Power Cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Brayton Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

TEXT BOOKS:

1. Thermodynamics: An Engineering Approach, Yunus A Cengel, Michael A Boles, McGraw-Hill, 9 th Edition
2. Engineering Thermodynamics by PK Nag, McGrawHill Publisher, 6th Edition.

REFERENCE BOOKS:

1. Thermodynamics, J.P.Holman, McGrawHill, 4th Edition 1988.
2. Fundamentals of Thermodynamics, G.J.Van Wylen & Richard E Sonntag, Claus Borgnakke, Wiley Publications, 6th Edition 2003.
3. An Introduction to Thermodynamics, Y.V.C.Rao – Universities press, 2004.
4. An Text Book of Engineering Thermodynamics, R K Rajput, Laxmi publications Ltd.,
5. Fundamentals of Engineering Thermodynamics, Volume 1, Michael - J.Moran, Howard N. Shapiro, Wiley Global Education, 7th Edition 2010.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/105/112105123/
2. https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring-2008/
3. http://www.nptelvideos.in/2012/12/basic-thermodynamics.html
4. https://freevideolectures.com/course/2681/basic-thermodynamics

II Year I Semester
METALLURGY AND MATERIAL SCIENCE

Course Category	Professional Core	**Course Code**	20ME3T05
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Chemistry	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To know the basic fundamentals of material science and understand the basic requirements for the formation of solid solutions and other compounds.
2	To study the basic construction of equilibrium diagram by studying various phases.
3	To study the differences between cast irons, steels, non-ferrous metals and alloys, their properties and practical applications.
4	To understand the various heat treatment and strengthening processes used in practical applications.
5	To study the concept of composite materials and its classification, nano materials.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the crystalline structure of different metals.	K2
CO2	Understand the various phases in equilibrium diagrams and draw phase diagrams of Cu-Ni, Bi-Cd and Fe-Fe_3C	K2
CO3	Explain the properties and applications of ferrous and non-ferrous metals and alloys used in different domains.	K2
CO4	Understand the various heat treatment and strengthening processes.	K2
CO5	Classify composite and nano-materials based on their applications.	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Structure of Metals and Constitution of alloys: Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor for cubic structures - SC, BCC, FCC-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Imperfections – point, line, Surface and volume. Slip and Twinning. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT II

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni, Bi-Cd and Fe-Fe_3C.

UNIT III

Ferrous Metals and Alloys: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron, Nodular cast iron, Alloy cast irons. Classification of steels, properties and applications of plain carbon steels.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

UNIT IV

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT V

Composite materials: Introduction, classification of composites, various methods of component manufacture of composites– Hand layup process, Filament winding process, Continuous pultrusion process, Particle – reinforced materials, Fiber reinforced materials, Metal ceramic mixtures, metal – Matrix composites and C – C composites. Nano materials – definition, properties and applications.

TEXT BOOKS

1. Introduction to Physical Metallurgy - Sidney H. Avner, McGrawHill, 2017.
2. Essential of Materials science and engineering - Donald R.Askeland - Cengage.

REFERENCE BOOKS

1. Material Science and Metallurgy for Engineers by V.D Kodgire and S.V Kodgire 39th Edition.
2. Materials Science and Engineering, Callister & Balasubramaniam, Wiley Publishers, 2nd Edition.
3. Material Science for Engineering Students, Fischer, Elsevier Publishers, 1st Edition.
4. Materials Science and Engineering V. Raghavan Prentice-Hall of India Pvt. Ltd., 5th Edition 2004.

WEB RESOURCES

1. http://nptel.ac.in/courses/113105024/7.
2. http://nptel.ac.in/courses/113106031/17.
3. http://nptel.ac.in/courses/112104122/12.
4. http://nptel.ac.in/courses/113104068/36.

II Year I Semester
MECHANICS OF SOLIDS

Course Category	Professional Core	**Course Code**	20ME3T06
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Engineering Mechanics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study the various types of stresses and strains subjected to axial loading and understand the strain energy concepts.
2	To study different beams, draw the shear force, bending moment diagrams and correlate the shear force, bending moment and rate of loading.
3	To study the bending and shear stresses on various cross sections of the beam.
4	To determine slope, deflection at any point on the determinate beams using various methods and stresses due to torsion.
5	To calculate stresses developed in thin and thick cylinders subjected to internal pressure and also to test the buckling and stability of columns based on Euler's and Rankine's Theories.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain various types of stresses due to axial loading and the concept of strain energy.	K2
CO2	Develop shear force and bending moment diagrams for determinate beams subjected to different types of loads.	K3
CO3	Analyze the bending and shear stresses on different cross sections of the beams.	K4
CO4	Examine the slope and deflection of the beam by various methods subjected to point load, UDL, and uniformly varying loads and stresses due to torsion.	K4
CO5	Determine the stresses in thin and thick cylinders subjected to internal pressure and also can be able to find the stability of the columns	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Simple Stresses & Strains: Types of stresses & strains – Hooke's law – stress – strain diagram for ductile and brittle materials – Factor of safety – Poisson's ratio & volumetric strain – Relation between elastic constants - Bars of varying section – composite bars – Temperature stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses (both analytical and graphical methods). Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L, uniformly varying loads and combination of these loads – Point of contraflexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV

Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load.

Torsion: Introduction – Derivation of torsion equation - Torsion of Circular shafts – Stresses and strains in pure Shear.

UNIT V

Thin & Thick Cylinders: Thin cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders. Thick cylinders – Lame's equation – cylinders subjected to inside & outside pressures.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

TEXT BOOKS

1. Mechanics of Materials, Ferdinand P Beer, Johnston, Dewolf and Mazurek, 7th Edition, Mc Graw Hill.
2. Strength of Materials, S. Ramamrutham, Dhanpat Rai and Co. Publications, 18th Edition

REFERENCE BOOKS

1. Strength of Materials, U.C. Jindal, Umesh Publications, 1st Edition.
2. Strength of Materials, D S Prakash Rao, Volume 1, University Press.
3. Strength of Materials, R.K.Bansal, Laxmi Publications, 4th Edition.
4. Strength of Materials, Andrew Pytel and Ferdinond L. Singer Longman, 4th Edition.
5. Mechanics of Materials, Gere & Timoshenko, CBS Publications, 2nd Edition.

WEB RESOURCES

1. http://nptel.ac.in/courses/112107147/1
2. http://nptel.ac.in/courses/112107147/7
3. http://nptel.ac.in/courses/112107147/23
4. http://nptel.ac.in/courses/105106116/
5. https://en.wikipedia.org/wiki/Strength_of_materials

II Year I Semester
FLUID MECHANICS & HYDRAULIC MACHINES

Course Category	Professional Core	**Course Code**	20ME3T07
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Mechanics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study different fluid properties and Manometers.
2	To learn about the different types of fluid flows, flow patterns, forces behind the flow, energy equation, Momentum equation and also to find the losses occurs in flow through the pipes.
3	To study the concept of boundary layer theory and hydrodynamic forces acting on vanes along with their performance evaluation.
4	To study different types of hydraulic turbines, draft tube theory, efficiency, governing and performance characteristics.
5	To study types of Pumps, work done, efficiency, performance of pumps & characteristic curves.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of fluid properties and the concepts of Buoyancy.	K1
CO2	Apply the Continuity, Momentum and energy equations to applications of Fluid Mechanics	K3
CO3	Understand the Boundary layer theory, flow separation and dimensional analysis.	K2
CO4	Examine the performance of hydraulic turbines like Pelton wheel, Francis turbine and Kaplan turbine.	K4
CO5	Evaluate the performance of Centrifugal pump and Reciprocating Pump.	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Fluid statics: Dimensions and units: physical properties of fluids-specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmosphere, gauge and vacuum pressure, Measurements of pressure – Manometers – Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and flotation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT II

Fluid Kinematics: Introduction, flow types, Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces – Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application, force on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes-pipes in series and pipes in parallel-total energy line-hydraulic gradient line.

UNIT III

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles. Basic concepts of dimensional analysis.

Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

UNIT IV

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design- draft tube-theory-functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT V

Centrifugal pumps: classification, working, work done- manometric head-losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: classification, Working, Discharge, slip, indicator diagrams.

TEXT BOOKS

1. Fluid Mechanics- Fundamentals and Applications, Y.A.Cengel & J.M.Cimbala, Tata McGrawhill, 2008.
2. Fluid Mechanics and Hydraulic Machines, R. K. Bansal, Lakshmi Publications, 9th Edition.

REFERENCE BOOKS

1. Fluid Mechanics, F.M.White, Tata Mc Graw Hill, 3rd Edition.
2. Hydraulics and Fluid Mechanics including Hydraulics Machines, P. N. Modi, S. M. Seth, Standard Book House Publishers, 14th Edition.
3. Fluid Mechanics and Fluid Power Engineering, D.S.Kumar, S.K. Kataria & Sons Publications.
4. Engineering Fluid Mechanics K L Kumar, Eurasia Publishing House.
5. Fluid Mechanics: Including Hydraulic Machines, A.K.Jain, Khanna Publications, 12th Edition.

WEB RESOURCES

1. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv078Page1.html
2. http://ga.water.usgs.gov/edu/hyhowworks.html
3. http://nptel.iitm.ac.in/courses/105101082/;
4. http://www.learnerstv.com/video/Free-video-Lecture-2630-Engineering.html
5. http://www.learnerstv.com/video/Free-video-Lecture-2654-Engineering.html

II Year I Semester

METALLURGY AND MATERIAL SCIENCE LABORATORY

Course Category	Professional Core	**Course Code**	20ME3L04
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Exposure to Metallurgy and Material Sciences	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To impart students with Knowledge of preparation of Various Compositions of Materials using Muffle Furnace.
2	To impart practical exposure on the microstructures of various materials and their hardness evaluation.
3	To impart knowledge of assessment of simple properties (like Strength, Hardness, etc) of the Billet materials made from Muffle Furnace.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Make a Billet (Cylindrical sample of the Iron and Copper family materials)	K3
CO2	Understand and differentiate microstructures of ferrous & non-ferrous alloys.	K2
CO3	Asses the properties of the samples taken from the Muffle Furnace	K3

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

LIST OF EXPERIMENTS:

1. Preparation and study of the Microstructure of Pure Iron.
2. Preparation and study of the Microstructure of Iron Alloy(s).
3. Preparation and study of the Microstructure of Al.
4. Preparation and study of the Microstructure of Al Alloy(s).
5. Preparation and Study of the Microstructure of Pure Copper.
6. Preparation and Study of the Microstructure of Copper Alloy (Brass).
7. Preparation and Study of the Microstructure of Copper Alloy (Bronze).
8. Study of the Microstructure of Heat Treated Steels.
9. To find the hardness of various Treated & Untreated Iron, its Alloy materials.
10. To find the hardness of various Treated & Untreated Copper, its Alloy materials.
11. To find the hardness of various Treated & Untreated Aluminum, its Alloy materials

II Year I Semester
MECHANICS OF SOLIDS LABORATORY

Course Category	Professional Core	**Course Code**	20ME3L05
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Exposure to Mechanics of Solids	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To study the behavior of materials under tension, compression, torsion, bending, shear and impact.
2	To study the behavior of springs under tension and compression.
3	To apply loads to various materials under different equilibrium conditions.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine modulus of elasticity of bars, beams and springs subjected to various loads.	K3
CO2	Calculate deflection and stiffness of helical spring.	K3
CO3	Examine the behaviour of the solid bodies subjected to various types of loading.	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

1. Direct Tension Test On Universal Testing Machine (Utm).
2. Compression Test on Wood on Universal Testing Machine (Utm).
3. Bending Test on Simply Supported Beam. (I)Mild Steel. (Ii) Wood.
4. Bending Test On Cantilever Beam Made Of Mild Steel/Aluminum/Brass/Stainless Steel.
5. Torsion Test.
6. Tension Test on springs.
7. Compression Test on springs.
8. Impact Charpy Test.
9. Impact Izod Test.
10. Brinell‟S Hardness Test.
11. Rockwell Hardness Test.

Additional Experiments:

1. Double Shear Test On Universal Testing Machine.
2. Punch Shear Test.

Note: Any 10 Experiments Out Of 11 To Be Conducted

II Year I Semester

FLUID MECHANICS & HYDRAULIC MACHINERY LABORATORY

Course Category	Professional Core	**Course Code**	20ME3L06
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Exposure to Fluid Mechanics and Hydraulic Machinery	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES

To impart practical exposure on the performance evaluation methods of various flow measuring equipment, hydraulic turbines and pumps.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the fundamental principles of fluid mechanics, calculations involving basic flow measuring devices like venture meter, Orifice meter and major and minor losses of fluid flow through the pipes.	K3
CO2	Estimate the optimum efficiency of a given turbine under different load and (or) speed conditions and to analyze the trends depicted by characteristic curves obtained from the experiments.	K4
CO3	Estimate the optimum efficiency of a given pump under different load and (or) speed conditions and to analyze the trends depicted by characteristic curves obtained from the experiments.	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

LIST OF EXPERIMENTS

1. Calibration of Venturimeter.
2. Calibration of Orificemeter.
3. Determination of Friction factor for a given pipe line.
4. Losses in pipe fittings.
5. Impact of jet on vanes.
6. Performance test on Pelton wheel-constant head.
7. Performance test on Pelton wheel-constant speed.
8. Performance test on Francis turbine-constant head.
9. Performance test on Francis turbine-constant speed.
10. Performance test on Single stage centrifugal pump.
11. Performance test on Multi stage centrifugal pump.
12. Performance test on Reciprocating pump.

Note: Any 10 of the above 12 experiments are to be conducted.

II Year I Semester
BASICS OF APPLIED ROBOT CONTROL

Course Category	SOC	**Course Code**	20ME3S01
Course Type	Skill Oriented	**L-T-P-C**	0-0-4-2
Prerequisites	Nil	**Internal Assessment** **Semester End Examination** **Total Marks**	15M 35M 50M

COURSE OBJECTIVES	
1	To understand the kinematics and coordinate transformation.
2	To follow the guidelines for accessing the robot and program it for desired task.
3	First-hand experience on industrial robots for the students to learn with industry-driven production requirements.
4	To train students in the field of Industrial Robotics, upgrading skill sets of the students to global standards.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the importance of robot dynamics and plan robot motions and paths.	K2
CO2	Familiarize with the most common robot sensors and understand fundamental sensor processing.	K2
CO3	Perform kinematics analysis of robot systems.	K3
CO4	Create, modify and execute different robot programs	K3

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

1. Robot mechanics and kinematics.
2. Robot motion control and controller functions.
3. Robot end arm tooling.
4. Sensors and adaptive functions.
5. Robot performance and programming.
6. Robot programming and simulation for pick and place operations.
7. Robot programming and simulation for colour identification.
8. Robot programming and simulation for commissioning and palletizing.
9. Robot programming and simulation for assembly of wind shields.
10. Robot programming and simulation for welding.

II Year I Semester
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(Common to all branches)

Course Category	Humanities including Management	**Course Code**	20HM3T06
Course Type	Theory	**L-T-P-C**	2 -0-0-0
Prerequisites		**Internal Assessment**	100M

Course Outcomes		**Cognitive Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the concept of Traditional knowledge and its importance	K1
CO 2	Know the need and importance of protecting traditional knowledge	K1
CO 3	Know the various enactments related to the protection of traditional knowledge	K1
CO 4	Understand the concepts of Intellectual property to protect the traditional knowledge	K1
CO 5	Understand the importance of Traditional Knowledge in the development of different sectors	K1

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program												
Outcomes: 1 – Low, 2 - Medium, 3 – High												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	1	2	0	0	3	0	1	0	2	0	0
CO2	0	0	2	0	0	2	0	2	1	0	0	2
CO3	0	0	1	0	0	3	2	3	1	2	0	1
CO4	0	0	0	0	0	2	1	3	1	1	0	1
CO5	1	0	1	0	0	3	1	1	1	3	0	1

COURSE CONTENT

UNIT I
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNIT II
Protection of Traditional Knowledge: The need for protecting traditional knowledge -Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge

UNIT III
Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);

B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indications act 2003.

UNIT IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

REFERENCE BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Pramod Chandra, India Arts, Howard Univ. Press, 1983.
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

WEB RESOURCES:

1. https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html
2. http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf
3. https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

II Year II Semester

COMPLEX VARIABLES & STATISTICAL METHODS

(Common to CE & ME)

Course Category	Basic Sciences	**Course Code**	20BM4T04
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To familiarize the complex variables
2	To familiarize the students with the foundations of probability and statistical methods.
3	To equip the students to solve application problems in their disciplines

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	find the differentiation and integration of complex functions used in engineering problems.	K2
CO2	make use of the Cauchy residue theorem to evaluate certain integrals	K3
CO3	apply discrete and continuous probability distributions	K3
CO4	design the components of a classical hypothesis test	K4
CO5	infer the statistical inferential methods based on small and large sampling tests	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-
CO4	3	3	3	1	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-

COURSE CONTENT	
UNIT I	**Functions of a complex variable and Complex integration:** Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method. Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems

UNIT II	**Series expansions and Residue Theorem:** Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated – Essential –Pole of order m– Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(cos\theta,\ sin\theta)d\theta.$
UNIT III	**Probability and Distributions:** Review of probability and Bayer's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.
UNIT IV	**Sampling Theory:** Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Maximum error of estimate.
UNIT V	**Tests of Hypothesis:** Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

TEXT BOOKS	
1.	**B. S. Grewal,** Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017. **.**
2.	**Miller and Freund's,** Probability and Statistics for Engineers, Pearson,7th edition, 2008.
REFERENCE BOOKS	
1.	**J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.
2.	**S.C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons Publications, 2012. .
3.	**Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
4.	Shron **L. Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
5.	**Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4thEdition, Academic Foundation,2011
WEB RESOURCES	
1.	**UNIT I:** https://en.wikipedia.org/wiki/Complex_analysis
2.	**UNIT II:** https://en.wikipedia.org/wiki/Contour_integration http://mathonline.wikidot.com/complex-power-series
3.	**UNIT III:** https://en.wikipedia.org/wiki/Normal_distribution https://en.wikipedia.org/wiki/Sampling_(statistics) https://nptel.ac.in/courses/111104073/
4.	**UNIT IV:** https://en.wikipedia.org/wiki/Statistical_hypothesis_testing
5.	**UNIT V:** https://machinelearningmastery.com/statistical-hypothesis-tests/

II Year II Semester
APPLIED THERMODYNAMICS

Course Category	Professional Core	**Course Code**	20ME4T08
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Thermodynamics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To make the student familiarize with the reasons and effects of various losses that occurs in the actual engine operation & Understand the basic working of IC Engine - Components.
2	To learn about normal combustion phenomenon and knocking in S.I. and C.I. Engines and to evaluate the several engine operating parameters that affect the smooth engine operation.
3	To make students learn about different types of compressors and to calculate power and efficiency of Compressors.
4	Basic components used in steam power plant cycles and & Selecting appropriate nozzle for maximum mass flow rate and steam turbine.
5	Basic principle for jet propulsion, rocket and their performance evaluation.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand various Air standard cycles Vs Actual Cycles & Classify various IC Engines and elucidate its components.	K2
CO2	Analyze the performance of CI and SI engines.	K4
CO3	Explain the working of Compressor along with factors influencing its performance.	K3
CO4	Classify steam nozzles and condensers based on various applications.	K2
CO5	Evaluate the performance jet population engine.	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

I. C. ENGINES: Classification - Working principles, Valve and Port Timing Diagrams, Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and turbo charging, DTSI technology.

UNIT II

Combustion in S.I. Engines : Normal Combustion and abnormal combustion; Importance of flame speed and effect of engine variables; Type of Abnormal combustion, pre-ignition and knocking (explanation)

Combustion in C.I. Engines: Four stages of combustion; Delay period and its importance; Effect of engine variables; Diesel Knock; Need for air movement; suction; compression and combustion induced turbulence in Diesel Engines.

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT III

Compressors – Classification – positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

Rotary compressors: Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation.

Axial Flow Compressors: Mechanical details and principle of operation

UNIT IV

Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

Steam Nozzles: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

Steam Condensers: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

UNIT V

JET PROPULSION: Principle of operation –classification of jet propulsive engines – working principles with schematic diagrams and representation on T-S diagram - thrust, thrust power and propulsion efficiency – turbo jet engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation, thrust augmentation – methods. Rockets: Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

TEXT BOOKS:

1. I.C. Engines / V. ganeshan - TMH

3. Heat engines, Vasandani & Kumar publications Thermal machines and *Heat Engines*.
4. Thermal Engineering – R K Rajput-Lakshmi Publications.
5. Thermodynamics and Heat Engines, Volume 2 - R.Yadav- Central book depot

REFERENCE BOOKS:

1. IC Engines – M.L. Mathur & R.P. Sharma – Dhanpath Rai & Sons
2. I.C. Engines – Applied Thermo sciences – C.R. Ferguson & A.T. Kirkpatrick-2nd Edition Wiley Publications
3. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
4. Thermal Engineering-P.L.Ballaney/ Khanna publishers.
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros

WEB RESOURCES:

1. https://nptel.ac.in/courses/112104033/
2. https://nptel.ac.in/courses/112103277/
3. https://nptel.ac.in/courses/112107216/

II Year II Semester
KINEMATICS OF MACHINERY

Course Category	Professional Core	**Course Code**	20ME4T09
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Engineering Mechanics	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the kinematics of different mechanisms and their constraints motion.
2	To study planar and spatial mechanisms.
3	To determine velocity and acceleration of different parts in a given mechanism by using graphical as well as analytical techniques.
4	To generate different cam profiles and study the transmission of power through belt drives.
5	To understand the concepts of gears and gears trains.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate the concepts of different mechanisms and their motion constraints.	K2
CO2	Develop straight line motion mechanisms and steering gear mechanisms.	K3
CO3	Determine the kinematic analysis of simple mechanisms.	K3
CO4	Develop cam profiles based on the prescribed follower motion and perform kinematic analysis on cams with specified contours.	K3
CO5	Illustrate gear terminology, gear types and analyse gear trains.	K4

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Mechanisms and Machines: Introduction: Mechanism and machine; Rigid and resistant bodies; Link; Kinematic pair; Degrees of freedom; Classification of kinematic pairs; Kinematic chain; Linkage, mechanism and structure; Mobility of mechanisms. Application of Kutzbach Criterion to Plane Mechanisms. Grubler's

Criterion for Plane Mechanisms. Grashoff's law.
Inversions of Mechanisms: The four-bar chain; single and double slider crank chains.

UNIT II

Mechanism with Lower Pairs: Pantograph - straight line motion mechanisms – exact straight-line motion mechanisms- Peaucellier mechanism, Approximate straight-line motion mechanisms, Watt mechanism. Condition for correct steering- Davis & Ackerman's steering gear mechanisms.
Hooke's Joint: Ratio of shaft velocities - maximum and minimum speed of driven shaft - condition for equal speeds -Angular acceleration of driven shaft - Double Hooke's joint.

UNIT III

Velocity Analysis: Relative velocity method - velocity of point on a link- application of relative velocity method to simple mechanisms - rubbing velocity of a joint – Instantaneous center method - body centrode and space centrode - velocity of point on a link by Instantaneous center method, location of Instantaneous center - three centers in line theorem and its application for simple mechanisms.
Acceleration Analysis: Acceleration diagrams of a link- acceleration diagrams for simple mechanisms- Coriolis component of acceleration - acceleration diagram for slotted lever quick return mechanism.

UNIT IV

Cams: Classification of followers and cams -terms used in radial cams - displacement, velocity and acceleration diagrams when the follower moves with uniform velocity, uniform acceleration and retardation, simple harmonic motion -construction of cam profiles.
Belt Drives: Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt.

UNIT V

Toothed Gearing: Classification of toothed wheels - terms used in gears - law of gearing - velocity of sliding of teeth - forms of teeth - Cycloidal and involute teeth- length of path of contact-arc of contact-contact ratio- interference in involute teeth - minimum number of teeth to avoid interference.
Gear Trains: Simple, compound and reverted gear trains - epicyclic gear train – velocity ratio of epicyclic gear train - sun and planet wheels - torques in epicyclic gear train - Differential of an automobile.

TEXT BOOKS

1. Theory of Machines, S. S. Rattan, McGraw-Hill Publications, 3rd Edition.
2. Theory of Machines, Thomas Bevan, CBS Publishers & Distributors, 3rd Edition.

REFERENCE BOOKS

1. Theory of Machines and Mechanisms, Shigley J. E. and John Joseph Uicker, Oxford University Press, 3rd Edition.
2. Theory of Machines, R.K. Bansal & J.S. Brar, Laxmi publications (P) LTD, 5th Edition.
3. Theory of Machines, Sadhu Singh , Pearson, 3rd Edition.
4. Mechanism and Machine Theory, J. S. Rao and R. V. Dukkipati, New Age International, 2nd Edition.
5. Theory of Mechanisms and Machines, A Ghosh & A K Malik, 3rd Edition, East West Press.

WEB RESOURCES

1. www.mekanizmalar.com
2. www.museum.kyoto-u. ac.jp
3. Makezine.com
4. https://nptel.ac.in/courses/112105236/21
5. https://nptel.ac.in/courses/112105236/34
6. https://nptel.ac.in/courses/112104121/
7. https://nptel.ac.in/courses/112106137/pdf/2_1.pdf.

II Year II Semester
PRODUCTION TECHNOLOGY

Course Category	Professional Core	**Course Code**	20ME4T10
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Engineering Workshop Laboratory	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand fundamentals of casting concepts
2	To provide insight into sand casting and introduce other casting processes
3	To impart knowledge on different welding processes.
4	To understand about the importance of rolling, forging and sheet metal operations.
5	To learn the basics of plastic and ceramics processing.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the working principle of different metal casting processes and gating system.	K2
CO2	Illustrate preparation of moulds as per casting design considerations to minimize defects.	K2
CO3	Explain the different welding processes for joining the parts to fabricate the final product.	K2
CO4	Identify different metal forming processes and their application in real time.	K3
CO5	Distinguish plastics and ceramics to produce required parts.	K3

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT -I

Introduction: Importance and Classification of manufacturing processes. Casting Processes: Steps involved in making a casting, Advantage of casting and its applications. Pattern: Types, materials used for pattern

and allowance. Cores: Types of cores, core prints, principles and design of gating system, Gating ratio.

UNIT – II

Melting and Casting Processes: Methods of melting and types of furnaces, Solidification of castings, Risers- Types, function and design, casting design considerations, basic principles and applications of shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

UNIT – III

Welding Processes: Classification of welding processes, types of welds and welded joints, weld bead geometry. Fusion welding: Basic principles of Arc welding and its types, Gas welding, Types of flames, Oxy – Acetylene Gas cutting, Thermit welding, Electron Beam welding, Laser beam welding. - Applications, advantages and disadvantages. Pressure welding: Resistance welding- Spot welding, seam welding, butt welding, projection welding; Solid State welding- Forge welding, Friction welding, Friction stir welding, Explosive welding; Heat affected zones in welding; Welding defects: causes and remedies. Soldering and brazing.

UNIT – IV

Sheet Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals; Sheet metal working operations: Blanking, piercing, bending, stamping. Spring back and its remedies. Coining, Spinning, types of presses and press tools. Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements. Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing. Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects.

UNIT – V

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding. Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; secondary processing of ceramics: Coatings, finishing.

TEXT BOOKS

1. Manufacturing Technology – Volume I, P.N.Rao 5th Edition, McGraw-Hill Education.
2. Fundamentals of Modern Manufacturing: Materials, Processes and Systems, Mikell P. Groover, John Wiley and Sons Inc, 4th Edition.

REFERENCES

1. Manufacturing Engineering and Technology, Kalpak Jain S and Schmid S.R. Pearson, 8th Edition
2. Manufacturing processes, Amitabha ghosh and Malik, East west press, 2nd Edition
3. Production Technology, P.C.Sharma ,S Chand Publishing, 8th Edition.
4. Process and Material of Manufacture ,Roy A Lindberg , PHI, 4th Edition.
5. Production Engineering-K.C. Jain, A.K. Chitale , PHI, 2nd Edition.

WEB REFERENCES

1. http://nptel.ac.in/courses/112107145/4
2. http://nptel.ac.in/courses/112107145/5
3. http://nptel.ac.in/courses/112107145/7
4. http://nptel.ac.in/courses/112107145/23#
5. https://onlinecourses.nptel.ac.in/noc19_me52

II Year II Semester
MACHINE DRAWING

Course Category	Professional Core	**Course Code**	20ME4T11
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Engineering Drawing	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To provide basic understanding of Conventional representation, sections, joints, simple mechanical parts.
2	The student will be able to draw the assembly from the individual part drawing.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level***
CO1	Illustrate different kinds of materials and mechanical components conventionally.	K2
CO2	Model the assembly drawing using part drawings.	K3

*K1- Remembering, K2- Understanding, K3- Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT	
PART A	**Conventional representation of materials and components:** • Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs, symbols for weldments. • Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned. • Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws. • Keys, Cotter joints and knuckle joint. • Riveted joints for plates. • Shaft coupling, spigot and socket pipe joint. • Journal, pivot and collar Pedestal Bearing (Plummer Block) and foot step bearings.

PART B	**Assembly Drawings:** Drawings of assembled views for the part drawings of the following, using conventions and easy drawing proportions. **Engine parts:** Stuffing box, Cross head, Eccentric, Petrol Engine connecting rod and Piston. **Other machine parts:** Screws jack, Machine Vice, Plummer block and Tool post. **Valves:** Steam stop valve, Spring loaded safety valve, Feed check valve and air cock.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts

TEXT BOOKS	
1	Machine Drawing –K.L. Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers, 6th Edition.
2	Machine Drawing: Includes Auto CAD – Ajeet Singh/McGraw Hill Education, 2nd Edition.
REFERENCE BOOKS	
1	Machine Drawing by N.D.Bhatt, V.M. Panchal Charotar Publications, 50th Edition.
2	Machine Drawing, O.P Jahkar, Amit Mathur, Khanna Publishing House, 1st Edition.
3	Machine Drawing, S.Gill, Katson Books,2017.
4	Machine Drawing, KC John, PHI,2009.
5	Fundamentals of Machine Drawing, Sadhu Sign , PL Sah, PHI,2nd Edition.
WEB RESOURCES	
1	http://gt3.bme.hu/wp-content/uploads/2016/02/Narayana-Machine_Drawing.pdf

II Year II Semester
DRAFTING AND MODELLING LABORATORY

Course Category	Professional Core	**Course Code**	20ME4L07
Course Type	LABORATORY	**L-T-P-C**	0-0-3-1.5
Prerequisites	CAEDP, MD	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To provide knowledge on modelling methods and procedures.
2	To impart training on solid modelling software.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Gain knowledge on modelling methods and procedures.	K3
CO2	Create 3D part and assembled views of various mechanical components.	K3

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

A) DRAFTING: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.

B) SURFACE MODELLING - Generation of various Surfaces using surface modelling.

C) The following contents to be done by any 3D software package:

(i) PART MODELLING: Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.

(ii) ASSEMBLY DRAWINGS: (Any four of the following using solid model software)
Generation of various Parts/assemblies like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder.

Packages to be provided to cater to drafting, modeling & analysis from the following:
AutoCAD, CATIA, CREO, Solidworks, Fusion 360 etc.

II Year II Semester
THERMAL ENGINEERING LABORATORY

Course Category	Professional Core	**Course Code**	20ME4L08
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Exposure to Thermodynamics	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To provide hands on experience in operating various types of internal combustion engines and understand their functioning and performance

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Estimate the performance of the I.C. Engine and prepare heat balance sheet	K4
CO2	Estimate the performance of the reciprocating compressor	K4
CO3	Understand the sequence of operations to assemble/disassemble an IC engine & study the various processes associated with the performance of boilers.	K2

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

LIST OF EXPERIMENTS

1. I.C. Engines valve timing diagram and port timing diagrams.
2. Performance test on 4 stroke diesel engine.
3. Performance test on 2 stroke petrol engine.
4. Evaluation of friction power by conducting Morse test on 4 stroke multi cylinder engine.
5. Determination of Friction Power by retardation or motoring test on IC engine.
6. Preparation of Heat balance sheet on IC Engines at different loads.
7. Economical speed test of an IC engine.
8. Performance test on variable compression ratio engine.
9. Performance test on reciprocating air compressor unit.
10. Disassembly / assembly of different parts in an IC Engine.
11. Study of boilers, mountings and accessories.
12. Performance test on Refrigeration test rig.

Note: Total 10 experiments should be conducted from the above 12 experiments

II Year II Semester
PRODUCTION TECHNOLOGY LABORATORY

Course Category	Professional Core	**Course Code**	20ME4L09
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Exposure to Production Technology	**Internal Assessment** **Semester End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES

To impart hands-on practical exposure on manufacturing processes and equipment.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Prepare the pattern, mould and casting.	K3
CO2	Perform different welding operations and plastic parts processing operations	K3
CO3	Perform sheet metal operations and bending operations.	K3

K1: Remembering, K2: Understanding, K3: Applying, K4: Analyzing, K5: Evaluating, K6: Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

A. Metal Casting Process:
1. Pattern making.
2. Sand testing - for strength.
3. Mould preparation.
4. Melting and Casting.

B. Welding:
1. Manual metal arc welding - Lap Joint.
2. Manual metal arc welding - Butt Joint.
3. Resistance Spot Welding.
4. Brazing and soldering.
5. Gas cutting.
6. TIG/MIG Welding.
7. Gas welding.

C. Processing of Plastics:
1. Injection Moulding.
2. Blow Moulding

D. Metal Forming:

1. Study of simple, compound and progressive dies.
2. Blanking & Piercing operations and
3. Deep drawing and extrusion operations.
4. Bending and other operations.

[Note: Total 10 experiments should be conducted, at least two from A, B, C & D]

II Year II Semester
NUMERICAL METHODS THROUGH PYTHON
(For ME only)

Course Category	Skill Oriented Course	**Course Code**	20CS4S08
Course Type	SOC	**L-T-P-C**	0-0-4-2
Prerequisites	Nil	**Internal** **Assessment Semester** **End Examination** **Total Marks**	15 35 50

COURSE OBJECTIVES	
1	To acquire programming skills in core Python and to acquire Object Oriented Skills in Python
2	To develop the skill of designing Graphical user Interfaces in Python
3	To develop the ability to write database applications in Python

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Write, Test and Debug Python Programs and Use Conditionals and Loops for Python Programs	K4
CO2	Use functions and represent Compound data using Lists, Tuples and Dictionaries	K3
CO3	Use various applications using python	K3

Note: K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

1. To find the roots of non-linear equation using Bisection method
2. To find the roots of non-linear equation using Newton Raphson's method.
3. Curve fitting by least – square approximations
4. To solve the system of linear equations using Gauss - elimination method
5. To solve the system of linear equations using Gauss - Siedal method

6. To solve the system of linear equations using Gauss - Jordan method
7. To integrate numerically using Trapezoidal rule
8. To integrate numerically using Simpsons rule
9. To find the largest Eigen value of a matrix by Power – method
10. To find numerical solution of ordinary differential equations by Euler's method
11. To find numerical solution of ordinary differential equations by Runge-Kutta method
12. To find numerical solution of ordinary differential equations by Milne's method
13. To find the numerical solution of Laplace equation
14. To find the numerical solution of Wave equation
15. To find the solution of a tri-diagonal matrix using Thomas algorithm
16. To fit a straight using least square technique