Schemes and Syllabus

(For academic session 2021-22 & onwards)

Bachelor of Technology

Mechanical Engineering

IEC School of Engineering

Atal Shiksha Nagar (Kallujhanda), P.O.
Mandhala, Village- Nanakpura,
Pinjore-Nalagarh highway, District - Solan,
Himachal Pradesh - 174103

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Table of Content

SECTION 1

Program Outcomes and Program Specific Outcomes

Program Outcomes

PO1: Professional Knowledge: Complex engineering problems are solved by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization courses.

PO2: Research/Project Orientation: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using basic principles of mathematics, natural sciences, and engineering sciences.

PO3: Entrepreneurship Capability: Apply 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 in multidisciplinary environments.

PO4: Conformist: To allow and establish the best, positive relationship between the colleagues and staff members to adhere to the norms of creating positive atmosphere in the lecture halls through best practices of teacher student relationship. Furthermore to compliance with the vision, mission and professional etiquettes as followed in an organization.

PO5: Critical Thinking Mindset: Explore and explain the substantial and procedural basic principle methods which science are discovered and how students think and understand the different methods of program.

PO6: Leadership and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO7: Professional Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO8: Professional Empowerment: Exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning to achieve career and organizational goals.

PO9: Communication: Communicate effectively on complex engineering activities with the engineering community and with 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.

PO10: Social Responsibility and Environmental Conservation: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO11: Modern Analytical Knowledge: Apply modern computational, analytical, simulation tools and techniques to address the challenges faced in the respective model.

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

Program Specific Outcomes

PSO1: Graduates of the program will achieve excellence in product design thermal engineering and manufacturing system by acquiring knowledge in mathematics, science and designing principles.

PSO2: Graduate will be able to analyze, interpret and provide solutions to the real life mechanical engineering problems.

PSO3: Graduate will develop an approach to solve multidisciplinary problems of manufacturing and allied industries.

PSO4: Plan, design, construct, maintain and improve mechanical engineering systems that are technically sound, economically feasible and socially acceptable to enhance quality of life.

SECTION 2

Semester wise Scheme

Semester – I

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
MATH-101	Engineering Mathematics-I	3	1	-	4	3.5	60	40	100
PHY-101	Engineering Physics	3	1	-	4	3.5	60	40	100
CSE-101	Fundamentals of computer and programming in "C"	3	1	-	4	3.5	60	40	100
HUM-101	Communication Skills	3	-	-	3	3	60	40	100
ME-101	Engineering Mechanics	3	1	-	4	3.5	60	40	100
CSE-102	IT infrastructure Landscape Overview	3	-	-	3	3	60	40	100
PHY-151	Engineering Physics Lab.	-	-	2	2	1	30	20	50
CSE-151	Programming in "C" lab.	-	-	2	2	1	30	20	50
ME-151	Engineering Mechanics Lab	-	-	2	2	1	30	20	50
HUM-151	Communication Skills Lab	-	-	2	2	1	30	20	50

Semester – II

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
MATH-201	Engineering Mathematics-II	3	1	-	4	3.5	60	40	100
CHEM-101	Engineering Chemistry	3	1	-	4	3.5	60	40	100
ME- 201	Engineering Drawing	3	-	-	3	3	60	40	100
EVS-101	Environment Science and technology	3	-	-	3	3	60	40	100
EEE-101	Basic Electrical & Electronics	3	1	-	4	3.5	60	40	100
CSE-201	Introduction to Internet of Things	3	-	-	3	3	60	40	100
CHEM-151	Engineering Chemistry Lab	-	-	2	2	1	30	20	50
EEE-151	Basic Electrical & Electronics Lab	-	-	2	2	1	30	20	50
ME-152	Workshop lab	1	-	2	4	2.5	60	40	100

Semester – III

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
HUM-305	Human Value & Professional Ethics	3	-	-	3	3	60	40	100
MAT-301	Mathematics-III	3	1	-	4	3.5	60	40	100
ME-301	Fluid Mechanics	3	1	-	4	3.5	60	40	100
ME-302	Materials Science in Engineering	3	-	-	3	3	60	40	100
ME-303	Strength of Materials-I	3	1	-	4	3.5	60	40	100
ME-304	Engineering Thermodynamics-I	3	1	-	4	3.5	60	40	100
ME-351	Fluid Mechanics Lab	-	-	2	2	1	30	20	50
ME-352	Material Science & Testing Lab	-	-	2	2	1	30	20	50
ME-353	Machine Drawing	-	-	3	3	1.5	30	20	50

Semester – IV

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
ME-401	Fluid Machinery	3	1	-	4	3.5	60	40	100
ME-402	Internal Combustion Engine and Gas Turbine	3	1	-	4	3.5	60	40	100
ME-403	Engineering Thermodynamics II.	3	1	-	4	3.5	60	40	100
ME-404	Manufacturing Science-I	4	-	-	4	4	60	40	100
ME-405	Measurement & Metrology	4	-	-	4	4	60	40	100
ME-406	Strength of Materials -II	3	1	-	4	3.5	60	40	100
ME-451	Fluid Machinery Lab	-	-	2	2	1	30	20	50
ME-452	Internal Combustion Engine and Gas Turbine Lab	-	-	2	2	1	30	20	50
ME-453	Engineering Thermodynamics Lab	-	-	2	2	1	30	20	50

Note- Summer Training (6 Weeks) done after 4th Semester would be evaluated in 5th semester through Report and viva voice etc

Semester – V

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
ME-501	Machine Design-I	3	1	-	4	3.5	60	40	100
ME-502	Theory of Machines-I	3	1	-	4	3.5	60	40	100
ME-503	Manufacturing Science-II	3	-	-	3	3	60	40	100
ME-504	Heat & Mass Transfer	3	1	-	4	3.5	60	40	100
ME-505	Production Planning & Control	3	-	-	3	3	60	40	100
ME-551	Machine Design-I Lab	-	-	-	3	1.5	30	20	50
ME-552	Manufacturing Science Lab	-	-	2	2	1	30	20	50
ME-553	Heat & Mass Transfer Lab	-	-	2	2	1	30	20	50
ME-554	Summer Training (6Weeks)	-	-	-	-	2	30	20	50
ME-555	Seminar	-	-	2	2	1	30	20	50

Semester – VI

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
ME-601	Industrial Engineering	3	-	-	3	3	60	40	100
ME-602	Unconventional Manufacturing Processes	3	-	-	3	3	60	40	100
ME-603	Mechanical Vibrations	3	1	-	4	3.5	60	40	100
ME-604	Machine Design-II	3	1	-	4	3.5	60	40	100
ME-605	Theory of Machine- II	3	1	-	4	3.5	60	40	100
ME-606	Refrigeration and Air Conditioning	3	1	-	4	3.5	60	40	100
ME-651	Machine Design-II Lab	-	-	3	3	1.5	30	20	50
ME-652	Theory of Machines Lab	-	-	2	2	1	30	20	50
ME-653	Refrigeration and Air Conditioning Lab	-	-	2	2	1	30	20	50
ME-654	AutoCAD Lab	-	-	2	2	1	30	20	50

Semester – VII

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
ME-701	Computer Aided Design/Computer Aided Manufacturing	4	-	-	4	4	60	40	100
ME-702	Automobile Engineering	4	-	-	4	4	60	40	100
	Departmental Elective-I	4	-	-	4	4	60	40	100
	Departmental Elective-II	4	-	-	4	4	60	40	100
	Departmental Elective-III	4	-	-	4	4	60	40	100
ME-751	CAD/CAM Lab	-	-	2	2	1	30	20	50
ME-752	Automobile Lab	-	-	2	2	1	30	20	50
ME-753	Project	-	-	4	4	3	30	20	50

Departmental Elective – I

ME-703	Total Quality Management
ME-703 A	Thermal Turbo Machines
ME-703 B	Tribology
ME-703 C	Industrial Ergonomics

Departmental Elective – II

ME- 704	Operations Research
ME- 704 A	Management information system
ME- 704 B	Advanced Fluid Mechanics
ME- 704 C	Advanced dynamics of machinery

Departmental Elective – III

ME-705	Non Conventional Energy Resources
ME- 705 A	Fundamentals of Biomedical Engineering
ME- 705 B	Energy management
ME- 705 C	Non-destructive testing

Semester – VIII

Course Code	Course Title	L	T	P	CH	CP	Int. A	ESE	Total
ME-851	Industrial Training(6 Months)	-	-	-	-	20	300	200	500

SECTION 3

Semester wise Syllabus

Program: B.Tech (ME)	**Semester:** 1st
Course Title: ENGINEERING MATHEMATICS –I	**Course Code:** MATH-101

Course Description: This course is designed to introduce students to the theory of systems of linear equations and to mathematical proof. Topics include solving systems of linear equations, linear independence, linear transformations, matrix operations, determinants, vector spaces.

Course Outcomes: After completing this course, the student will be able to:

CO1: Find and analyse area, mass of lamina and volume of solid by using double and triple integration.

CO2: Understand the concepts of linear transformations and their properties

CO3: Apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods

CO4: Adjoint of a linear transform**.**

Theory 3hr/Week

Unit	Topic	Hours
1	**Linear Algebra:** Review of Matrices; Linearly dependent / independent of vectors; Rank and Matrix Inverse; Linear Transformation & Matrix Representation; System of Linear Equations, Eigen values and Eigenvectors; properties of Eigen values, Diagonalization of Matrices; Jordan Canonical Form, Cayley Hamilton Theorem.	10
2	**Complex Numbers:** Roots of complex number, Real and imaginary parts of functions of a complex variables - Exponential, Circular, Hyperbolic, Logarithmic and Inverse hyperbolic functions; Summation of the series C+ iS; Limit and derivative of complex functions, Cauchy -Riemann equations, Analytic functions, Entire functions and its applications.	10
3	**Differential Calculus:** Leibnitz theorem, Partial derivatives, Euler"s theorem for homogenous function, Total derivative, Change of variable; Taylor"s and Maclaurin"s series, Jacobian, Extrema of function of two variables, Method of undetermined multipliers. Multiple Integrals: Double and triple integrals and their applications, Change of order of integration, Change of variables. Application of multiple integral to surface area and volume, Beta and Gamma functions and their relationships.	15
4	**Vector Differentiation:** Scalar and vector point functions, Gradient of a scaler field, Directional derivative, Divergence and Curl of a vector field, Laplacian and second order operators. **Vector Integration**: Line, surface and volume integrals; Vector integral theorems: Greens, Stokes and Gauss divergence theorems (Without proof) and related problems.	10

Textbooks

- Kreyszig E., "Advanced Engineering Mathematics", Wiley ,9th edition.
- B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.

Reference Books

- H.K. Dass and Rama Verma, "Engineering Mathematics", S. Chand Publications.
- N.P. Bali and Manish Goel, "Engineering Mathematics", Laxmi Publications.
- D. Kandu, "Engineering Mathematics", Neel Kamal Prakashan.
- B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd., New Delhi

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 1st
Course Title: ENGINEERING PHYSICS	**Course Code:** PHY- 101

Course Description: The course aims at making students to understand the basic concepts and Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses. Students will be able to demonstrate competency and understanding of the concepts found in electromagnetic waves, quantum concepts, magnetic and superconducting phenomenon, wave Optics, Lasers and a broad base of knowledge in physics.

Course Outcomes

CO1: Learn about position of electrons, their interactions with each other and shapes and geometries of molecules.

CO2: Give knowledge about quantum mechanics of particle behaviour, energy wise arrangement of electrons and their interactions in bond formation.

CO3: Learn about the process of polymerization of different substances with more emphasis on rubber.

CO4: Give knowledge about interaction of light with matter and the principles on which different types of spectroscopic techniques were based.

Theory 3hr/Week

Unit	Topic	Hours
1	**Electromagnetic fields and em wave:** Gradient of a scalar, divergence and cul of a vector, Gauss's law (integral and differential form) and its applications, Electric potential and electric field (in vector form), Dieletrics, Polarization, Electric displacement, Susceptibility and permittivity, Lorentz foce law, Magnetic field of a steady current (Biot-Savart's law), Faraday's law, Ampere's circuital law and its applications, Maxwell's equations a dn their significance, Electromagnetic Spectrum (basic idea of different regions).	10
2	**Quantum Theory:** Need of Quantum Mechanics, Davisson-Germer Experiment and Matter waves, Group and Phase velocities. Uncertainity Principle and its applications, Time-independent and Time-Dependent Schrödinger Wave equation, Eigen values and Eigen Functions, Applications of Schrödinger Wave equation to Particle in a box (one dimensional)	10
3	**Lasers and Optical Fibers:** Spontaneous and Stimulated Emission, Einstein's coefficients, Population Inversion and Optical Pumping, Three-level and Four-level Lasers, Ruby, He-Ne, CO_2, Semiconductor Lasers, Application of lasers, Basic theory of fiber optics, accepatance angle, numerical aperture, modes of propagation, material and pulse dispersion, application of optical fibers.	10
4	**Magnetic materials and Superconductivity:** Hard and soft magnetic materials and their applications, Ferrites and their applications, Phenomenon of superconductivity,	10

	Magnetic properties of superconductors (Meissner effect), Type-I and Type-II Superconductors, Applications of Superconductivity.	
5	**Radiation Physics:** A few X- and Gamma-radioisotopes (^{109}Cd, ^{241}Am, ^{60}Co, ^{137}Cs) and their applications, Coolidge tube; Continuous and Characteristic X-rays; Moosley's law; Absorption of X-rays and gamma rays; X-ray Diffraction and Bragg's law, EDXRF and WDXRF (qualitative idea).	10

Textbooks

- Applied Solid State Physics; Wiley India Pvt Ltd.
- Quantum Mechanics: Theory and Applications- Ajoy Ghatak, Tata McGraw-Hill.
- Engineering Physics; Satya Prakash and Vibhav saluja, Pragti Prakashan Meerut.
- Modern Engineering Physics; A.S.Vasudeva, S. Chand & Co. Ltd.

Reference Books

- M.Armugam, Engineering Physics, Anuradha Agencies, 2003
- Optics- Ajoy Ghatak, Tata McGraw-Hill.
- Optics- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand & Co. Ltd.
- Fiber optics and laser Principles and Applications- Anuradha De, New Age International.
- Concepts of Modern Physics-Arthur Beiser, Tata McGraw-Hill.
- Introduction to electrodynamics; David J Griffiths, Prentice Hall of India, New Delhi.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	0	1	1	0	1	0	0	0	1	0	2	2	2	2
CO2	3	2	0	1	1	0	1	0	0	0	1	0	2	2	2	2
CO3	3	2	0	1	1	0	1	0	0	0	1	0	2	2	2	2
CO4	3	2	0	1	1	0	1	0	0	0	1	0	2	2	2	2

Program: B.Tech(ME)	**Semester:** 1st
Course Title: ENGINEERING PHYSICS LAB	**Course Code:** PHY-151

Course Description: The course will describe the experimental part related to lasers, optics, energy bandgaps, e/m ration, spectrometers, etc. In this course students will perform experiments to determine physical quantities specific rotation of cane sugar, Planck's constant, wavelength of monochromatic light, numerical aperture, divergence and angle of prism.

Course Outcomes: The course will help the students to:

CO1: understand the apparatus of various experiments.

CO2: understand the physical working procedure of apparatus.

CO3: learn to perform experiments and make record by taking readings.

CO4: understand the physical concept behind the experiment, which will strengthen their theoretical knowledge.

Sr No.	Experiment Title
1.	To determine the specific rotation of cane sugar solution with the help of polarimeter.
2.	To determine Planck's constant.
3.	To determine the dispersive power of the material of the prism using mercury light with the help of a spectrometer.
4.	To determine the wavelength of sodium light by Newton's Ring.
5.	To determine the Energy Band Gap of a Semiconductor by using Four probe method.
6.	To measure the numerical aperture of the given an optical fiber.
7.	To determine the specific resistance of a given wire using Carey Foster's bridge.
8.	To determine e/m ratio using Thompson's method
9.	To determine angle of divergence of Laser beam
10.	To determine angle of prism and minimum deviation using spectrometer.

Textbooks

- Printed Manual supplied to the students.

Reference books

- M.Armugam, Engineering Physics, Anuradha Agencies, 2003
- Optics- Ajoy Ghatak, Tata McGraw-Hill.
- Optics- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand & Co. Ltd.
- Fiber optics and laser Principles and Applications- Anuradha De, New Age International.
- Concepts of Modern Physics-Arthur Beiser, Tata McGraw-Hill.
- Introduction to electrodynamics; David J Griffiths, Prentice Hall of India, New Delhi.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 1st
Course Title: FUNDAMENTALS OF COMPUTERS & PROGRAMMING IN "C"	**Course Code:** CSE-101

Course Description: This course introduces the concepts of computer basics & programming with particular attention to Engineering examples. The C programming language is used but the course will stress on fundamental parts of programming language, so that it will help basic concept for understanding and using other programming language.

Course Outcomes

CO1: Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming

CO2: Write, compile and debug programs in C language and use different data types for writing the programs

CO3: Design programs connecting decision structures, loops and functions

CO4: Explain the difference between call by value and call by address

Theory 3hr/Week

Unit	Topic	Hours
1	**An Overview of Computer System:** Anatomy of a digital Computer, Memory Units, Main and Auxiliary Storage Devices, Input Devices, Output Devices, Classification of Computers, Introduction to microprocessor, commonly used CPUs, Input/output ports and connectors. Radix Number System: Decimal, Binary, Octal, Hexadecimal numbers **Operating System:** The user Interface, Running Programmes, Managing files, Introduction to PC operating Systems: Unix/Linux, DOS, and Windows 2000.	15
2	**Networking Basics**: Introduction to the basic concepts of Networks and Data Communications, Network topologies, Network Types (LAN, WAN and MAN), How Internet works, Major features of internet, Emails, FTP, Using the internet. **Programming Languages:** Machine-, Assembly-, High Level- Language, Assembler, Compiler, Interpreter, debuggers, Programming fundamentals: problem definition, algorithms, flow charts and their symbols, introduction to compiler, interpreter, assembler, linker and loader and their inter relationship	15
3	**C Programming language**: C fundamentals formatted input/ output, expressions, selection statements, loops and their applications; Basic types, arrays, union, structure, functions, including recursive functions, program organization: local and external variables and scope, pointers & arrays.	10
4	**Strings**: strings literals, string variables, I/O of strings, arrays of strings; applications. Structures, Unions and Enumerations: Structure variables and operations on structures; Structured types, nested array structures; unions; enumeration as integers, tags and types. Standard library: Input / output; streams, file operations, formatted I/O, character I/O, line I/O, block, string I/O, Library support for numbers and character data, error Handling:	10

Textbooks

- Fundamentals of Computing and C Programming, R. B. Patel, Tech Publications, New Delhi.
- C Programming – A modern approach by K.N. King, 1996, WW Norton & Co.

Reference Books

- Using Information Technology, 5th Edi, Brian K Williams & Stacey C. Sawyer, 2003, TMH
- The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.

Assessment Process (Internal)

Assessment Process (Internal)

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CO1	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO2	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO3	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO4	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**

Program: B.Tech(ME)	**Semester:** 1st

Course Title: FUNDAMENTALS OF COMPUTERS & PROGRAMMING IN "C" LAB	**Course Code:** CSE-151

Course Description: The purpose of this course is to introduce to students to the field of programming using C language. The students will be able to enhance their analyzing and problem solving skills and use the same for writing programs in C.

Course Outcomes

CO1: Read, understand and trace the execution of programs written in C language.

CO2: Write the C code for a given algorithm.

CO3 Know concepts in problem solving.

CO4: Write programs that perform operations using derived data types.

Sr No.	Experiment Title
1.	Wap to add two numbers.
2.	Wap to swap two numbers.
3.	Wap to find simple interest.
4.	Wap to check no is odd/even.
5.	Wap to find greatest no. Out of three numbers.
6.	Wap to find greatest & second greatest out of three numbers.
7.	Wap to find year is centuary/leap year or not.
8.	Wap to find grade with percentage.
9.	Wap to find income tax from total salary.
10.	Wap to print day of weeks using switch statement.
11.	Wap to print no of days of months using switch statement.
12.	Wap to print 'n' natural numbers using while loop.
13.	Wap to find number of digits in an integer using while loop.
14.	Wap to find reverse of an integer using while loop.
15.	Wap to check wheather number is pallindrome or not using while loop.
16.	Wap to find sum of an integer using do-while loop.
17.	Wap to use goto & continue statement
18.	Wap for linear search
19.	Wap for binary search
20.	Wap for bubble sort
21.	Wap to find addition of two matrices

22.	Wap to find multiplication of two matrices
23.	Wap to find transpose of a matrix
24.	Wap to find wheather the matrix is symmetric or not
25.	Wap to print address using pointers
26.	Wap for structure
27.	Wap for union

Textbooks

- Printed Manual supplied to the students.

Reference books

- Fundamentals of Computing and C Programming, R. B. Patel, Tech Publications, New Delhi.
- C Programming – A modern approach by K.N. King, 1996, WW Norton & Co.
- Using Information Technology, 5th Edi, Brian K Williams & Stacey C. Sawyer, 2003, TMH
- The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO2	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO3	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO4	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**

Program: B.Tech (ME)	**Semester:** 1st
Course Title: ENGINEERING MECHANICS	**Course Code:** ME-101

Course Description: Course will help the students to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Solve for the resultants of any force system and determine equivalent force system.

CO2: Determine displacement of completely constrained bodies by principles of virtual work and solve the mechanics problems associated with friction force.

CO3: Calculate the centroid, first moment and second moment of area.

CO4: Analyze the forces acting on rigid body during translation motion.

Theory 3hr/Week

Unit	Topic	Hours
1	**Two Dimensional Concurrent Force Systems:** Basic concepts, Units, Force systems, Laws of motion, Moment and Couple, Vectors - Vectorial representation of forces and moments - Vector operations. Principle of Transmissibility of forces,, Resultant of a force system, Equilibrium and Equations of Equilibrium, Equilibrium conditions, Free body diagrams, Determination of reaction, Resultant of Two dimensional concurrent forces, Applications of concurrent forces.	10
2	**Two Dimensional Non-Concurrent Force Systems:** Basic Concept, Varignon's theorms, Transfer of a force to parallel position, Distributed force system, Types of supports and their reactions, converting force into couple and Vise versa Applications. **Friction:** Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Belt friction, ladder Friction, Applications of Friction in daily life. **Structure:** Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section.	13
3	**Centroid and Moment of Inertia:** Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems, Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their , Axis of Symmetry. Pappus theorems, polar moment of inertia, Applications of Moment of Inertia in daily life.	8
4	**Kinematics of Rigid Body:** Introduction, plane rectilinear motion of rigid body, Plane curvilinear Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational Motion, Relative Velocity.	8
5	**Kinetics of Rigid Body:** Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's Principles and Dynamic Equilibrium, Friction in moving bodies.	8

Textbooks

- Engineering Mechanics(Static & Dynamics) , Dr. D.S. Kumar , Katson Books
- A Textbook Of Engineering Mechanics , R.S. Khurmi , N Khurmi , S. Chnad

Reference Books

- Engineering Mechanics Statics , J.L Meriam , Wiley
- Engineering Mechanics Dynamics , J.L Meriam , Wiley
- Engineering Mechanics by Irving H. Shames, Prentice-Hall
- Engineering Mechanics : Statics and Dynamics, R. C. Hibbler
- Mechanics of Solids by Abdul Mubeen, Pearson Education Asia.
- Mechanics of Materials by E.P.Popov, Prentice Hall of India Private limited.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech(ME)	**Semester:** 1st
Course Title: ENGINEERING MECHANICS LAB	**Course Code:** ME-151

Course Description: Course will help the students to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To understand about 2- stroke and 4- stroke engines through prototypes.

CO2: Tounderstand about the methods of measurements.

CO3: To verify various theories by experimenting different performance characteristics of various devices like screw jack.

CO4: Analyze data, assess its reliability and draw conclusions.

Sr No.	Experiment Title
1.	To study the 2-stroke & 4-stroke I.C. Engine models.
2.	Friction experiment(s) on inclined plane.
3.	To determine the velocity ratio, mechanical advantage and efficiency of a simple screw jack.
4.	Simple & compound gear-train experiment.
5.	Belt-Pulley experiment.
6.	Torsion of rod/wire experiment.
7.	Experiment on Trusses.
8.	Dynamics experiment on momentum conservation
9.	Experiment on Moment of Inertia.
10.	To draw the load-extension curve of a metallic wire and hence determine the modulus of elasticity of the material of the wire.
11.	To investigate the relationship between shear stress and shear strain for rubber and to determine the modulus of rigidity of the material.
12.	To determine the central deflection of a simply supported beam loaded by a concentrated load at mid point and hence determine the modulus of elasticity of the material of the beam.
13.	To determine the central deflection of a fixed ended beam loaded at mid-span by concentrated loads and to compare with theoretical value.
14.	To verify the laws of shearing force and bending moment on a beam.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Engineering Mechanics Statics , J.L Meriam , Wiley
- Engineering Mechanics Dynamics , J.L Meriam , Wiley

- Engineering Mechanics by Irving H. Shames, Prentice-Hall
- Engineering Mechanics : Statics and Dynamics, R. C. Hibbler
- Mechanics of Solids by Abdul Mubeen, Pearson Education Asia.
- Mechanics of Materials by E.P.Popov, Prentice Hall of India Private limited.
- Engineering Mechanics(Static & Dynamics) , Dr. D.S. Kumar , Katson Books
- A Textbook Of Engineering Mechanics , R.S. Khurmi , N Khurmi , S. Chnad

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 1st
Course Title: COMMUNICATION SKILLS	**Course Code:** HUM-101

Course Description: This course aims to equip students with basics of communication and English grammar.

Course Outcomes

CO1: To adept students with meaning and purpose of communication.

CO2: To develop effective writing skills of students.

CO3: To prepare students for interviews.

CO4: To develop the overall personality of students.

Theory 3hr/Week

Unit	Topic	Hours
1	**Communication:** Meaning of Communication, Types of Communication, Process of Communication, Channels of Communication, modes of communication, Barriers to communication, Role of communication in society. **Reading Skills:** Characteristics of reading, Types of reading, Purpose of reading, Process of reading, Rules for faster comprehension, Approach to reading, SQ3R, Comprehension (Unseen passage).	15
2	**Listening Skills:** Process of listening, Types of listening, and Barriers to effective listening, Difference between hearing and listening, Feedback skills. **Speaking Skills:** Study of Vowels symbols & diagram(Long, Short, Open, Close, Rounded, Unrounded, Monophthongs, Diphthongs) , Consonants & symbols , Accent , Stress , Voice Modulation	10
3	**Grammar:** Abbreviations, Idioms & phrases, One word substitution, Antonyms, Synonyms, Homophones, Homonyms, Word formation: prefix, suffix, Punctuation. Transformation of sentences: Simple to compound, compound to Complex& vice versa.	10
4	**Writing Skills:** Business letters: principles, structure, Writing a memo, Job application letters, preparing a personal resume; Writing notices, Agenda and Minutes of meetings; Paragraph writing, Report writing: Characteristics, types of reports, structure of technical/research reports, preparatory steps to report writing.	10

Textbooks

- Bhattacharya, Inderjit, an Approach to Communication Skills. Dhanpat Rai, New Delhi.
- K.K.Sinha, Business Communication, Galgotia Publishing Company, New Delhi, 1999.

Reference Books

- Sheila H.A. Smith, M and Thomas, L., Methuen, Reading to Learn; London, 1982.
- McGraw, SJ;Basic Managerial Skills for all, Prentice Hall of India, New Delhi 1991
- Technical Reporting Writing British Association for commercial and Industrial Education, BACIE, 1992
- Chrissie Wright (Ed.); Handbook of Practical Communication Skills; JAICO Books
- Common Errors in English, by Sudha Publication (P) Ltd., B-5, Prabhat Kiran Building, Rajendra Place, New Delhi – 110008.
- Abul Hashem, Common Errors in English, Ramesh Pub. House, Daryagang New Delhi.
- Objective English by Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- R.K.Bansal & J.B. Harrison, spoken English for India, Orient Longman.
- Veena Kumar, the Sounds of English, Makaav Educational Software, New Delhi.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
CO2	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
CO3	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
CO4	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

Program: B.Tech(ME)	**Semester:** 1st
Course Title: COMMUNICATION SKILLS LAB	**Course Code:** HUM-151

Course Description: This course aims to enhance the general conversational skills of students in different socio-cultural contexts and to strengthen their professional skills.

Course Outcomes

CO1: Better pronunciation and accent

CO2: Ability to use functional English

CO3: Competency in analytical skills and problem solving skills

CO4: Effective spoken skills.

Sr No.	Experiment Title
1.	Group Discussion.
2.	Just a minutes session: Speaking Extempore for one minutes on given topics.
3.	Reading aloud of newspaper headlines and important articles.
4.	Improving pronunciation through tongue twisters.
5.	Soft Skills: Mannerism or Etiquette.
6.	Mock Interview.
7.	Preparing PPTs.
8.	Telephonic Skills.
9.	Phonetics.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Sheila H.A. Smith, M and Thomas, L., Methuen, Reading to Learn; London, 1982.
- McGraw, SJ;Basic Managerial Skills for all, Prentice Hall of India, New Delhi 1991
- Technical Reporting Writing British Association for commercial and Industrial Education, BACIE, 1992
- Chrissie Wright (Ed.); Handbook of Practical Communication Skills; JAICO Books
- Common Errors in English, by Sudha Publication (P) Ltd., B-5, Prabhat Kiran Building, Rajendra Place, New Delhi – 110008.
- Abul Hashem, Common Errors in English, Ramesh Pub. House, Daryagang New Delhi.
- Objective English by Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- R.K.Bansal & J.B. Harrison, spoken English for India, Orient Longman.
- Veena Kumar, the Sounds of English, Makaav Educational Software, New Delhi.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
CO2	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
CO3	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
CO4	**0**	**0**	**0**	**3**	**0**	**2**	**1**	**1**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

Course Title: IT INFRASTRUCTURE LANDSCAPE OVERVIEW	**Course Code:** CSE-102

Course Description: To understand the concept of database system. To understand the understanding of the differences between OODBMS, ORDBMS, and RDBMS and the practical implications of each approach. Analyze and design a software design application connecting with databases

Course Outcomes

CO1: Gains good knowledge of Database, Application, and middleware software along with System Hardware and networking.

CO2: Develop an understanding of the differences between OODBMS, ORDBMS, and RDBMS and the practical implications of each approach.

CO3: Gains practical understanding of industry-standard storage networking concepts.

CO4: Analyze and design a software design application connecting with databases.

Theory 3hr/Week

Unit	Topic	Hours
1	Database Overview:- Understanding Database types, Database Terminology, Characteristics Of Databases, Introduction To Database Management Systems, Types Of Database Management Systems, Database Security And Recovery, Data Mining, Data Warehousing, And Data Marts, Data Mining (DM), Data Warehousing and Data Marts, SQL Overview , Introduction to SQL, History of SQL, Relational database schema, Data Types, Dates and Times, Creating a table, Default Values, NULL values, Constraints, Referential integrity, Creating a schema, Creating a view, Creating other database objects, Modifying database objects, Renaming database objects, Data manipulation with SQL, Selecting data, Ordering the result set, Cursors, Inserting data, Deleting data, Updating data, Table joins, Inner joins , Equi-join, Natural join, Cross join, Outer joins, Left outer join, Right outer join, Full outer join, Union, intersection, and difference operations, Union, Intersection, Difference (Except), Relational operators, Grouping operators, Aggregation operators, HAVING Clause, Sub-queries, Sub-queries returning a scalar value, Sub-queries returning vector values, Correlated sub-query, Sub-query in FROM Clauses, Mapping of object-oriented concepts to relational concepts, JDBC, What is JDBC?, JDBC Architecture:, Common JDBC Components: Database APIs, ODBC and the IBM Data Server CLI driver, Indexes , Clustered And Non-clustered Indexes, Failure Management With Db2 Cluster Services.	10
2	Storage Overview :-Storage Networking Technology, Types Of Storage System, FC-AL (Fibre Channel Arbitrated Loop), Fabric, Storage Area Network, Zoning, Storage Virtualization.	6
3	Systems & Directory Services Overview :- Server Technology, Operating System, Virtualization, Hypervisor, I/o Virtualization, Partitioning, Server Deployment, Server Management Console, Server Availability Concepts And Techniques, Server	10

	Workload. Directory Server Concepts, Directory, LDAP PROTOCOL, Overview of LDAP, LDAP Architecture, LDAP Models, LDAP Replication Topologies, LDAP Data Interchange Format (LDIF).	
4	Network Security and Overview:-Network Overview, Network Topologies, Tree Topology, Firewalls, Switching Concepts , What Is Routing? , Virtual Lan's, Security Basics, Loss Of Privacy, Loss Of Integrity, Security Technology, Active Audit , Secure Messaging, Data Security, Network Security.	9
5	Application and Middleware Overview:-Introduction To Common Messaging System (MQ SERIES), Application Integration – Business Need, Middleware, Message Oriented Middleware, Synchronous interaction, Asynchronous interaction, Coupling, Reliability, Scalability, Availability, IBM Websphere MQ, Websphere MQ Objects, Web Tier Deployment, Application Servers And Clustered Deployment, EMAIL, Lotus Architecture, Lotus Domino Server Types, Lotus Notes Clients, Types of Certificates, data warehousing, Warehouse Modeling Approaches , Basic Concepts, Dimension, Basic OLAP Operations.	10

Textbooks

- IT Infrastructure Landscape Overview (IBM ICE Publication)

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO2	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO3	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**
CO4	**3**	**2**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**1**

Program: B.Tech (ME)	**Semester:** 2nd
Course Title: ENGINEERING MATHEMATICS-II	**Course Code:** MATH-201

Course Description: This course is designed to introduce students to the Ordinary Differential Equations, Linear Differential Equations of first order and Higher degree, Special Functions, Laplace Transforms.

Course Outcomes: After completing this course, the student will be able to:

CO1: Apply and analyse various types of numerical methods for solving differential equations.

CO2: Solve and analyse the Differential equations and its application in related field of Engineering.

CO3: Apply Laplace transform and Fourier transform techniques to solve differential Equations involved in Vibration theory, Heat transfer and related engineering Applications.

CO4: Solve various partial differential equations such as wave equation, one and two dimensional heat flow equations.

Theory 3hr/Week

Unit	Topic	Hours
1	**Ordinary Differential Equations:** Brief review of first order ordinary differential equations, Exact differential equations, Equations reducible to exact equations; Solution of differential equations – variable separable. **Linear Differential Equations of first order and Higher degree:** Equations of the first order and higher degree, Linear differential equations with constant coefficients (nth order): general solution, complementary function and particular integral; Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy"s and Legendre"s linear equations), Applications of differential equations to engineering problems.	15
2	**Series Solution of Differential Equations:** Series solution of second order differential equations with variable coefficient (Power series method and Frobeneous method). **Special Functions:** Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.	10
3	**Laplace Transforms:** Laplace **t**ransforms of simple functions, Basic operational properties, Transforms of derivatives and integrals, Initial and final value theorems; Inverse Laplace transforms – Convolution theorem; Periodic functions - Unit step function, Laplace transform of Periodic function; Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only.	10
4	**Fourier Series:** Periodic Functions, Fourier Series of period 2π, Change of interval, Even and Odd periodic functions, Expansion of odd and even periodic functions, Half range Sine and Cosine Series, Typical wave-forms, Parseval"s formula. **Partial Differential Equations:** Harmonic analysis, Partial Differential Equations with constant coefficients, Complimentary function and particular integral.	10

Textbooks

- B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers.
- H.K. Dass and Rama Verma, “Engineering Mathematics”, S. Chand Publications.

Reference Books

- N.P. Bali and Manish Goel, “Engineering Mathematics”, Laxmi Publications
- B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 2nd
Course Title: ENGINEERING CHEMISTRY	**Course Code:** CHEM-101

Course Description: The course of engineering chemistry is a basic introductory course based on curriculum of senior secondary level. This course provide knowledge to students about chemical aspects of matter, its constitution upto electronic level, the interactions at electronic level and its effect on the states of matter. This course explains the interaction of light with matter with different parameters defining the interaction effects. This course give some brief introduction about recent researches in the field of production of products using green approach for the moto of sustainable development.

Course Outcomes

CO1: Learn about position of electrons, their interactions with each other and shapes and geometries of molecules.

CO2: Give knowledge about quantum mechanics of particle behaviour, energy wise arrangement of electrons and their interactions in bond formation.

CO3: Learn about the process of polymerization of different substances with more emphasis on rubber.

CO4: Give knowledge about interaction of light with matter and the principles on which different types of spectroscopic techniques were based.

Unit	Topic	Hours
1	**Periodic properties** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.	9
2	**Atomic and molecular structure** Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.	12
3	**Polymers** Introduction, classification, types of polymerization, synthesis and applications of some important polymers. PVC, Polyamides, Polyurethane, Polyethylene, Poly propylene, PET, Resins (Phenol Formaldehyde), PMMA, PAN. Conducting and Biodegradable polymers; Introduction: Rubber and different types of rubber, Vulcanization of rubber. Natural and synthetic rubber. Some important rubber and its uses.	07
4	**Spectroscopic techniques and applications** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface	08

	characterisation techniques. Diffraction and scattering.	
5	**Green Chemistry** Solvents: Reactions in solvent less systems, use of supercritical fluids such as CO_2, Ionic liquids.Catalysts: For increased selectivity, reduced energy requirement, photocatalytic reaction and asymmetric synthesis. Synthetic Methodologies: New synthetic protocols using new energy sources like Microwaves, Ultrasound etc.	10

Textbooks

- A Text Book of Engineering Chemistry: by Shashi Chawla.
- Applied Chemistry- A textbook for engineers and technologist by H.D. Gesser.

Reference Books

- Organic Chemistry, P.Y. Bruice, Ninth Impression, 2011, Pearson India
- Chemistry 3 , A. Burrows, john Holman, A, Parsons, G. Pilling, G.Price, Oxford Univ. Press, 2009
- Engineering Chemistry, published by John Wiley and Sons, India 2011
- Unit processes in Organic Synthesis by Groggins, Tata McGraw Hill, 2001
- Engineering Chemistry: by P C Jain & Monika Jain
- Chemistry: Principles and Applications, byM. J. SienkoandR. A. Plane

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**

Program: B.Tech(ME)	**Semester:** 2nd
Course Title: ENGINEERING CHEMISTRY LAB	**Course Code:** CHEM-151

Course Description: the lab of engineering chemistry for the students impart on hand practice of some basic chemical procedures or processes occurring in the nature. Natural water with the addition of minerals have changes its nature, its verification in lab by experiment will impart knowledge to students. Properties of polymeric substances, estimation of constituent in the mixture, its separation by different methods can enhance knowledge of student.

Course Outcomes

CO1: Knowledge about hardness of water and its removal.

CO2: preparation of polymers in lab and to check its properties.

CO3: Separation of constituent of mixture by chromatography.

CO4: on hand verification of spectroscopic principle.

Sr No.	Experiment Title
1.	Determination of total, permanent and temporary hardness of water sample EDTA method.
2.	Preparation of polystyrene by anionic/cationic/emulsion polymerization method.
3.	Estimation of chloride content in water by argentometric method [mohr's method].
4.	Estimation of alkalinity in water sample.
5.	Ion exchange column for removal of hardness of water.
6.	Thin layer chromatography.
7.	Estimation of total iron in iron ore.
8.	Chemical analysis of a salt.
9.	Verification of Lamberts Beer's law by UV-Vis spectrophotometer.
10.	Analysis of concentration of a drug in the given sample by comparing with the given standard.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Organic Chemistry, P.Y. Bruice, Ninth Impression, 2011, Pearson India
- Chemistry 3 , A. Burrows, john Holman, A, Parsons, G. Pilling, G.Price, Oxford Univ. Press, 2009
- Engineering Chemistry, published by John Wiley and Sons, India 2011
- Unit processes in Organic Synthesis by Groggins, Tata McGraw Hill, 2001
- Engineering Chemistry: by P C Jain & Monika Jain
- Chemistry: Principles and Applications, byM. J. SienkoandR. A. Plane.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO2	**3**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO3	**3**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO4	**3**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**

Course Title: ENGINEERING DRAWING	**Course Code:** ME-201

Course Description: Course will help the students to to know projection of points ,straight lines, solids etc. To know development of different types of surfaces and about isometric projection. Different lines used for representation of different Engineering Sections.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Know the Standard conventions and Construction of various Engineering curves

CO2: Apply fundamentals of theory of projections and draw orthographic projections of points and lines in any position

CO3: Draw sectional views and developments of various objects

CO4: Construct isometric views and construct multi view drawings of simple and complex objects

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction** Sheet layout, Drawing instruments and their uses, Lettering and free hand practicing, Dimensioning, Types of lines, BIS conventions	10
2	**Orthographic projections** Definitions, Planes of projection, Reference line and convention employed, Projections of points, lines, True and apparent lengths, inclinations, Orthographic projections of plane surfaces.	10
3	**Projections of solids** Definitions, Projections of right regular tetrahedron, Projections of hexahedron, Projections of prisms, Projections of pyramids, cylinders and cones.	08
4	**Isometric projections** Isometric scales, Isometric projections of simple figures, tetrahedron, hexahedron, right regular prisms, pyramids, cylinder and cones, Spheres, cut spheres and combination of solids.	10
5	**Sections and Sectional Views of Right Angular Solids** Covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.	10

Textbooks

- Engineering Drawing – N D Bhatt & V M Panchal, 48th edition, 2005 Charotar Publishing House, Gujarat.
- A Primer on Computer Aided Engineering Drawing – 2006, Published by VTU, Belgaum.
- A Textbook of Engineering Graphics, K. Venugopal and V. Prabhu Raja, New Age International Publishers.
- Engineering Drawing and Graphics using Auto Cad, T. Jeyapoovan, Vikas Publishing House Pvt. Ltd.
- Engineering Drawing (Geometrical Drawing), P.S. Gill , Ketson Books

Reference Books

- Computer Aided Engineering Drawing – S. Trymabaka Murthy, I K International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition – 2006.
- Engineering Graphics – K R Gopalakrishna, 32nd edition, 2005 – Subhash Publishers, Bangalore.
- Fundamentals of Engineering Drawing with an introduction to Interactive Computer
- Graphics for Design and Production – Luzadder Warren J., duff John M., Eastern Economy Edition, 2005 - Prentice – Hall of India Pvt. Ltd., New Delhi.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**0**	**1**

Course Description: The course deals with the subjects on environment relevant matters like Pollution Control, Hazardous waste management, Toxic materials control, Water supply-related problems and other main areas in this field. The course helps to reduce the effects of ozone depletion, global warming, automobile emissions and acid rain. They are also concerned in the protection of wildlife. Several sponsored and consulting projects in areas like health-based air quality index, atmospheric dispersion of pollutants, air pollution monitoring and control, drinking water supply, heavy metal pollution, industrial waste treatment, biological processes, bio-sorption, virology, environmental systems modelling,

Course Outcomes :- After completion of the program, the students have:

CO1: Acquired fundamental knowledge of different aspects of environment and local, regional and global environmental problems.

CO2: Developed environmental monitoring skills, including conduct of experiments and data analysis.

CO3: Acquired the knowledge and skills needed for the environmental design and management.

CO4: Acquired skills in the preparation, planning and implementation of environmental projects

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction: Definition and Scope:** Importance, Public awareness and education. **Natural Resources:** Introduction, Renewable and non-renewable, Forest, water, mineral, food, energy and land resources, Conservation of resources, Equitable use of resources. **Human population and the environment:** Population growth, Environment and human health, Human rights, HIV/AIDS, Value education, Women and child welfare.	10
2	**Ecology: Ecosystems,** Concept, Structure, Function, Energy flow, Ecological pyramids, Forest, grassland, desert and aquatic ecosystems - Introduction, characteristic features, structure and function. **Biodiversity:** Genetic, Species and ecological diversity, Threats to biodiversity, Conservation of Biodiversity.	07
3	**Social issues & environmental legislation: Social Issues**: Sustainable development, Water conservation, Climatic change, Concept of Green Computing, and Green Building **Environmental Laws**: Environmental ethics, EIA, Environmental protection acts and issues.	08
4	**Pollution &waste management** **Pollution**: Definition, Causes, effects and control measures of the pollution – Air, soil, Noise, Water, Marine and Thermal and Nuclear Pollution. **Disaster management:** Flood, Earthquake, Cyclone, Landslide, Drought. **Solid waste management**: Waste Management hierarchy; Collection, transportation and storage of MSW; Treatment and disposal of MSW	11
5	**Environmental chemistry** **General Chemistry:** Review of concepts like oxidation-reduction, Gas laws, pH and Buffers.	09

	Atmospheric Chemistry: Photochemical reactions in atmosphere, Major chemical pollutants and their effects. **Water and Wastewater Chemistry:** Hardness, Residual chlorine, Dissolved oxygen, BOD, COD, Solids. **Green Chemistry:** Principles, Green materials, reactions, reagents and product.	

Textbooks

- Environmental Studies by J.P.Sharma.
- Environmental studies by Smriti Srivastava.

Reference Books

- Environment and Ecology by H.Kaur.
- Environmental Studies by Ranjit Daniels.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	0	2	0	1	0	0	2	0	1	0	1	0	1
CO2	3	2	1	0	2	0	1	0	0	2	0	1	0	1	0	1
CO3	3	2	1	0	2	0	1	0	0	2	0	1	0	1	0	1
CO4	3	2	1	0	2	0	1	0	0	2	0	1	0	1	0	1

Program: B.Tech (ME)	**Semester:** 2nd

Course Title: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	**Course Code:** EEE-101

Course Description: To understand the various laws and principles associated with electrical and electronics engineering

Course Outcomes:-

CO1: Calculate energy consumption in electrical systems.

CO2: Basic knowledge about the Electric and Magnetic circuits, electromagnetism

CO3: Understand & demonstrate fundamentals of electromagnetism for working of single phase transformer & electrostatics

CO4: Use the concept of poly phase ac circuit to analyze three phase star, delta circuits

Theory 3hr/Week

Unit	Topic	Hours
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.	8
2	**AC Circuits** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	8
3	**DC Machine** Construction and working of DC motor and generator, Fleming's Rule, Different types of Dc Motors , Starting of DC motor and Speed Control.	6
4	**Transformers** Construction and Working Principle, Transformation Ratio, emf equation, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer.	6
5	**Electrical Machines** Types of AC motors and their applications, Construction and working principle of Single phase and three phase induction motor, Stating of Three phase induction motor using Star/Delta and DOI, Starters, Starting of Single Phase Motors.	8
6	**Basic Electronics** Basic idea of Semiconductor products, Diode, Zener Diode, Transistor, SCR and their Applications.	8

Textbooks

- J. B. Gupta, "Basic Electrical Engineering", S.K. Kataria & Sons.
- Basic Electrical and Electronics Engineering, S.K S. K. Bhattacharya, Pearson.

Reference Books

- D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- T.K. Nagsarkar and M.S. Sukhija, "Basic Electrical Engineering", Oxford University Press
- D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

- L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
- E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
- V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
- B. L. Theraja, “Electrical Technology”, S Chand Publishing.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**

Course Description: To enhance the student with knowledge on electrical and electronic equipments

Course Outcomes

CO1: Get an exposure to common electrical components and their ratings.

CO2: Understand the usage of common electrical measuring instruments.

CO3: Understand the basic characteristics of transformers and electrical machines.

CO4: Get an exposure to the working of power electronic converters

Sr No.	Experiment Title
1.	Verification of Ohm's Law
2.	Series and parallel connection of resistance.
3.	Verification of Kirchoffs laws.
4.	Verification of Superpostion theorem
5.	Verification of Thevenin's theorem.
6.	Verification of Maximun Power Transfer theorem
7.	To observe sine wave, square wave, triangular wave and ramp waveforms on the C.R.O. and to measure amplitude and frequency of the waveforms.
8.	Study of study of phenomenon of resonance in RLC series circuit and obtain resonance frequency.
9.	Measure the armature and field resistance of a dc machine.
10.	Starting and speed control of a DC shunt motor.
11.	Determination of, voltage ratio, polarity and efficiency by load test of a single phase transformer.
12.	Short circuit/open circuit tests on single phase transformer.
13.	Measurement of power and power factor in a single phase AC series inductive circuit.
14.	To study VI characteristics of PN diode.
15.	To study VI characteristics of NPN diode.
16.	To obtain V-I characteristics of Zener diode.

Textbooks

- Printed Manual supplied to the students.

Reference books

- D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- T.K. Nagsarkar and M.S. Sukhija, "Basic Electrical Engineering", Oxford University Press
- D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
- L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
- B. L. Theraja, "Electrical Technology", S Chand Publishing.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**		**1**		**1**			**1**			**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**		**1**		**1**			**1**			**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**		**1**		**1**			**1**			**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**		**1**		**1**			**1**			**2**	**2**	**2**	**2**

Course Description: The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Outcomes

CO1: Understand the definition and significance of the Internet of Things.

CO2: Discuss the architecture, operation, and business benefits of an IoT solution

CO3: Examine the potential business opportunities that IoT can uncover

CO4: Explore the relationship between IoT, cloud computing, and big data & Identify how IoT differs from traditional data collection systems

Theory 3hr/Week

Unit	Topic	Hours
1	Introduction:-IOT Concepts, Introduction to IOT Communications, Telemetry vs IOT, Applications of IOT Communications, People, Processes and Devices.	6
2	IOT Technologies behind smart and intelligent devicesAutomation, asset management, telemetry, transportation, telematics. Telemetry and Telemetric; Report location, logistics, tracking and remote assistance; Next generation kiosks, self-service technology; Cellular IOT connectivity services	6
3	IOT Applications IOT Verticals; IOT Hosted Services; IOT Application development.; IOT Connectivity; IOT Software providers.	6
4	IOT Systems and Networks Study of RF Wireless Sensors; Wireless networks; Computer Connected to Internet; Network Devices; Device configuration and management; Exchange information in real time without human intervention.	6
5	IOT Design and System Engineering Discuss IOT Requirements; Hardware & Software; Study of IOT Sensors; Tagging and Tracking; Embedded Products; IOT Design; (U) SIM Card Technology; IOT Connectivity and Management; IOT Security & IOT Communication	8
6	IOT Communication Technologies Discuss Wireless Sensor Networking (WSN); Cellular Machine-to- Machine (M2M) application networks; Software for M2M Applications, Hardware, IP Based Cellular Networks & 3G, 4G.	6
7	IOT Security Discuss Security & Trust M2M Communications; Secure Communications;; M2M Security Framework; Securing Data input/output and internet communication.	6

Textbooks

- Introduction to Internet Of Things (IOT) (IBM ICE Publications)

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**1**	**0**	**0**	**1**
CO2	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**1**	**0**	**0**	**1**
CO3	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**1**	**0**	**0**	**1**
CO4	**3**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**2**	**1**	**0**	**0**	**1**

Course Description: Course will help the students to learn about the fundamental knowledge of various shops like welding, fitting and casting etc. Furthermore use such technology in real time working industries.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Student will be able to know how much time a joint will take for the assessment of time.

CO2: Student will be able to make various joints in the given object with the available work material.
CO3: Student will be able to make various welding joints.

CO4: Student will be able to make castings by different gating systems.

Sr No.	Experiment Title
1.	**Carpentry Shop:-** To Prepare a "T–LAP JOINT"
2.	**Carpentry Shop:-** To prepare a "Cross Lap Joint"
3.	**Carpentry Shop:-** To prepare "Mortise and Tenon Joint"
4.	**Fitting Shop :-** To Make Right Angle Fitting Job
5.	**Fitting Shop :-** To Make A Square Fitting Job.
6.	**Machine Shop :-** To prepare the job as per the given specifications provided for different operations on lathe machine
7.	**Welding Shop:-** Beading practice with arc welding
8.	**Welding Shop:-** To make a butt joint by arc welding.

Textbooks

- A text book of workshop technology , R.S. Khurmi , J.K. Gupta , S Chand.
- Workshop Practice , Sawarn Singh, Katson Books

Reference books

- Workshop Technology, Chapman W. A. J., CBS Publishers & Distributors.
- A Course in Workshop,B.S. Raguwanshi Dhanpat Rai & Co.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Practical work Performance = 50 Marks. (Practical File = 30 Marks , Viva-Voce = 20 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2

81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**2**	**1**	**1**	**2**
CO2	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**2**	**1**	**1**	**2**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**2**	**1**	**1**	**2**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**2**	**1**	**1**	**2**

Course Description: This course is designed to introduce students to the Fourier Series: Periodic functions Fourier Transforms: Fourier integrals, Fourier transforms, Fourier cosine and sine transforms, Properties of Fourier transforms, Numerical analysis, Dual-Simplex Method.

Course Outcomes: After completing this course, the student will be able to

CO1: Solve the model by selecting and applying a suitable mathematical method like Trapezoidal rule, Simpson's (1/3)rd rule etc.

CO2: Interpreting the mathematical results practically.

CO3: Able to solve the problems of higher order and transcendental equations analytically with the helpof iterations techniques their error analysis. also able to solve problems computationally.

CO4: Find length of arc of a given curve.

Theory 3hr/Week

Unit	Topic	Hours
1	**Fourier Series:** Periodic functions, Fourier series of period $2p$, Euler's formulas, Dirichlet's condition, Fourier series for discontinuous functions, Change of interval, Odd and even function, Half- range sine and cosine series.	8
2	**Fourier Transforms:** Fourier integrals, Fourier transforms, Fourier cosine and sine transforms, Properties of Fourier transforms, Convolution theorem, Perseval's identity, Relation between Fourier and Laplace transforms, Fourier transforms of the derivatives of a function, Application to boundary value problems.	9
3	**Functions of a Complex Variables:** Functions of a complex variable, Exponential function, limit and continuity of a function, Analytic function, Cauchy-Riemann equations, Necessary and sufficient conditions for a function to be analytic, Polar form of the Cauchy-Riemann equations, Harmonic functions, Cauchy integral theorem, Cauchy residue theorem.	10
4	**Numerical analysis:** Solution of algebraic and transcendental equations by the Bisection, Regula-falsi and Newton-Raphsion methods, Solution of linear simultaneous equations by Gauss elimination method, Iteration methods, Jacobi's iteration method, Gauss-seidel method, Relaxation method, Numerical integration methods, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Numerical solution of differential equations, Picard's method, Taylor's series method, Euler's method and forth-order Runge-Kutta method.	10
5	**Linear Programming:** Linear programming problems formulation, Solution of Linear Programming Problem using Graphical method, Simplex Method, Dual-Simplex Method.	8

Textbooks

- Higher Engg. Mathematics: B.S. Grewal

- Advanced Engg. Mathematics: E. Kreyzig.

Reference Books

- Complex variables and Applications: R.V. Churchil; Mc. Graw Hill
- Engg. Mathematics Vol. II: S.S. Sastry; Prentice Hall of India.
- Operation Research: H.A. Taha
- Probability and statistics for Engineer: Johnson. PHI

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 3rd
Course Title: FLUID MECHANICS	**Course Code:** ME-301

Course Description: Course will help the students to learn about the fluids, types of fluids and effect of various forces on fluids during construction of fluid flow channels by establishing the construction of hydro projects.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To understand the basic properties of fluids and laws governing it.

CO2: By applying the different conservation laws solve different problems of engineering applications

CO3: Understand the various types of fluid flows and solve the problems of one to two dimensional compressible fluid flow.

CO4: Understand the concept of Boundary layer, Energy gradient and pipe losses and solve the problems related to above mentioned concepts**.**

Theory 3hr/Week

Unit	Topic	Hours
1	Fluids, Properties of Fluids: Density, Specific Weight, Specific Volume and Specific Gravity, Viscosity, Surface Tension and Capilarity, Vapour Pressure**.** **Hydrostatics**: Pascal's Law, Pressure Variation with Fluid Depth, Absolute and Gauge Pressures. Manometers for measurement of pressures of different ranges in Liquids or Gasses and Vacuum Pressures, Single-tube, Differential and Micro Manometers. Hydrostatic Pressure on Surfaces, Centre of Pressure, Pressure Forces on Curved Surfaces, Hydrostatic Forces on Dams, Hoop Tension in Circular Pipes. Buoyancy and Stability of Floating Bodies. **Relative Motion of Liquids**: Fluids Subjected to Acceleration, Vessel with Vertical Acceleration, Vessel with Horizontal Acceleration, Vessel Rotating about Vertical Axis.	10
2	**Kinematics of Fluid Flow**: Velocity of Fluid, Streamlines, Path Lines and Streak Lines, Equation of Continuity, One-, Two-, Three-dimensional Flows, Flow Net, Uses and Limitations. **Dynamics of Fluid Flow**: Energy of Fluids, Kinetic Energy Factor, Internal Energy, Energy Equation for Liquids, Gases and Vapours, External Work done on Fluid; Introduction to Navier-Stokes Equations, Euler's Equation along a Streamline, Bernoulli's Equation, Examples of Application of Bernoulli's Equation., Cavitation, Pitot Tube, Energy and Hydraulic Grade Lines for various pipe and open channel flow cases. Free Vortex, Rotational and Irrotational Motion; Momentum Equation and applications.	9
3	**Viscous Flow:** Flow Between Parallel Boundaries, Free Surface Flow over Inclined Surface, Flow Between a Moving and Stationary Boundary, Flow through Circular Tubes, Stokes' Law, Oiled Bearings, Viscosity Measurements and Viscometers. **Dimensional Analysis and Similarity laws:** Dimensional Analysis, Development of Equations, Buckingham's Pi Theorem, Examples. Similarity of Flows: Geometric,	8

	Kinematic and Dynamic Similarities; Reynolds, Froude, Weber and Mach Similarity Laws & Applications	
4	**Real Fluid Flow:** Turbulent Flow, Boundary Layer, Flow past Solid Boundaries and through Pipes, Boundary Layers in Pipes, Separation of Boundary Layer, Examples, Secondary Flows. **Pipe Flow**: Laminar and Turbulent Flow, Equation for Flow and Head Loss, Velocity Distribution for Turbulent Flow in Smooth Pipes and Rough Pipes, Universal Chart for Pipe Friction Factors, Approximate Equations for Pipe Friction and Head Loss, Chezy's, Manning's and Hazen Williams Formulae, Friction Factor in Non-Circular Conduits, Minor Losses - Sudden and Gradual Enlargement and Contraction, Pipe Entrances, Bends, Losses in Pipe Fittings, Pipeline Problems, Pipes in Series and parallel, Method of Equivalent Pipes, Siphon, Pipeline with a Pump, Pipeline with Turbine, Economical Pipe Diameter. **Flow in Open Channels:** Hydraulic and Energy Gradient, Steady Uniform Flow, Kutter, Bazin and Manning Formulae	10
5	**Fluid Measurements:** Measurement of Fluid Properties, Measurement of Static Pressure, Velocity Measurement, Mechanical and Chemical Devices. Measurement of Discharge: Discharge Through an Orifice, Energy Loss, Orifice Flow for Pressures Other than Atmospheric, Discharge Through Large Openings under Small Heads, Coefficients, Short Tubes, Mouthpieces, Nozzles, Discharge under Gates; Discharge Through an Orifice Meter, Flow Nozzle, Ventura Meter, Comparison, Elbow Meter, Rotameter, Displacement Meters, Inferential Meters; Open Channel Flow Measurements, Rectangular, Contracted, Triangular, Trapezoidal, Proportional or Sutro Weirs.	8

Textbooks

- M.Manohar, P.Krishnamachar, Fluid Mechanics, vol.1, SBPRA Pub. Huston, USA, 2013.
- Vennard and Street, Fluid Mechanics
- R J Fox, Introduction to Fluid Mechanics,
- Hunter Rouse John Wiley and sons,Elementary Mechanics of Fluids, Omc/1946

Reference Books

- L H Shames Mechanics of Fluids, McGraw Hill, Internatioal student edition.
- K L Kumar, Engineering Fluid Mechanics
- V Gupta and S K Gupta, Fluid Mechanics and its applications, Wiley Eastern
- Som and Biswas, Introduction to Fluid Mechanics and Machines, TMH
- Modi and Seth, Fluid Mechanics and Fluid Machines .
- Bruce R.Donald F Young and T H Okishi, Fundamentals of Fluid Mechanics, Wiley Eastern.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
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91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**	**2**	**1**	**1**
CO2	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**

Course Description: Course will help the students to learn about the types of material and its composition and furthermore its usage and applications in various specialized parts of engineering.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will be able to classify the materials and their crystal structures.

CO2: Students will judge the mechanical properties and their suitability of applications.

CO3: Understand the Time Temperature Transformation (TTT) Diagrams.

CO4: Understand and interpret the various kind of heat treatment processes, magnetic properties, electric properties and performance action of materials when material are in real time usage.

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction:** Historical perspective, importance of materials. Brief review of modern & atomic concepts in Physics and Chemistry, Atomic models, Periodic table, Chemical bonding. **Crystallography and Imperfections:** Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices, X-ray crystallography techniques, Imperfections, Defects & Dislocations in solids.	10
2	**Mechanical properties and Testing:** Stress strain diagram, Ductile & brittle material, Stress vs strength. Toughness, Hardness, Fracture, Fatigue and Creep, Testing such as Strength testing, Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT). **Micro structural Exam:** Microscope principle and methods. Preparation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass **Phase Diagram and Equilibrium Diagram:** Uniary and Binary diagrams, Phase rules. Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram	10
3	**Ferrous materials:** Brief introduction of iron and steel making furnaces. Various types of carbon steels, alloy steels and cast irons, its properties and uses. **Heat Treatment:** Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams. **Non-Ferrous metals and alloys:** Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications, Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.	8
4	**Magnetic properties**: Concept of magnetism - Dia, Para, Ferro Hysteresis. Soft and hard magnetic materials, Magnetic storages **Electric properties:** Energy band concept of conductor, insulator and semi-conductor. Intrinsic & extrinsic semi-conductors. P-n junction and transistors. Basic devices and its	8

	application, Diffusion of Solid, Super conductivity and its applications, Messier effect, Type I & II superconductors, High Tc superconductors.	
5	**Ceramics :** Structure types and properties and applications of ceramics. Mechanical/Electrical behavior and processing of Ceramics Plastics: Various types of polymers/plastics and its applications. Mechanical behavior and processing of plastics, Future of plastics **Other materials :** Brief description of other material such as optical and thermal materials concrete, Composite Materials and its uses. Brief introduction to Smart-materials & Nano-materials and their potential applications **Performance of materials in service:** Brief theoretical consideration of Fracture, Fatigue, and Corrosion and its control.	9

Textbooks

- A textbbok of material Science & Engineering , Er. R.K rajput , Katson Books.
- W.D. Callister, Jr, - Material Science & Engineering Addition-Wesley Publication.

Reference Books

- K.M.Gupta, Materials Science, Umesh Publication.
- Van Vlash - Elements of Material Science & Engineering John Wiley & Sons.
- V. Raghvan - Material Science, Prentice Hall.
- Narula - Material Science, TMH.
- Srivastava, Srinivasan - Science of Materials Engineering, NewAge Publication.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4

CO1	**3**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**0**
CO2	**3**	**2**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**1**	**3**	**3**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**3**	**3**	**3**	**3**

Course Description: Course will help the students to learn about the different stresses and real time applications in construction of bridges and flyovers.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understanding of numerous stresses and strains especially principal stresses and strains.

CO2: Understanding and implementation of bending moment and shear force diagrams for several kinds of loads.

CO3: Calculate the slope and deflection for many beams like simply supported beams.

CO4: Understand the concept of columns and struts and their applications.

Unit	Topic	Hours
1	**Simple, Compound Stresses and Strains:** Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load variation of temperature in single and compound bars.	10
2	Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress ellipse of stress and their applications. Generalized Hook's law, principal stresses related to principal strains.	7
3	**Bending Moment (B.M) and Shear Force (S.F) Diagrams:** S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under the following loads: a) Concentrated loads b) Uniformity distributed loads over the whole span or part of span c) Combination of concentrated and uniformly distributed load d) Uniformly varying loads e) Application of moments	10
4	**Bending Stresses In Beams:** Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T-sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams. **Shear stresses in beams:** Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance.	8
5	**Slope and deflection**: Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of these methods to calculate slope and deflection for the following: a) Cantilevers b) Simply supported beams with or without overhang c) Under concentrated loads, uniformly distributed loads or combination of concentrated & uniformly distributed loads.	10

	Columns and struts: Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.	

Textbooks

- A Textbook of Strength of Materials Dr. R.K. Bansal.Laxmi publication Ltd.
- A Textbook of Strength of Materials, Er. R.K. Rajput , Katson Books.

Reference Books

- D.S. Bedi, Strength of Materials, Khanna Book Publishing Company.
- E.P. Popov, Mechanics of Materials-(SI Version), Prentice Hall India.
- R.S Lehri and A.S. Lehri, Strength of Materials, Kataria and Sons.
- S.S.Rattan, Strength of Materials, Tata McGraw Hill.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**1**	**1**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**1**	**1**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**1**	**1**	**0**	**3**	**3**	**3**	**3**

Course Title: ENGINEERING THERMODYNAMICS-I	**Course Code:** ME-304

Course Description: Course will help the students to learn about the numerous types of engineering applications of thermodynamics in construction of boilers, engines and various home appliances like refrigerators and air- conditioners etc.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understanding the concept of continuum, control surface, control boundary and thermodynamic properties.

CO2: Understand the three laws of thermodynamics, Zeroth law of thermodynamics and concept of internal energy and enthalpy.

CO3: Understanding the concept of entropy and evaluate the availability, unavailability and irreversibility.

CO4: Understand and evaluate the properties of steams and thermodynamic cycles for solving different problems of thermodynamics.

Theory 3hr/Week

Unit	Topic	Hours
1	**Fundamental Concepts and Definitions:** Introduction and definition of thermodynamics, Dimensions and units, Microscopic and Macroscopic Systems, approach system surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasi static process, Energy and its forms, Work and heat, Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases.	08
2	**Zeroth law of thermodynamics:** Zeroth law of thermodynamics, Temperature and its'measurement, Temperature scales. **First law of thermodynamics:** Thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics, PMM-I.	10
3	**Second law:** Devices converting heat to work, Thermal reservoir, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of	08

	two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM-II.	
4	**Entropy :** Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics. **Availability and Irreversibility**: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function.	08
5	**Properties of steam and thermodynamics cycles:** Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier charts, Dryness factor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.	08

Textbooks

- Engineering Thermodynamics by P.K.Nag, Tata Mc Graw Hill Pub.
- Thermal Engineering By R.K. Rajput, Laxmi Publication.

Reference Books

- Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
- Fundamentals of Thermodynamics by Sonntag, Wiley India Pvt. Ltd.
- Fundamentals of Classical Thermodynamics by Van Wylen, John wiley & sons.
- Thermodynamics by J.P. Holman, McGraw Hill.
- Engineering Thermodynamics by Onkar Singh, New Age International Pub..
- Engineering Thermodynamics by C.P. Arora.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**2**	**2**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**1**	**1**	**0**	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**1**	**0**	**2**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**3**	**3**	**3**	**3**

Course Description: Course will help the students to learn about the ethics, values, etiquettes, concept of introspection and action of individual's responsibility towards the society to maintain harmony and balance between the society and nature.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understanding the real meaning of education and introspection- i.e. self exploration

CO2: Students will maintain the harmony at various levels i.e. between one's body, soul and mind, between family and society, between society and nature.

CO3: Understanding the existence of nature**.**

CO4: Understanding the professional manner, values and ethics and few sociological and environmental issues.

Theory 3hr/Week

Unit	Topic	Hours
1	Introduction - Understanding the need of Value Education, Self Exploration as the process for value education; basic Human Aspirations- Continuous Happiness and Prosperity	10
2	Understanding Harmony at various levels (in brief): Self ('I') and Body, Self and Myself, Human Body	8
3	Understanding Harmony in the Family (relationship), Society to world, nature	8
4	Understanding Harmony in the Nature and Existence - Whole existence as Coexistence,	8
5	Right Understanding concepts –morals, Values, Ethic (professional), Value of time, Confidence, Spirituality, Respect, Peace Various issues related to Education, Societies (gender inequalities, security for women-crime-), Nature (Earth) (Environment issues- Global Warming, deforestation, over population, ozone layers depletion, climate change, etc.) and Life.	13

Textbooks

- R R Gaur, RSangal, GP Bagaria, Human Values and professional Ethics , Excel Books, New Delhi 2013.
- John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

Reference Books

- Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

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Below 75%	0
75% - 80%	1
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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
CO2	**0**	**0**	**1**	**3**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
CO3	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
CO4	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**3**	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**1**

Course Description: Course will help the students to learn about to enrich the concept of fluid mechanics and hydraulic machines

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understanding of basic physics of fluids.

CO2: Gaining knowledge to calculate and design engineering applications involving fluid.

CO3: Understanding of analyzing flow systems in terms of mass, momentum, and energy balance.

CO4: Having knowledge about current research topics about fluid mechanics.

Sr No.	Experiment Title
1.	To verify the momentum equation using the experimental set-up on diffusion of submerged air jet.
2.	To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3.	To calibrate an orifice meter, venture meter, and bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
4.	To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
5.	To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
6.	To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.

Textbooks

- Printed Manual supplied to the students.

Reference books

- L H Shames Mechanics of Fluids, McGraw Hill, Internatioal student edition.
- K L Kumar, Engineering Fluid Mechanics
- V Gupta and S K Gupta, Fluid Mechanics and its applications, Wiley Eastern
- Som and Biswas, Introduction to Fluid Mechanics and Machines, TMH
- Modi and Seth, Fluid Mechanics and Fluid Machines .
- Bruce R.Donald F Young and T H Okishi, Fundamentals of Fluid Mechanics, Wiley Eastern.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**1**	**2**	**1**	**1**
CO2	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**3**	**3**	**3**

Course Description: Course will help the students to learn about microstructures of various specimens under microscope to gain wisdom about the grain size after various heating processes.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Analyze about the material identification.

CO2: Analyze about the corrosion and its effects.

CO3: Analyze about the welded components microstructure.

CO4: Analyze about the grain size determination of given specimen.

Sr No.	Experiment Title
1.	Making a plastic mould for small metallic specimen.
2.	Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
3.	Grain Size determination of a given specimen.
4.	Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
5.	Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
6.	Material identification of, say, 50 common items kept in a box.
7.	Faradays law of electrolysis experiment.
8.	Study of corrosion and its effects.
9.	Study of microstructure of welded component and HAZ. Macro & Micro Examination
10.	Suitable experiment on Magnetic/ Electrical/Electronic materials.
11.	Strength testing of a given mild steel specimen on UTM with full details and s-e plot on the machine.
12.	Other tests such as shear bend tests on UTM.
13.	Impact testing on impact testing machine like Charpy, Izod or both.
14.	Hardness testing of given specimen using Rockwell and Vickers/Brinell testing machines.
15.	Spring index testing on spring testing machine.
16.	Fatigue testing on fatigue testing machine.
17.	Creep testing on creep testing machine.
18.	Deflection of beam experiment, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
19.	Torsion testing of a rod on torsion testing machine.
20.	Study of non-destructive testing methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

Textbooks

- Printed Manual supplied to the students.

Reference books

- K.M.Gupta, Materials Science, Umesh Publication.
- Van Vlash - Elements of Material Science & Engineering John Wiley & Sons.
- V. Raghvan - Material Science, Prentice Hall.
- Narula - Material Science, TMH.
- Srivastava, Srinivasan - Science of Materials Engineering, NewAge Publication.
- D.S. Bedi, Strength of Materials, Khanna Book Publishing Company.
- E.P. Popov, Mechanics of Materials-(SI Version), Prentice Hall India.
- R.S Lehri and A.S. Lehri, Strength of Materials, Kataria and Sons.
- S.S.Rattan, Strength of Materials, Tata McGraw Hill.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**	**2**
CO2	**3**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**3**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**3**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 3rd
Course Title: MACHINE DRAWING LAB	**Course Code:** ME-353

Course Description: Course will help the students to learn about the different views of drawing, orthographic views, isometric views and assembly drawings by manually drawing these assemblies and other drawings on drawing sheet.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Recognize the conventional representation of materials and various standard components.

CO2: Study different categories of drawings.

CO3: Draw various machine components in three orthogonal views.

CO4: Draw small assembly drawings with details.

Sr No.	Experiment Title
1.	**Review of Orthographic Projections** (1 drawing sheet) Orthographic Projection of solids in First angle of projection, missing lines views, interpretation of views
2.	**Part and Assembly Drawing** (2 drawing sheet)
3.	**Specification of Materials** (1 drawing sheet) Engineering materials, representation, Code designation of steel, copper, aluminium etc.
4.	**Limits, Tolerance and Fits** (1 drawing sheet) Limit system, Tolerances, Method of placing limit dimensions, Fits-types
5.	**Surface Roughness** (1 drawing sheet) Introduction, nomenclature, machining symbols, indication of surface roughness
6.	**Production Drawing** (1drawing sheet) Types, Examples of simple machine elements like helical gear, bevel gear, crank connecting rod, belt pulley, piston etc.
7.	**Computer Aided Drafting** (2 drawings) Introduction, input, output devices, introduction to software like AutoCAD, ProE, basic commands and development of 2D and 3D drawings of simple parts.

Textbooks

- Machine Drawing - PS Gill - SK Kataria & sons.
- Engineering Drawing - CM Agrawal - Tata McGraw Hill
- AutoCAD-S. Vshal - Dhanpat Rai.

Reference books

- Machine Drawing - KL Narayana, P Kannaiah, KV Reddy - New Age.
- Machine Drawing -N. Siddeshswar, P Kannaiah, VVS Shastry -Tata McGraw Hill.
- Engineering Drawing - RK Dhawan - S. Chand.
- Engineering Graphics - BK Goel & PK Goel - SK Kataria
- Computer Aided Engineering Graphics - Rajashekhar Patil - New Age.
- Engineering Drawing - Dhananjay A Jolhe - Tata McGraw Hill.
- Machine Drawing – Ajeet Singh – The Mc Graw Hill Companies

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**3**
CO2	**3**	**1**	**1**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**3**
CO3	**3**	**1**	**1**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**3**
CO4	**3**	**1**	**1**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**3**

Program: B.Tech (ME)	**Semester:** 4th
Course Title: FLUID MACHINERY	**Course Code:** ME-401

Course Description: Course will help the students to learn about the working of turbines and pumps and their actual installation in hydro power projects.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understand the application of momentum and momentum equation to flow through hydraulic machinery

CO2: Interpret the classification of turbines, their working and performance characteristics .

CO3: Interpret the classification of different types of pumps**,** their working and performance characteristics

CO4: Discern the water lifting devices and their working.

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction:**Classification of Fluid Machines & Devices, Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation. **Impact of jet:**Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), Effect of inclination of jet with the surface. **Hydraulic Turbines:**Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel.	10
2	**Reaction Turbines:**Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.	8
3	**Centrifugal Pumps:** Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Model testing, Cavitation & separation and their control, Performance characteristics.	8
4	**Positive Displacement Pumps:** Reciprocating pump theory, Slip and coefficient of discharges, Indicator diagram, Effect and acceleration, Work saved by fitting air vessels, Comparison of centrifugal and reciprocating pumps, Positive rotary pumps, Gear and Vane pumps, Performance characteristics.	8
5	**Other Machines:** Hydraulic accumulator, Special duty pumps, Intensifier, Hydraulic press, Lift and cranes, Theory of hydraulic coupling and torque converters, Performance characteristics. **Water Lifting Devices :**Hydraulic ram, Jet pumps, Air lift pumps.	8

Textbooks

- Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
- Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar , Katson Books .

Reference Books

- Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd. Hydraulic
- Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
- Applied Hydraulics by Addison

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 4th
Course Title: INTERNAL COMBUSTION ENGINE AND GAS TURBINE	**Course Code:** ME-402

Course Description: Course will help the students to learn about the functioning of engines, lubricants used during engine working- to use these concepts in automobile industry.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Interpret about the various types of engines and different types of working cycles in engines and their performance characteristics.

CO2: Students will understand effect of different kind of grading oils used in engines and issues related to them like detonation and knocking

CO3: Students will differentiate the lubricants and their SAE rating while using in engines. Understand combustion phenomena in SI and CI engines and factors influencing combustion chamber design.

CO4: Understanding of gas turbine and their applications. Understand working principles of instrumentation used for engine performance and emission parameters.

Theory 3hr/Wee

Unit	Topic	Hours
1	Heat engines; Internal and external combustion engines; Classification of I.C. Engines; Cycle of operations in four strokes and two-stroke IC engines; Wankle Engine. Assumptions made in air standard cycles; Otto cycle; Diesel cycle; Dual combustion cycle; Comparison of Otto, diesel and dual combustion cycles; Sterling and Ericsson cycles; Air standard efficiency, Specific work output. Specific weight; Work ratio; Mean effective pressure; Deviation of actual engine cycle from ideal cycle.	8
2	Mixture requirements for various operating conditions in S.I. Engines; Elementary carburetor, Calculation of fuel air ratio; The complete carburetor; Requirements of a diesel injection system; Type of injection system; Petrol injection; Requirements of ignition system; Types of ignition systems, ignition timing; Spark plugs. S.I. engines; Ignition limits; Stages of combustion in S. I. Engines; Ignition lag; Velocity of flame propagation; Detonation; Effects of engine variables on detonation; Theories of detonation; Octane rating of fuels; Pre-ignition; S.I. engine combustion chambers. Stages of combustion in C.I. Engines; Delay period; Variables affecting delay period; Knock in C.I. Engines; Cetane rating; C.I. Engine combustion chambers.	10
3	Functions of a lubricating system, Types of lubrication system; Mist, Wet sump and dry sump systems; Properties of lubricating oil; SAE rating of lubricants; Engine performance and lubrication; Necessity of engine cooling; Disadvantages of overcooling; Cooling systems; Air-cooling, Water-cooling; Radiators. Performance parameters; BHP, IHP, Mechanical efficiency; Brake mean effective pressure and indicative mean effective pressure, Torque, Volumetric efficiency; Specific fuel consumption (BSFG, ISFC); Thermal efficiency; Heat balance; Basic engine measurements; Fuel and air consumption, Brake power, Indicated power and friction power, Heat lost to coolant and exhaust gases; Performance curves;	10
4	Pollutants from S.I. and C.I. Engines; Methods of emission control, Alternative fuels for I.C. Engines; The current scenario on the pollution front. Working of a single stage reciprocating air compressor; Calculation of work input;	10

	Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor with inter-cooling; Perfect inter cooling; Optimum intercooler pressure; Rotary air compressors and their applications; Isentropic efficiency.	
5	Brayton cycle; Components of a gas turbine plant; Open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; Multi stage compression with inter-cooling; Multi stage expansion with reheating between stages; Exhaust gas heat exchanger; Application of gas turbines.	8

Textbooks

- Internal Combustion Engines, V.Ganesan , Tata McGraw Hill Education Private Limited New Delhi
- A course in Internal combustion engine , V.M Domkundwar , Dhanpat Rai & Co.

Reference Books

- Internal combustion engine by Ramalingam scitech publication
- Internal combustion engine by Ganeshan TMG
- Internal combustion engine by Mathur & Sharma

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	0	2	0	2	2	0	0	0	0	3	3	3	3
CO2	3	2	1	0	2	0	1	1	0	0	0	0	3	3	3	3
CO3	3	2	1	0	2	0	2	1	0	0	0	0	3	3	3	3
CO4	3	2	1	0	2	0	2	1	0	0	0	0	3	3	3	3

Program: B.Tech (ME)	**Semester:** 4th
Course Title: ENGINEERING THERMODYNAMICS-II	**Course Code:** ME-403

Course Description: Course will help the students to learn about the various vapor cycles, types of turbines and their working parameters, furthermore used those concepts in boilers construction, Refrigeration and air-conditioning plants and also in hydro projects.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will understand about the classification of boilers, their efficiency, equivalent evaporation and also study about different components in boilers used in industries.

CO2: Students will understand the effect of operating parameters on different kind of cycles and use those analysis in working industries.

CO3: Interpret the function of steam nozzle and also design the steam nozzle.

CO4: Students will understand the working principle of various turbines and effect of parameters on turbines.

Theory 3hr/Week

Unit	Topic	Hours
1	Introduction; classification of boilers; comparison of fire tube and water tube boiler; their advantages; description of boiler; Lancashire; locomotive; Babcock; Wilcox etc.; boiler mountings; stop valve; safety valve; blow off valve; feed check etc.; water level indicator; fusible plug; pressure gauge; boiler accessories; feed pump; feed water heater; preheater; superheater; economizer; natural draught chimney design; artificial draught; stream jet draught; mechanical draught; calculation of boiler efficiency and equivalent evaporation(no numerical problem)	10
2	Carnot cycle; simple and modified Rankine cycle; effect of operating parameters on rankine cycle performance; effect of superheating; effect of maximum pressure; effect of exhaust pressure; reheating and regenerative Rankine cycle; types of feed water heater; reheat factor; binary vapour cycle. Simple steam engine, compound engine; function of various components.	8
3	Function of steam nozzle; shape of nozzle for subsonics and supersonics flow of stream; variation of velocity; area of specific volume; steady state energy equation; continuity equation; nozzle efficiency; critical pressure ratio for maximum discharge; physical explanation of critical pressure; super saturated flow of steam; design of steam nozzle.	9
4	Advantage of steam condensation; component of steam condensing plant; types of condensers; air leakage in condensers; Dalton's law of partial pressure; vacuum efficiency; calculation of cooling water requirement; air expansion pump	8
5	Introduction; classification of steam turbine; impulse turbine; working principal; compounding of impulse turbine; velocity diagram; calculation of power output and efficiency; maximum efficiency of a single stage impulse turbine; design of impulse turbine blade section; impulse reaction turbine; working principle; degree of reaction; parsons turbine; velocity diagram; calculation of power output; efficiency of blade height; condition of maximum efficiency; internal losses in steam turbine; governing of steam turbine.	10

Textbooks

- Thermal Engineering – P L Ballaney, Khanna Publishers
- Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House

Reference Books

- Internal combustion engine by Ramalingam scitech publication
- Internal combustion engine by Ganeshan TMG
- Internal combustion engine by Mathur & Sharma

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 4th
Course Title: MANUFACTURING SCIENCE-I	**Course Code:** ME-404

Course Description: Course will help the students to learn about the different types of casting and its defects for using all these concepts of manufacturing in working industries like casting units and forging units.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will be able to understand the classification of manufacturing processes, and their economical and technological considerations.

CO2: Students will be able to understand about the metal forming processes.

CO3: Students will be able to understand about the jigs and fixtures and their applications.

CO4: Students will be able to understand about the basic principle of casting, its types and defects of casting.

Theory 4hr/Week

Unit	Topic	Hours
1	**Introduction :**Importance of manufacturing. Economic & technological considerations in manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for common items. **Metal Forming Processes :**Elastic & plastic deformation, yield criteria. Hot working vs cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging	15
2	**Metal Forming Processes (continued):** Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusionand its application. Condition for Rolling force and power in rolling. Rolling mills & rolled-sections.Design, lubrication and defects in metal forming processes.	12
3	**Sheet Metal working :**Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs Piercing. Compound vs Progressive die. Flat-face vs Inclined-face punch and Load(capacity) needed. Analysis of forming process like cup/deep drawing. Bending & spring-back.	10
4	**Unconventional Metal forming processes :**Unconventional metal forming processes such as explosive forming, electro- magnetic, electro-hydraulic forming. **Powder Metallurgy :**Powder metallurgy manufacturing process. The need, process, advantage and applications. **Jigs & Fixtures :**Locating & Clamping devices & principles. Jigs and Fixtures and its applications. **Manufacturing of Plastic components :**Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives.	15
5	**Casting (Foundry)** Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand. Elements of mould and design considerations, Gating, Riser, Runnes, Core. Solidification of casting,. Sand casting, defects & remediesand inspection. Cupola furnace. Die Casting, Centrifugal casting. Investment casting,CO_2 casting and Stir casting etc.	10

Textbooks

- Production Engg. Science by P.C. Pandey
- Production Technology by R.K. Jain.

Reference Books

- Manufacturing Science by Ghosh and Mallik
- Manufacturing Technology by P.N. Rao., TMH
- Materials and Manufacturing by Paul Degarmo.
- Manufacturing Science by KM Moeed.
- Manufacturing Engineering & Technology by Kalpakjian, Pearson Pub.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	0	2	0	2	0	0	0	1	0	3	2	3	2
CO2	3	2	1	0	2	0	2	0	0	0	1	0	3	2	3	2
CO3	3	2	1	0	2	0	2	0	0	0	1	0	3	2	3	2
CO4	3	2	1	0	2	0	2	0	0	0	1	0	3	2	3	2

Program: B.Tech (ME)	**Semester:** 4th
Course Title: MEASUREMENT AND METROLOGY	**Course Code:** ME-405

Course Description: Course will help the students to learn about the internationally accepted measuring standards, and different types of instruments or devices for measuring various parameters in daily life like manometers, vibration measurements etc.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understand working principles in the measurement of field quantities.

CO2: Identify sensors for measurement of vibration, thermo-physical properties and radiation properties of surfaces.

CO3: Estimate errors and uncertainty in measurements using statistical analysis.

CO4: Identify internationally accepted measuring standards for measurands.

Theory 4hr/Week

Unit	Topic	Hours
1	**Mechanical MeasurementsIntroduction:** Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors. **Sensors and Transducers:** Types of sensors, types of transducers and their characteristics. **Signal transmission and processing:** Devices and systems.Signal Display & Recording Devices	12
2	**Time related measurements:** Counters, stroboscope, frequency measurement by direct comparison .Measurement of displacement **Measurement of pressure:** Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures **Strain measurement:** Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.	12
3	**Measurements of force and torque:** Different types of load cells, elastic transducers, pneumatic & hydraulic systems. **Temperature measurement:** Thermometers, bimetallic thermocouples, thermistors and pyrometers. **Vibration:** Seismic instruments, vibration pick ups and decibel meters, vibrometers accelerometers.	12
4	**Metrology and Inspection:** Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standardization, Linear and angular measurements devices and systems Comparators: Sigma, Johansson's Microkrator.Limit gauges classification, Taylor's Principle of Gauge Design.	12
5	Measurement of geometric forms like straightness, flatness, roundness, Tool maker's microscope, profile project autocollimator. Interferometry: principle and use of Interferometry, optical flat. Measurement of screw threads and gears, Surface texture: quantitative evaluation of surface roughness and its measurement. **Measurement and Inspection:** Dimensional inspection – Tolerance, Limit gauging, comparators, Surface roughness, Feature inspection.	12

Textbooks

- Jain, R.K., “Engineering Metrology” Khanna Publishers
- Jain, R.K., “Mechanical Measurement” Khanna Publishers
- Mechanical Measurements and instrumentation, Er. R.K.Rajput , Katson Books

Reference Books

- Beckwith Thomas G., Mechanical Measurements, Narosa Publishing House, N. Delhi.
- Doeblein E.O., “Measurement Systems, Application Design”, McGraw Hill, 1990.
- Kumar D.S., “Mechanical Measurements and Control”, Metropolitan, N. Delhi.
- Hume K.J., “Engineering Metrology”, MacDonald and Co. 1963
- Gupta, I.C., “Engineering Metrology”, Dhanpat Rai & Sons, New Delhi, 1994
- Sirohi, “Mechanical Measurement” New Age Publishers

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	0	2	2	0	0	0	0	1	0	2	1	1	3
CO2	3	2	1	0	2	2	0	0	0	0	1	0	2	2	2	3
CO3	3	2	1	0	2	2	0	0	0	0	1	0	2	2	2	3
CO4	3	2	1	0	2	2	1	0	0	0	1	0	2	2	2	3

Program: B.Tech (ME)	**Semester:** 4th
Course Title: : STRENGTH OF MATERIALS-II	**Course Code:** ME-406

Course Description: Course will help the students to learn about the stresses and deformations of objects under external loadings and to give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To determine the Mechanical behaviour of the body by determining the stresses, strains produced by the application of load.

CO2: To apply the fundamentals of simple stresses and strains.

CO3: To facilitate the concept of bending and its theoretical analysis.

CO4: To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, column and struts, principal stresses and strains.

Theory 3hr/Week

Unit	Topic	Hours
1	**Strain energy:** Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection. **Theories of failure:** Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application to problems related to two dimensional stress systems.	10
2	**Torsion:** Derivation of torsion equation and its assumptions and its application to the hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts; principal stress and maximum shear stresses under combined loading of bending and torsion.	8
3	**Springs:** Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs- derivation of formula for strain energy, maximum stress and rotation. Leaf spring deflection and bending stresses.	7
4	**Thin cylinders and spheres:** Calculation of Hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume. **Thick cylinders:** Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress.	10
5	**Unsymmetrical Bending:** Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis(for symmetry about both axis and about one axis) for I-section and channel- section **Bending of curved beams:** Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides. **Rotational discs:** Stresses in rotating discs and rims of uniform thickness; disc of uniform strength	10

Textbooks

- A Textbook of Strength of Materials Dr. R.K. Bansal.Laxmi publication Ltd.
- A Textbook of Strength of Materials, Er. R.K. Rajput , Katson Books.

Reference Books

- D.S. Bedi, Strength of Materials, Khanna Book Publishing Company.
- E.P. Popov, Mechanics of Materials-(SI Version), Prentice Hall India.
- R.S Lehri and A.S. Lehri, Strength of Materials, Kataria and Sons.
- S.S.Rattan, Strength of Materials, Tata McGraw Hill.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**1**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**1**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**0**	**0**	**2**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 4th
Course Title : FLUID MACHINERY LAB	**Course Code:** ME-451

Course Description: Course will help the students to learn about the understanding of basic physics of fluids. ,gaining knowledge to calculate and design engineering applications involving fluid, understanding of analyzing flow systems in terms of mass, momentum, and energy balance and having knowledge about current research topics about fluid mechanics.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Verification of Bernoulli's Equation.

CO2: Performance test on Francis turbines.

CO3: Performance test on Pelton wheel turbine.

CO4: Performance characteristics of a Reciprocating pump and study of hydraulic jump.

Sr No.	Experiment Title
1.	Impact of Jet experiment.
2.	Turbine experiment on Pelton wheel.
3.	Turbine experiment on Francis turbine.
4.	Turbine experiment on Kaplan turbine.
5.	Experiment on Reciprocating pump.
6.	Experiment on centrifugal pump.
7.	Experiment on Hydraulic Jack/Press.
8.	Experiment on Hydraulic Brake.
9.	Experiment on Hydraulic Ram.
10.	Study through detailed visit of any water pumping station/plant
11.	Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.
12.	Experiment on Compressor.
13.	Experiment for measurement of drag and lift on aerofoil in wind tunnel.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd. Hydraulic
- Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
- Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
- Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar , Katson Books .

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks

Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 4th
Course Title : INTERNAL COMBUSTION ENGINE AND GAS TURBINE LAB	**Course Code:** ME-452

Course Description: Course will help the students to learn about the working of C.I. and S.I. engines.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Analyze the models of gas turbine.

CO2: Analyze the four stroke diesel engine test rig .

CO3: Analyze the fuel injection system of C.I. engine.

CO4: Analyze the battery ignition system of S.I. engine.

Sr No.	Experiment Title
1.	To make a trial on single cylinder 4-stroke Diesel Engine to calculate B. H. P., S.F.C. and to draw its characteristics curves.
2.	To make a trial on 4-stroke high-speed diesel engine and to draw its Heat Balance Sheet and to draw its characteristic Curves.
3.	To make Morse Test to calculate IHP of the multi cylinder petrol engine and to determine its mechanical To make a trial on Wiley's jeep Engine at constant speed to calculate B. H. P., S. F. C. Thermal efficiency.
4.	To calculate the isothermal efficiency and volumetric efficiency of a 2 stage reciprocating air compressor.
5.	To find out the efficiency of an air Blower.
6.	To make a trial on the Boiler to calculate equivalent evaporation and efficiency of the Boiler.
7.	To study the following models; (a) Gas Turbine. (b) Wankle Engine.
8.	To study (a) Lubrication and cooling systems employed in various I. C. Engines in the Lab (b) Braking system of automobile in the lab.
9.	To study a Carburetor.
10.	To study (a) the Fuel Injection System of a C. I. Engine. (b) Battery Ignition system of a S. I. Engine.
11.	To study Cooling Tower.
12.	To study multi Cylinder four strokes vertical Diesel Engine test RIG With Hydraulic Dynamometer.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Internal Combustion Engines, V.Ganesan , Tata McGraw Hill Education Private Limited New Delhi
- A course in Internal combustion engine , V.M Domkundwar , Dhanpat Rai & Co.
- Internal combustion engine by Ramalingam scitech publication
- Internal combustion engine by Ganeshan TMG
- Internal combustion engine by Mathur & Sharma.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks

Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 3rd
Course Title : ENGINEERING THERMODYNAMICS LAB	**Course Code:** ME-453

Course Description: Course will help the students to learn about the different types of boilers, their working and effect of performance characteristics under different conditions in boilers.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understand about the gas turbine and steam engine models.

CO2: Analyze about the fire tube boiler.

CO3: Analyze about the water tube boiler.

CO4: Analyze the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.

Sr No.	Experiment Title
1.	Study of Fire Tube boiler.
2.	Study of Water Tube boiler.
3.	Study and working of Two stroke petrol Engine.
4.	Study and working of Four stroke petrol Engine.
5.	Determination of Indicated H.P. of I.C. Engine by Morse Test.
6.	Prepare the heat balance for Diesel Engine test rig.
7.	Prepare the heat balance sheet for Petrol Engine test rig.
8.	Study and working of two stroke Diesel Engine.
9.	Study and working of four stroke Diesel Engine.
10.	Study of Velocity compounded steam turbine.
11.	Study of Pressure compounded steam turbine.
12.	Study of Impulse & Reaction turbine.
13.	Study of steam Engine model.
14.	Study of Gas Turbine Model.
15.	Any other suitable experiment on thermodynamics.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Thermal Engineering – P L Ballaney, Khanna Publishers.
- Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House.
- Internal combustion engine by Ramalingam scitech publication
- Internal combustion engine by Ganeshan TMG
- Internal combustion engine by Mathur & Sharma

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks

Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 5th
Course Title: MACHINE DESIGN-I	**Course Code:** ME-501

Course Description: Course will help the students to learn about the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components and to illustrate to students the variety of mechanical components available and emphasize the need to continue learning.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will understand the design considerations in machine elements

CO2: Able to differentiate the designing of machine components under static and fluctuating loads.

CO3: To discern about the design of riveted joints, design of shafts under twisting and bending moments and design of flexible couplings.

CO4: Students will understand about the design of different springs.

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction:** Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads **Design against Static Load:** Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.	10
2	**Design against Fluctuating Loads:** Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria. **Riveted Joints**-Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.	10
3	**Shafts:** Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity. **Keys and Couplings:** Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings- Design of rigid and flexible couplings.	10
4	**Mechanical Springs:** Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.	8
5	**Power Screws:** Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack.	6

Textbooks

- A textbook of machine Design Dr. P.C. Sharma , Dr. D.K Aggarwal , Katson Books
- A textbook of Machine Design , R.S. Khurmi , J.K Gupta , S, Chand

Reference Books

- Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications

- Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw Hill Co.
- Machine design-M.F. Spott, Prentice Hall India
- Machine Design-Maleev and Hartman, CBS
- Machine design -Black & Adams, Mc Graw Hill
- Machine Design-Sharma and Agrawal, S.K. Katara & Sons
- Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 5th
Course Title: THEORY OF MACHINES - I	**Course Code:** ME-502

Course Description: Course will help the students to learn about the approaches and mathematical models used in kinematic and dynamic analysis of machinery.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms.

CO2: Analyze the planar mechanisms for position, velocity and acceleration.

CO3: Evaluate gear tooth geometry and select appropriate gears for the required applications.

CO4: Analyze design of cams and followers for specified motion profiles.

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction** Links-types, Kinematics pairs-classification, Constraints-types, Degrees of freedom of planar mechanism, Grubler's equation, linkage mechanisms, inversions of four bar chain, slider crank chain and double slider crank chain **Velocity in Mechanisms** Velocity of point in mechanism, relative velocity method, Velocities in four bar mechanism, slider crank mechanism and quick return motion mechanism, Rubbing velocity at a pin joint, Instantaneous center method, Types & location of instantaneous centers, Kennedy's theorem, Velocities in four bar mechanism & slider crank mechanism.	10
2	**Acceleration in Mechanisms** Acceleration of a point on a link, Acceleration diagram, Coriolis component of acceleration, Crank and slotted lever mechanism, Klein's construction for Slider Crank mechanism and Four Bar mechanism, Analytical method for slider crank mechanism . **Mechanisms with Lower Pairs** Pantograph, Exact straight line motion mechanisms-Peaucellier's, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms–Grass-Hopper, Watt and Tchebicheff mechanisms, Analysis of Hooke's joint, Davis and Ackermann steering gear mechanisms.	10
3	**FRICTION** Laws of friction, Friction on inclined plane, Efficiency on inclined plane, Friction in journal bearing-friction circle, Pivots and collar friction-uniform pressure and uniform wear, Belt and pulley drive, Length of open and cross belt drive, Ratio of driving tensions for flat belt drive, centrifugal tension, condition for maximum power transmission, V belt drive. **Brakes & Dynamometers** Shoe brake, Band brake, Band and Block brake, Absorption and transmission type dynamometers	8
4	**CAMS** Cams and Followers - Classification & terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, simple harmonic and parabolic motion of followers, Analytical methods of cam design – tangent cam with roller follower and circular cams with flat faced follower.	8
5	**Gears & Gear Trains** Classification & terminology, law of gearing, tooth forms & comparisons, Systems of gear teeth, Length of path of contact, contact ratio, interference & under cutting in involute gear teeth, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and planetary gear trains, Sun and planet gear.	8

Textbooks

- Theory of Machines-S.S. Rattan
- Theory of Machines – Khurmi & Gupta.

Reference Books

- Theory of Machines and Mechanisms-Ghosh & Mallik
- Theory of Machines - Thomas Bevan
- Theory of Machines and Mechanisms- Rao & Dukkipati
- Theory of Machines – R.K. Bansal
- Mechanics of Machines – V. Ramamurti
- Theory of Machines – P.L. Ballaney
- Theory of Machines – V. P. Singh

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	0	2	0	0	2	0	0	2	1	3	3	3	3
CO2	3	2	1	0	2	0	0	2	0	0	2	1	3	3	3	3
CO3	3	2	1	0	2	0	0	2	0	0	2	1	3	3	3	3
CO4	3	2	1	0	2	0	0	2	0	0	2	1	3	3	3	3

Program: B.Tech (ME)	**Semester:** 5th
Course Title: MANUFACTURING SCIENCE-II	**Course Code:** ME-503

Course Description: Course will help the students to learn about to emphasize the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To discern about the simplified manufacturing processes with the aim of reduction of cost and manpower.

CO2: To identify/control the appropriate process parameters and possible defects of manufacturing processes so as to remove them.
CO3 Students will be able to understand about the suitable manufacturing processes for economical manufacturing**.**
CO4: Students will be able to understand about the appropriate design of gating systems, forming processes and welding processes.

Unit	Topic	Hours
1	**Metal Cutting and Machine Tools ,Metal Cutting-**Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability. Dynamometer. Brief introduction to machine tool vibration and surface finish. Economics of metal cutting.	10
2	**Machine Tools** (a) Lathe:- Principle, construction, types, operations, Turret/capstan,Semi/Automatic, Tool layout (b) Shaper, slotter, planer : Construction, operations & drives. (c) Milling : Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required. (d) Drilling and boring : Drilling, boring, reaming tools. Geometry of twist drills.	9
3	**Grinding & Super finishing** Grinding : Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and Cylindrical grinding. Centerless grinding. Super finishing : Honing, lapping, polishing. **Standardization & Interchangeability, Limits, Fits & Tolerance and Surface-roughness:** Introduction to Standardization & Interchangeability Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness.	9
4	**Metal Joining (Welding)**Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding : Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding.Soldering & Brazing.Thermodynamic and Metallurgical aspects in welding and weld,. Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies.Weld decay in HAZ.	9
5	**Introduction to Un-conventional Machining and Welding** Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma-arc welding, Diffusion welding, Explosive welding/cladding.	9

Textbooks

- Production Technology by R.K. Jain
- Production Technology - H.M.T.
- Production Engineering Science by P.C. Pandey

Reference Books

- Manufacturing science by Ghosh and Mallik
- Fundamentals of Metal Cutting and Machine tools by Boothroyd.
- Modern Machining Processes by P.C. Pandey & H.S. Shan
- Manufacturing science by Degarmo
- Fundamentals of metal cutting & machine tools - Juneja & Shekhon
- Process & materials of manufacturing - Lindburg.
- Advanced Machining Process - VK Jain

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	0	1	1	0	1	0	0	1	0	3	3	3	3
CO2	3	2	0	0	1	0	2	0	0	0	1	0	3	3	3	3
CO3	3	2	1	0	1	1	0	0	0	0	1	0	3	3	3	3
CO4	3	2	0	0	1	0	2	0	0	0	1	0	3	3	3	3

Program: B.Tech (ME)	**Semester:** 5th
Course Title: HEAT AND MASS TRANSFER	**Course Code:** ME-504

Course Description: : Course will help the students to learn about to understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Ability to understand and solve conduction, convection and radiation problems.

CO2: Ability to design and analyze the performance of heat exchangers and evaporators.

CO3: Ability to design and analyze reactor heating and cooling systems.

CO4: Students will be able to learn about the diffusion mass transfer.

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction to Heat Transfer:** Concepts of the mechanisms of heat flows; Conduction, convection and radiation; Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism. **Conduction: One**-dimensional general differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems; Initial and boundary conditions. **Steady State one-dimensional Heat conduction :** Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Thermal resistance concept; Analogy between heat and electricity flow; Thermal contact resistance; Critical thickness of insulation.	10
2	**Fins:** Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells. **Transient Conduction:** Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only, Heisler charts.	9
3	**Forced Convection:** Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer. **Natural Convection :** Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere ; Combined free and forced convection.	9
4	**Thermal Radiation :** Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation; Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect.	9
5	**Heat Exchanger :** Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers. **Condensation And Boiling :** Introduction to condensation phenomena; Heat transfer	9

	relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Dropwise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convective boiling. **Introduction To Mass Transfer :** Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion though a stagnant gas film.	

Textbooks

- Heat Transfer, by Vijay Gupta, New Age International (P) Ltd. Publishers
- Heat & Mass Transfer , Dr. D.S. Kumar , Katson Books

Reference Books

- Elements of Heat transfer by Bayazitouglu & Ozisik, McGraw-Hill Book Company.
- Heat Transfer By J.P. Holman, McGraw-Hill International edition.
- Schaum's outline of Heat Transfer by Pitts & Sisson McGraw-Hill International edition.
- Principles of Heat Transfer by Frank Kreith, McGraw-Hill Book co.
- Fundamentals of Momentum, Heat and Mass Transfer by James R.Welty; John Wiley & Sons (Pvt). Ltd.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	2	2	2

Program: B.Tech (ME)	**Semester:** 5th
Course Title: PRODUCTION PLANNING & CONTROL	**Course Code:** ME-505

Course Description: Course will help the students to learn about to produce goods and services of the right quality, in the right quantities, according to the time schedule and at a minimum cost by using the best and least expensive methods.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will understand basics of variability and its role in the performance of a production system.

CO2: Students will understand production systems and their characteristics.

CO3: Evaluate MRP and JIT systems against traditional inventory control systems.

CO4: Apply forecasting and scheduling techniques to production systems.

Theory 3hr/Week

Unit	Topic	Hours
1	**Introduction:** Types and characteristics of production systems Objective and functions of Production, Planning & Control, Place of production, Planning in Engineering, manufactures organization. **Preplanning:** Forecasting & Market Analysis. Factory Location & Layout, Equipment policy and replacement. Preplanning production, capacity planning.	15
2	**Production Planning:** Aggregate Planning, MPS, Material Resource Planning, Selection of material methods, machines & manpower. Routing, Scheduling and Dispatching and its sheets & charts, Production Line Balancing.	10
3	**Production and Inventory Control:** Progress control through records and charts. Types of inventories, Inventory Classification. Inventory Control under constraints Economic lot (batch) size. Trends in purchasing and store keeping, JIT production MRP II, comparison of Push & Pull systems, ERP, CAPPC.	10
4	**Productivity:** Importance, Productivity patterns, productivity measurements & ratios, improvement-maintenance process. **Human Factors & Ergonomics:** Human abilities, Training & motivation safety programs, workplace design & working conditions.	10

Textbooks

- Production Planning & Control – Jain and Agarwal
- Elements of Production Planning & Control –Eilon

Reference Books

- Operations Management – Buffa.
- Production System – J.L. Riggs.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

(i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**2**	**3**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**0**
CO2	**2**	**2**	**3**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**	**1**
CO3	**2**	**2**	**3**	**1**	**2**	**0**	**0**	**1**	**0**	**0**	**2**	**2**	**0**	**1**	**1**	**0**
CO4	**2**	**2**	**3**	**1**	**2**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**1**	**1**

Program: B.Tech (ME)	**Semester:** 5th
Course Title : MACHINE DESIGN-I LAB	**Course Code:** ME-551

Course Description: Course will help the students to learn about the study of drawings by gaining knowledge of (GD&T) Geometric Dimensioning and Tolerancing.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Discern about the drawing of various joints like cotter joint .

CO2: Analyze about the design of various riveted joints and draw on drawing sheets

CO3: Analyze about the design and drawing of numerous couplings.

CO4: Analyze about the design and drawing of different assemblies.

Sr No.	Experiment Title
1.	Design & drawing of Cotter joint.
2.	Design & drawing of Knuckle joint
3.	Design of machine components subjected to combined steady and variable loads
4.	Design of eccentrically loaded riveted joint
5.	Design of boiler riveted joint.
6.	Design of shaft for combined constant twisting and bending loads
7.	Design of shaft subjected to fluctuating loads
8.	Design and drawing of flanged type rigid coupling
9.	Design and drawing of flexible coupling
10.	Design and drawing of helical spring
11.	Design and drawing of screw jack

Note: Eight experiments out of the following are to be performed. Students are advised to use design data book for the design. Drawing shall be made wherever necessary on small drawing sheets

Textbooks

- Machine Drawing - PS Gill - SK Kataria & sons.
- Machine Drawing - KL Narayana, P Kannaiah, KV Reddy - New Age.
- Machine Drawing -N. Siddeshswar, P Kannaiah, VVS Shastry -Tata McGraw Hill.

Reference books

- Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications
- Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw Hill Co.
- Machine design-M.F. Spott, Prentice Hall India
- Machine Design-Maleev and Hartman, CBS
- Machine design -Black & Adams, Mc Graw Hill
- Machine Design-Sharma and Agrawal, S.K. Katara & Sons
- Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
- A textbook of machine Design Dr. P.C. Sharma , Dr. D.K Aggarwal , Katson Books
- A textbook of Machine Design , R.S. Khurmi , J.K Gupta , S, Chand

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**1**	**1**	**2**
CO2	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**1**	**1**	**2**
CO3	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**1**	**1**	**2**
CO4	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**1**	**1**	**2**

Program: B.Tech (ME)	**Semester:** 5th
Course Title : MANUFACTURING SCIENCE LAB	**Course Code:** ME-552

Course Description: Course will help the students to learn about the principles and science of various basic manufacturing processes.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Analyze different types of tools and its angles & materials.

CO2: Analyze about the experiment on tool wear and tool life.

CO3: Analyze about the macro and micro structure of welding joints.

CO4: Analyze about the experiment on unconventional welding.

Sr No.	Experiment Title
1.	Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2.	Bolt (thread) making on Lathe machine
3.	Tool grinding (to provide tool angles) on tool-grinder machine.
4.	Gear cutting on Milling machine.
5.	Machining a block on shaper machine.
6.	Finishing of a surface on surface-grinding machine.
7.	Drilling holes on drilling machine and study of twist-drill.
8.	Study of different types of tools and its angles & materials.
9.	Experiment on tool wear and tool life.
10.	Experiment on jigs/Fixtures and its uses
11.	Gas welding experiment
12.	Arc welding experiment
13.	Resistance welding experiment.
14.	Soldering & Brazing experiment
15.	Experiment on unconventional machining.
16.	Experiment on unconventional welding.
17.	Experiment on TIG/MIG Welding.
18.	Macro and Microstructure of welding joints, HAZ.

Note: Eight experiments out of the following are to be performed. Students are advised to use design data book for the design. Drawing shall be made wherever necessary on small drawing sheets

Textbooks

- Printed Manual supplied to the students.

Reference books

- Manufacturing science by Ghosh and Mallik.
- Fundamentals of Metal Cutting and Machine tools by Boothroyd.
- Modern Machining Processes by P.C. Pandey & H.S. Shan
- Manufacturing science by Degarmo.
- Fundamentals of metal cutting & machine tools - Juneja & Shekhon.
- Process & materials of manufacturing - Lindburg.

- Advanced Machining Process - VK Jain.
- Production Technology by R.K. Jain.
- Production Technology - H.M.T.
- Production Engineering Science by P.C. Pandey.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**2**	**1**	**1**	**1**
CO2	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**2**	**1**	**1**	**1**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**2**	**1**	**1**	**1**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**2**	**1**	**1**	**1**

Program: B.Tech (ME)	**Semester:** 5th
Course Title : HEAT & MASS TRANSFER LAB	**Course Code:** ME-553

Course Description: Course will help the students to learn about the heat transfer rates , dissipation of heat and other performance parameters under working conditions, especially the efficiency heat transfer of fins used in automobile industry.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Analyze the given problem and conduct investigation on the experimental setup.

CO2: Use modern tools for measurements/modeling and simulation/draw the graphs etc.

CO3: Understand the environmental impact of the investigation and work individually and in a team for conducting the experiments.

CO4: Effectively communicate and explain the experimental analysis.

Sr No.	Experiment Title
1.	Conduction - Composite wall experiment
2.	Conduction - Composite cylinder experiment
3.	Convection - Pool boiling experiment
4.	Convection - Experiment on heat transfer from tube-natural convection.
5.	Convection - Heat Pipe experiment.
6.	Convection - Heat transfer through fin-natural convection .
7.	Convection - Heat transfer through tube/fin-forced convection.
8.	Any experiment on Stefan's Law, on radiation determination of emissivity, etc.
9.	Any experiment on solar collector, etc.
10.	Heat exchanger - Parallel flow experiment
11.	Heat exchanger - Counter flow experiment
12.	Any other suitable experiment on critical insulation thickness.
13.	Conduction - Determination of thermal conductivity of fluids.
14.	Conduction - Thermal Contact Resistance Effect.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Elements of Heat transfer by Bayazitouglu & Ozisik, McGraw-Hill Book Company.
- Heat Transfer By J.P. Holman, McGraw-Hill International edition.
- Schaum's outline of Heat Transfer by Pitts & Sisson McGraw-Hill International edition.
- Principles of Heat Transfer by Frank Kreith, McGraw-Hill Book co.
- Heat Transfer, by Vijay Gupta, New Age International (P) Ltd. Publishers
- Heat & Mass Transfer , Dr. D.S. Kumar , Katson Books.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 6th
Course Title: INDUSTRIAL ENGINEERING	**Course Code:** ME-601

Course Description: Course will help the students to learn about to Contribute to the success of companies through effective problem solving and design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments

Course Outcomes : Students will be able to understand and solve following particular problems by the end of this course:-

CO1: An ability to apply knowledge of mathematics, science, and engineering.

CO2: An ability design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

CO3: An ability to function on a multidisciplinary team.

CO4: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Theory 3hr/Week

Unit	Topic	Hours
1	Introduction to work study; Method study; Basic procedure; Recording techniques (charts and diagrams); Elemental breakdown; Micro-motion studies; Therbligs; SIMO-chart; Principles of motion –economy. Introduction; Objectives; technique; (time) information recording; methods of timings; Time study allowances; Work sampling technique; Performance rating and its determination PMTS; M. T. M.; Work factor	12
2	Principles of organization, Importance and characteristics of organization, Organization theories; Classical Organization theory; Neo-Classical organization theory, Modern organization theory; Types of organization, Military or line organization, Functional organization, Line and staff organization, Committees	8
3	Objectives of PPC; Functions of PPC; Preplanning and planning; Routing; Estimating; scheduling-master schedule; Daily schedule; Gantt chart; Dispatching –centralized vs. decentralized; Control; Follow up and progress reporting. Introduction; Product development; Product characteristics; Role of product development; 3Ss – Standardization; Simplification and Specialization.	8
4	Introduction, Objectives and importance of sales forecasting, Types of forecasting, Methods of sales forecasting-Collective opinion method, Delphi technique, economic indicator method; Regression analysis, Moving average method, Time series analysis. Introduction, Functions of inventory; Types of inventory; Control importance and functions, Inventory costs, Factors affecting inventory control, Various inventory control models. A. B. C. analysis, Lead-time calculations.	8
5	Introduction; Objectives; Concept and life cycle of a product and V.E.; Steps in VE., Methodology and techniques, Fast diagram, Matrix method. Various concepts in industrial engineering WAGES AND INCENTIVES; -Concept; Types; Plans; Desirable characteristics.ERGONOMICS; - its importance; Man-machine work place system; Human factors considerations in system design.SUPPLY CHAIN MANAGEMENT; - its definition, Concept, Objectives, Applications, benefits, Some successful cases in Indian Industries. JIT; - Its definition, Concept, Importance, Misconception, Relevance, Applications, Elements of JIT (brief description). MRP;-Introduction, Objectives, factors, Guide lines, Techniques Elements of MRP system, Mechanics of MRP, MRP-IITIME MANAGEMENT;-Introduction, Steps of time management, Ways for saving time, Key for time saves.	12

Textbooks

- Industrial engg. and management by S Sharma and Savita sharama
- Industrial engg. and management manufacturing system by Surender kumar, Satya prakashan

Reference Books

- Production planning and control by S.Elion
- Modren production Management by S.S Buffa
- Essence of Supply Chain Management by R.P mohanty and S.G Deshmukh

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**
CO2	**3**	**1**	**2**	**1**	**1**	**1**	**0**	**2**	**0**	**0**	**0**	**2**	**2**	**2**	**2**	**3**
CO3	**3**	**1**	**3**	**1**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**
CO4	**3**	**1**	**3**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**3**	**2**	**2**	**0**	**1**	**0**

Program: B.Tech (ME)	**Semester:** 6th
Course Title: UNCONVENTIONAL MANUFACTURING PROCESSES	**Course Code:** ME-602

Course Description: Course will help the students to learn about to to provide the knowledge of modern manufacturing processes such as Ultrasonic machining, Abrasive machining processes, Electrochemical machining, Electro discharge machining & their modifications into hybrid processes

Course Outcomes : Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will be able to demonstrate different unconventional machining processes.

CO2: Students will know the influence of difference process parameters on the performance and their applications

CO3: Students will be able to understand about the unconventional welding processes especially like underwater welding

CO4: Students will be able to understand about the principle working of unconventional forming processes and their performance characteristics under different parameters.

Theory 3hr/Week

Unit	Topic	Hours
1	Introduction: Limitations of conventional manufacturing processes need of unconventional manufacturing processes & its classification and its future possibilities.	8
2	Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.	10
3	Unconventional Machining Process (continued) :Principle and working and application of unconventional machining processes such as Laser beam machining, Electron beam machining, Ultrasonic machining etc. (These can also be used for welding).	9
4	Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma are welding/cutting etc.	8
5	Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc. Electronic-device Manufacturing: Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing.	10

Textbooks

- Non traditional Machining Process , Jagdeesha T , Willy
- A text book of production technology , Dr. P.C. Sharma , S. Chand

Reference Books

- Modern Machining Processes – P.C. Pandey
- Unconventional Machining – V.K. Jain

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**2**	**2**	**2**
CO2	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**2**	**2**	**2**
CO3	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**3**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 6th
Course Title: MECHANICAL VIBRATION	**Course Code:** ME-603

Course Description: Course will help the students to learn about formulate mathematical models of problems in vibrations using Newton's second law or energy principles, Determine a complete solution to the modeled mechanical vibration problems.

Course Outcomes : Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will be able to understand the causes and effects of vibration in mechanical systems.

CO2: Analyze the role of damping, stiffness and inertia in mechanical systems

CO3: Analyze rotating and reciprocating systems and compute critical speeds.

CO4: Develop schematic models for physical systems and formulate governing equations of motion.

Theory 3hr/Week

Unit	Topic	Hours
1	**INTRODUCTION** Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis **Single Degree Freedom System** Free vibration, Natural frequency, Equivalent systems, Energy method for determining natural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic	10
2	**Single Degree Freedom: Forced Vibration** Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments	10
3	**Two Degree Freedom systems** Introduction, Principal modes, Double pendulum, Torsional system with damping, coupled system, undamped dynamic vibration absorbers, Centrifugal pendulum absorbers, Dry friction damper	8
4	**Multi Degree Freedom system: Exact Analysis** Undamped free and forced vibrations of multi-degree freedom systems, influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts	8
5	**Multi Degree Freedom system: Numerical Analysis** Rayleigh's, Dunkerely's, Holzer's ad Stodola methods, Rayleigh-Ritz method **CRITICAL SPEED OF SHAFTS** Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.	10

Textbooks

- Mechnical Vibration , VP Singh , Dhanpat Rai & Co.
- Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.

Reference Books

- Mechanical Vibrations – P. Srinivasan, TMH
- Mechanical Vibrations – W. T. Thomson
- Mechanical Vibrations – JS Rao & K Gupta, New Age
- Mechanical Vibrations – Tse, Morse & Hinkle
- Mechanical Vibrations – V. Rama Murthy, Narosa Publications

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 6th
Course Title: MACHINE DESIGN-II	**Course Code:** ME-604

Course Description: Course will help the students to learn about Plan and design mechanical systems and their controls by: establishing performance requirements, designing system to meet performance requirements, selecting the concept to pursue, selecting components, integrating system components, and making the system work.

Course Outcomes : Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To have knowledge in the discipline of Machine Design with hands on skill in using modern engineering tools to address real world engineering problems and be socially responsible.

CO2: Students shall be successful in their career as analysts and designers of structural components of conventional and advanced materials, participating in a team or individually in an industry, research or academia.

CO3: Students shall be proficient in their communication, presentation and will be prepared to engage in the process of life-long learning through professional development and research.

CO4: Analyze complex engineering problems critically; apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

Theory 3hr/Week

Unit	Topic	Hours
1	**Spur Gears** Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards	10
2	**Helical Gears** Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design of helical gears. **Worm Gears** Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing	8
3	**Sliding Contact Bearing** Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties an materials,Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing, **Rolling Contact Bearing** Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing	15
4	Design of flat belts &Pulleys, Design /selection of V belts &Pulleys, Design/selection of wire ropes, Design/selection of chains Single &multiple Plate clutch, Cone clutch External shoe brake, Internal shoe brakes	8
5	**IC ENGINE PARTS** Selection of type of IC engine, General design considerations, Design of Cylinder and cylinder head; Design of piston, piston ring and gudgeon pin; Design of connecting rod; Design of centre crankshaft .	8

Note: Design data book is allowed in the examination

Textbooks

- A textbook of machine Design Dr. P.C. Sharma , Dr. D.K Aggarwal , Katson Books

- A textbook of Machine Design , R.S. Khurmi , J.K Gupta , S, Chand

Reference Books

- Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications
- Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw Hill Co.
- Machine design-M.F. Spott, Prentice Hall India
- Machine Design-Maleev and Hartman, CBS
- Machine design -Black & Adams, Mc Graw Hill
- Machine Design-Sharma and Agrawal, S.K. Katara & Sons
- Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**1**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 6th
Course Title: THEORY OF MACHINES- II	**Course Code:** ME-605

Course Description: Course will help the students to learn about to equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations. Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments

Course Outcomes : Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Assess the effect of Gyroscopic couple in a dynamic body such as aero plane, 4-wheeler etc. And calculate coefficient of fluctuation of speed and energy of a flywheel.

CO2: Students will be able to determine balancing mass for rotating and reciprocating mass systems.

CO3: Perform static and dynamic analysis to attain equilibrium in mechanisms and synthesize mechanisms for motion, path and function generation.

CO4: Analyze friction clutches, brakes dynamometer and Governors.

Theory 3hr/Week

Unit	Topic	Hours
1	**Static & Dynamic Force Analysis** Static equilibrium of two/three force members, Static equilibrium of member with two forces and torque, Static force analysis of linkages, D'Alembert's principle, Equivalent offset inertia force, Dynamic force analysis of four link mechanism and slider crank mechanism, Engine force analysis-Piston and crank effort.	10
2	**Turning Moment & Flywheel** Turning moment on crankshaft, Turning moment diagrams-single cylinder double acting steam engine, four stroke IC engine and multi-cylinder steam engine, Fluctuation of energy, Flywheel.	8
3	**Balancing of Machines** Static and dynamic balancing, Balancing of several masses in the same plane and different planes, Balancing of reciprocating masses, Balancing of primary force in reciprocating engine, Partial balancing of two cylinder locomotives, Variation of tractive force, swaying couple, hammer blow.	10
4	**Governors** Terminology, Centrifugal governors-Watt governor, Dead weight governors-Porter & Proell governor, Spring controlled governor-Hartnell governor, Sensitivity, Stability, Hunting, Isochronism, Effort and Power of governor, Controlling force diagrams for Porter governor and Spring controlled governors.	8
5	**Gyroscopic Motion** Principles, Gyroscopic torque, Effect of gyroscopic couple on the stability of aero planes & automobiles. **Mechanical Vibrations** Types of vibrations, Degrees of freedom, Single degree free & damped vibrations, Forced vibration of single degree system under harmonic excitation, Critical speeds of shaft.	10

Textbooks

- Theory of Machines-S.S. Rattan
- Theory of Machines – Khurmi & Gupta.

Reference Books

- Theory of Machines and Mechanisms-Ghosh & Mallik
- Theory of Machines - Thomas Bevan
- Theory of Machines and Mechanisms- Shigley
- Theory of Machines and Mechanisms- Rao & Dukkipati
- Theory of Machines – R.K. Bansal
- Mechanics of Machines – V. Ramamurti

- Theory of Machines – P.L. Ballaney
- Theory of Machines – V. P. Singh

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 6th
Course Title: REFRIGERATION & AIR CONDITIONING	**Course Code:** ME-606

Course Description: Course will help the students to learn about the fundamental principles and applications of refrigeration and air conditioning system and Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Study the concepts and methods of refrigeration systems, and evaluate the performance of air refrigeration cycles for aircraft applications.

CO2: Evaluate the performance of vapour compression refrigeration systems and understand the working of various evaporative.

CO3: Estimate the heat load for the given conditions and suggest the requirements of a suitable AC system with respect to psychometric charts.

CO4 Students will be able to understand the working of various vapour absorption, non-conventional refrigeration systems and summarize the effects of refrigerants on Global Warming and ozone depletion.

Theory 3hr/Week

Unit	Topic	Hours
1	**Refrigeration:** Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. **Air Refrigeration cycle:** Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).	10
2	**Vapour Compression System:** Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.	10
3	**Vapour Absorption system;** Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. **Refrigerants:** Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants.	8
4	**Air Conditioning:** Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP).	10
5	**Refrigeration Equipment & Application:** Elementary knowledge of refrigeration & air conditioning equipments e.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of	8

	transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.	

Textbooks

- Refrigeration and Air conditioning by C.P Arora.
- Refrigration and Air conditioning , Dr. D.S. Kumar, Katson Books

Reference Books

- Refrigeration and Air conditioning, by Manohar Prasad, New Age International (P) Ltd.Pub.
- Refrigeration and Air conditioning by Arora & Domkundwar.
- Refrigeration and Air conditioning by stoecker & Jones.
- Refrigeration and Air conditioning by Roy J. Dossat.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**3**	**1**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:6th**
Course Title : MACHINE DESIGN-II LAB	**Course Code:** ME-651

Course Description: Course will help the students to learn about the study and understanding of many different assemblies.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Design and Drawing of Flat belt, pulley V-belt and rope

CO2: Design and Drawing of crane hook.

CO3: Design and Drawing of connecting rod.

CO4: Understand the selection of lubrication in the transmission systems.

Sr No.	Experiment Title
1.	Design and Drawing of clutch and brake assembly.
2.	Design and Drawing of gear assembly.
3.	Design and Drawing of single plate clutch.
4.	Design and Drawing of crane hook.
5.	Design and Drawing of the single shoe brake. of double shoe brake.
6.	Design and Drawing of connecting rod.
7.	Find an assembly containing the belt and pulley mechanism and do the complete design calculations and then justify the existing design.
8.	Understand the selection of lubrication in the transmission systems.
9.	Design and Drawing of Flat belt, pulley V-belt and rope (steel wire).

Note: Eight experiments out of the following are to be performed. Students are advised to use design datebook for the design. Drawing shall be made wherever necessary on small drawing sheets

Textbooks

- Machine Drawing - PS Gill - SK Kataria & sons.
- Machine Drawing - KL Narayana, P Kannaiah, KV Reddy - New Age.
- Machine Drawing -N. Siddeshswar, P Kannaiah, VVS Shastry -Tata McGraw Hill.

Reference books

- Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications
- Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw Hill Co.
- Machine design-M.F. Spott, Prentice Hall India
- Machine Design-Maleev and Hartman, CBS
- Machine design -Black & Adams, Mc Graw Hill
- Machine Design-Sharma and Agrawal, S.K. Katara & Sons
- Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
- A textbook of machine Design Dr. P.C. Sharma , Dr. D.K Aggarwal , Katson Books
- A textbook of Machine Design , R.S. Khurmi , J.K Gupta , S, Chand

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4

86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**
CO2	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**
CO3	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**
CO4	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**

Program: B.Tech (ME)	**Semester:6th**
Course Title : THEORY OF MACHINES LAB	**Course Code:** ME-652

Course Description: Course will help the students to learn about the understanding of different gear trains, gear tooth profiles etc and working of gyroscope couple, governors, flywheel and concept of balancing.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will understand the experiment on static/dynamic balancing.

CO2: Students will understand the experiment on gyroscope.

CO3: Students will understand the experiment on critical speed of shaft.

CO4: Students will understand the experiment on spring controlled governor.

Sr No.	Experiment Title
1.	Study of simple linkage models/mechanisms
2.	Study of inversions of four bar linkage
3.	Study of inversions of single/double slider crank mechanisms
4.	Experiment on Gears tooth profile, interference etc.
5.	Experiment on Gear trains
6.	Experiment on longitudinal vibration
7.	Experiment on transverse vibration
8.	Experiments on dead weight type governor
9.	Experiment on spring controlled governor
10.	Experiment on critical speed of shaft
11.	Experiment on gyroscope
12.	Experiment on static/dynamic balancing
13.	Experiment on Brake
14.	Experiment on clutch

Textbooks

- Printed Manual supplied to the students.

Reference books

- Theory of Machines and Mechanisms-Ghosh & Mallik
- Theory of Machines - Thomas Bevan
- Theory of Machines and Mechanisms- Shigley
- Theory of Machines and Mechanisms- Rao & Dukkipati
- Theory of Machines – R.K. Bansal
- Mechanics of Machines – V. Ramamurti
- Theory of Machines – P.L. Ballaney
- Theory of Machines – V. P. Singh
- Theory of Machines-S.S. Rattan
- Theory of Machines – Khurmi & Gupta.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**
CO2	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**
CO3	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**
CO4	**3**	**1**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**1**	**2**

Program: B.Tech (ME)	**Semester:6th**
Course Title : REFRIGERATION & AIR CONDITIONING LAB	**Course Code:** ME-653

Course Description: Course will help the students to learn about the basic components of refrigeration system and calculate its performance with different configurations.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Illustrate the fundamental principles and applications of refrigeration and air conditioning system

CO2: Acquire the knowledge of psychometric processes and applications of air washer

CO3: Acquire the knowledge about the thermodynamic cycle of air compressors and compute the volumetric efficiency.

CO4: Acquire the knowledge about various Components of Vapour Compression Refrigeration.

Sr No.	Experiment Title
1.	Experiment on refrigeration test rig and calculation of various performance parameters.
2.	To study different types of expansion devices used in refrigeration system.
3.	To study different types of evaporators used in refrigeration systems.
4.	To study basic components of air-conditioning system.
5.	Experiment on air-conditioning test rig & calculation of various performance parameters.
6.	To study air washers
7.	Study of window air conditioner.
8.	Study & determination of volumetric efficiency of compressor.
9.	Visit of a central air conditioning plant and its detailed study.
10.	Visit of cold-storage and its detailed study.
11.	Experiment on Ice-plant.
12.	Experiment on two stage Reciprocating compressor for determination of volumetric efficiency, PV diagram and effect of intercooling.
13.	Study of Hermetically sealed compressor
14.	Experiment on Desert coolers.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Refrigeration and Air conditioning, by Manohar Prasad, New Age International (P) Ltd.Pub.
- Refrigeration and Air conditioning by Arora & Domkundwar.
- Refrigeration and Air conditioning by stoecker & Jones.
- Refrigeration and Air conditioning by Roy J. Dossat.
- Refrigeration and Air conditioning by C.P Arora.
- Refrigration and Air conditioning , Dr. D.S. Kumar, Katson Books

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2

81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:6th**
Course Title : AUTO CAD LAB	**Course Code:** ME-654

Course Description: Course will help the students to learn about the software Auto-CAD and draw drawings on this software.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing.
CO2: Layout drawing of any machine using different layer and line color indicating all machine details. Name the details using text commands, Make a Title Block.
CO3: Draw 3D models by extruding simple 2D objects, dimension and name the objects.
CO4: To make an isometric dimensional drawing of a connecting rod using isometric grid and snap.

Sr No.	Experiment Title
1.	Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwgextension.
2.	Layout drawing of any machine using different layer and line color indicating all machine details. Name the details using text commands, Make a Title Block.
3.	Draw 3D models by extruding simple 2D objects, dimension and name the objects.
4.	To make an isometric dimensional drawing of a connecting rod using isometric grid and snap.
5.	Draw a Spiral by extruding a circle.
6.	Create a 2D view of the given diagram using Auto CAD
7.	Create a 2D view of the given diagram using Auto CAD
8.	To create a 2D view of the given diagram using Auto CAD
9.	To create a 2D view of the given diagram using Auto CAD
10.	To create a 2D view of the given diagram using Auto CAD
11.	To create a 2D view of the given diagram using Auto CAD

Textbooks

- Printed Manual supplied to the students.

Reference books

- E. Finkelstein, "AutoCAD 2007 Bible", Wiley Publishing Inc., 2007

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: Computer Aided Design/Computer Aided Manufacturing (CAD/CAM)	**Course Code:** ME-701

Course Description: Course will help the students to learn about the integration of these tools and the automation of the product development cycle. It is to introduce geometric modeling techniques, data structure design and algorithms for solid modeling. It also covers the machining theory, automated CNC machining, and process control.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will be able to understand structure and units of a digital computer and its related hardware.

CO2: Describe the role of computer graphics especially geometric transformations for CAD/CAM application.

CO3: Recognize various modeling techniques.

CO4: Describe the basic NC system and write part programming in CNC system

Theory 4hr/Week

Unit	Topic	Hours
1	Introduction**:** Fundamentals of CAD: Introduction: Design Process: Application of computers in design: Creating manufacturing database: benefits of CAD. Basic concepts of manufacturing system and CAD/CAM. Computer Hardware; Graphic input devices; display devices; Graphics output devices; Central processing unit (CPU) plotters .	15
2	CAD software and Database: Software configuration of a graphics system: functions of a graphics package: geometric modeling: Database structure and control; Graphics standard: GKS and IGES. Geometric Transformations: Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of transformation matrices. Application of geometric transformations.	10
3	Representation of curves and surfaces: Polygon, meshed and ruled surfaces: Bezier curves; B-spline curves. Geometric Modeling: Wireframe model: solid modeling: representation, volumetric properties, surface modeling, concepts of hidden-line removal and shading: Kinematics analysis and simulation. Application of CAD techniques to finite Element Mesh Generation. Computer Aided Manufacturing (CAM)	10
4	NC/CMNC Machine Tools; NC machine tools- basic components, coordinate systems; features of NC machine tools. Computerized Numerical Control (CNC): Tooling for NC machines - tool presetting equipment, flexible tooling, tool length compensation, tool path graphics; NC motion control system; Manual part programming, fixed/floating zero. Block format and codes: Computer assisted part programming. DNC and Adaptive Control: Direct numerical control: Adaptive control in machining system; Combined DNC/CNC system.	10
5	Group Technology (GT): Part families; part classification and coding system: Group technology machine cells: Advantages of GT. Computer Aided Process Planning: Introduction and benefits of CAPP. Types of CAPP systems, machinability data selection systems in CAPP. Flexible Manufacturing System (FMS) and Computer integrated manufacturing system: FMS and its advantages, components of a FMS system. Introduction to CIMS	15

Textbooks

- CAD/CAM by Groover & Simmers, Prentice Hall of India.
- Automation, Production Systems and computer integrated manufacturing by Groover, Prentice Hall of India.

Reference Books

- Computer Integrated Design and Manufacturing by D.D. Bedworth, M.R Henderson & P.M. Wolfe, Tata MCGraw Hill Pub. Co.
- CAD/CAM - theory and Practice by Zeid Ibraham, Tata McGraw Hill Pub Co.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: AUTOMOBILE ENGINEERING	**Course Code:** ME-702

Course Description: Course will help the students to learn about to make the student conversant with fundamentals of automobile systems and to make the student conversant with automobile safety, electrical system and vehicle maintenance.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Students will understand the basic lay-out of an automobile.

CO2: Students will understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.

CO3: Students will understand the principles of transmission, suspension, steering and braking systems.

CO4: Students will understand automotive electronics.

Theory 4hr/Week

Unit	Topic	Hours
1	**Power Unit and Gear Box:** Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination. Design of Gear box.	12
2	**Transmission System:** Requirements. Clutches. Torque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering geometry. Ackerman mechanism, Understeer and Oversteer.	12
3	**Braking System:** General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects. **Chasis and Suspension System:** Loads on the frame. Strength and stiffness. Various suspension systems.	12
4	**Electrical System :** Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc. **Fuel Supply System:** Diesel & Petrol vehicle system such as Fuel Injection Pump,Injector & Fuel Pump, Carburetor etc. MPFI.	12
5	**Automobile Air Conditioning:** Requirements, Cooling & heating system. **Cooling & Lubrication System:** Different type of cooling system and lubrication system. **Maintenance system:** Preventive maintenance, break down maintenance and over hauling.	12

Textbooks

- Automobile Engineering, Kripal Singh.
- Automobile Engineering , Dr. D.S. Kumar , Katson Books.

Reference Books

- Automotive Engineering- Hietner.
- Automobile Engineering - Narang.
- Automotive Mechanics- Crouse.
- Automobile Engineering - Newton and Steeds.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**

DEPARTMENTAL ELECTIVE I

Program: B.Tech (ME)	**Semester:** 7th
Course Title: TOTAL QUALITY MANAGEMENT	**Course Code:** ME-703

Course Description: Course will help the students to learn about to Diagnose problems in the quality improvement process and Identify ethical and unethical behaviour in Quality Management.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Develop an understanding on quality management philosophies and frameworks.

CO2: Adopt TQM methodologies for continuous improvement of quality.

CO3: Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.

CO4: Students will determine the set of indicators to evaluate performance excellence of an organization .

Theory 4hr/Week

Unit	Topic	Hours
1	**Quality Concepts** Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. **Control on Purchased Product** Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. **Manufacturing Quality** Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.	15
2	**Quality Management** Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme. **Human Factor in Quality** Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.	15
3	**Control Charts** Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. **Attributes of Control Charts** Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.	15
4	**Defects Diagnosis and Prevention** Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.	8
5	**IS0-9000 and its concept of Quality Management:** ISO 9000 series, Taguchi method, JIT in some details.	8

Textbooks

- Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990.

Reference Books

- Greg Bounds. “Beyond Total Quality Management”. McGraw Hill, 1994.
- Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**

- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**0**	**1**	**2**	**0**	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**2**	**1**	**1**	**1**	**2**
CO2	**0**	**1**	**2**	**0**	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**2**	**1**	**1**	**1**	**2**
CO3	**0**	**1**	**2**	**0**	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**2**	**1**	**1**	**1**	**2**
CO4	**0**	**1**	**2**	**0**	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**2**	**1**	**1**	**1**	**2**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: THERMAL TURBOMACHINES	**Course Code:** ME-703 A

Course Description: Course Description: Course will help the students to learn about the understanding of working of turbo machines like pumps, compressors etc.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Recognize typical designs of turbo-machines and differentiate from positive displacement machines

CO2: To understand about the working principles of turbo-machines and apply it to various types of machines

CO3: Recognize and discuss today's and tomorrow's use of turbo-machines for enabling a sustainable society

CO4: Determine the off-design behavior of turbines and compressors and relate it to changes in the velocity triangles.

Theory 4hr/Week

Unit	Topic	Hours
1	Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam & gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler's equation, Definition of various efficiencies, Preheat factor, Reheat factor, Blade classification, Blade terminology, Cascade testing, Velocity diagrams for axial and radial turbomachinery and pumps.	15
2	**Centrifugal compressors-** Principle of operation, work done and pressure rise, Velcoity diagram for centrifugal compressor, Slip factor, Stage pressure rise, Loading coefficient, Diffuser, degree of reaction, Effect of impeller blade profile, Pre-whirl and inlet guide vanes, Centrifugal Compressor characteristic curves. **Axial flow compressor-** Principle of operation and working, Energy transfer, Velocity diagram for axial compressor, Factors affecting stage pressure ratio, Blockage in compressor annulus, Degree of reaction, 3-D flow, Design process, blade design, calculation of stage performance, Axial compressor performance characteristic curves.	15
3	**Axial flow turbines-**Elementary theory of axial flow turbine, Energy transfer, Velocity diagram, Types of blades, Vortex theory, Choice of blade profile, pitch and chord, Estimation of stage performance, Characteristic curves.	8
4	**Steam turbines-** Constructional details, working of steam turbine. **Pumps :** Classification of Pumps, Main components, indicator diagram and modification due to piston acceleration, Performance characteristics, Cavitation and its control, Miscellaneous types of pumps. **Radial flow turbines:** Elementary theory of radial flow turbines, Enthalpy-Entropy diagram, State losses, Estimation of stage performance, Performance characteristics.	15
5	**Gas Turbine Starting & Control Systems**: Starting ignition system, Combustion system types, Safety limits & control. **Turbine Blade coding:** Different cooling techniques, Types of coolants, Comparative evaluation of different cooling techniques. **Mechanical Design consideration:** Overall design choices, Material selection, Design with traditional materials.	7

Textbooks

- Gas turbine theory : Cohen & Rogers, Addison Weslay Longman Ltd.
- Gas Turbine – Ganeshan Tata Mc Graw Hill.

Reference Books

- Design of high efficiency turbomachinery and gas turbines, David Gordon Wilson, Theodosios Korakianitis, Prentice Hall International.
- Turbomachinery : S.M. Yahya.
- Turbine, Compressors and Fans, S.M. Yahya, Tata Mc Graw Hill.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: TRIBOLOGY	**Course Code:** ME-703 B

Course Description: Course will help the students to learn about the design of surfaces in contact is a critical problem for mechanical engineering, design of tribological systems, the interfaces between two or more bodies in relative motion, fundamental topics include- friction, wear, wear mechanism, wear model, hydrodynamic, hydrostatic and gas lubrication.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To impart knowledge about lubricants and its properties.

CO2: To acquire and apply fundamental principles of hydrostatic lubrication.

CO3: To impart knowledge about gas lubrication.

CO4: To accustom with hydrodynamic lubrication.

Theory 4hr/Week

Unit	Topic	Hours
1	**Introduction to Tribology** Definition, Scope, Applications, Friction, Definition, Scope, Laws of friction. Friction theories. Surface contaminants, Effect of sliding speed on friction.	08
2	**Wear** Definition, Scope, wear of metals, Types, Classification. Mechanism of wear, Quantitative laws. Hypothesis of Holm. Hypothesis of Burwell and Strang. Hypothesis of Archard, Rawe, Rabinowicz. Quantitative law for Abrasive wear, Bayerku surface fatigue theory. Delamination theory & Fatigue theory of wear, wear resistant materials. Introduction to wear of Polymers and Ceramics. Wear reduction by Surface Improvements, Pitting, Erosion & Stress Corrosion.	15
3	**Surface Interactions** Elastic & Plastic deformation of surfaces. Contact of Solids, Contact of Ideally Smooth Surfaces. Distribution of Pressure over elastic contact of two curvilinear bodies. Formulae for calculation of contact area. Physico-Mechanical properties of surface layers, Characteristics of Surface Geometry. Classes of surface roughness. Contact of rough surfaces. Interaction of surface peaks. Real and contour area of contact.	15
4	**Lubrication** Definition & Scope. Generalized Reynold's equation. Flow and shear stress, energy equation. Mechanism of pressure development in bearings. Concept of Boundry Layer.	7
5	**Bearing design considerations & characteristics** Bearing design procedure & steps. Plain slider bearing. Step (Rayleigh step) bearing. Infinitely long journal bearing. Infinitely short journal bearing. Future scope and applications.	15

Textbooks

- Introduction to Tribology of bearings by - B. C. Majumdar., S Chand & Co.
- Tribology in Industries by Sushil. K. Srivastava, S Chand & Publications.

Reference Books

- Hand Book of Tribology – WHILEY
- Fundamentals of Fluid film lubrication by – Bernard Hamrock, Mc Graw Hill International Edition.

- Basic Lubrication theory by Alastair Cameron.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	1	1	1	1
CO2	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	1	1	1	1
CO3	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	1	1	1	1
CO4	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	1	1	1	1

Program: B.Tech (ME)	**Semester:** 7th
Course Title: INDUSTRIAL ERGONOMICS	**Course Code:** ME-703 C

Course Description: Course will help the students to learn about the working postures and lifting tasks, assessment about occupational exposure to heat stress, noise, vibrations and RSPM

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To analyze and calculate the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.

CO2: To learn about the appropriate wage and incentive plan for the employees of an organization.

CO3: To learn about the appropriate allowances for the jobs under analysis.

CO4: To calculate the basic work content of a specific job for employees of an organization.

Theory 4hr/Week

Unit	Topic	Hours
1	**Introduction:** Importance applications and principles of occupational ergonomics . **Physiological Principles:** Muscular work, Nervous control of movements, Improving working efficiency. Optimal use of muscle strength. /Guidelines for work layout. **Skilled work:** Acquiring skill, control of skilled movements. Design of tools and equipments for skilled work.	10
2	**Heavy work:** Energy consumption, Efficiency, Heart rate as a measure of workload. **Work-station Design:** Anthropometric data, Reach and clearance dimensions. Percentiles to be accommodated.	10
3	**Working Heights:** Comfortable working postures. Room to grasp or move things, and operate controls. Sedentary work. Its advantages, disadvantages and limitation. Sedentary workplace design. Design of VDT workstations, Design of Key board. Handling Lads: The Human spine, back troubles associated with industrial work, Intervertebral disc, disc pressure, slip of disc, Bio-mechanical models of lower back. Recommendations for handling loads. **Man-Machine System:** Display equipment, Controls, Relation between control and display instruments, Mental activity, Fatigue, Occupational stress, Job design in monotonous task.	15
4	**Human Visual System:** Accommodation, Aperture of the pupil, Adaptation of reline, eye movements Visual capacity, Visual strain, Physiology of reading. **Ergonomic Principles of Lighting:** Light sources, measurement, physiological requirements of artificial lighting, arrangement of light. Light for fine work and for VDT offices.	10
5	**Noise and Violation:** Sound perception, Noise load, damage to hearing, physiological and psychological effects of noise. Protection against noise, Vibrations and their effect on performance. **Working Environment:** Thermo-regulation in human body, comfort indoors, Air quality and its dryness, Air pollution and ventilation. Heat in industry Recommendations for comfort indoors. Daylight, colours and music for pleasant work environment.	15

Textbooks

- A guide to Ergonomics of Manufacturing, Helander, M., East-West Press.

Reference Books

- Fitting the task to the Man, E. Gandjean, Taylor and Francis.
- Human Factor in Engineering and Design, Sanders, M.S., and Mc Cormik, E.J., Mc Graw.Hill

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**0**	**1**	**3**	**1**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
CO2	**0**	**1**	**3**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**1**
CO3	**0**	**1**	**3**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
CO4	**0**	**1**	**3**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**1**

DEPARTMENT ELECTIVE-II

Program: B.Tech (ME)	**Semester:** 7th
Course Title: OPERATIONS RESEARCH	**Course Code:** ME-704

Course Description: Course will help the students to learn about thecharacteristics of differenttypes of decision-making environments. Students will be able to design new simple models, like: CPMto improve decision–making and develop critical thinking and objective analysis of decision problemsand develop a report that describes the model and the solving technique, analyze the results and proposerecommendations in language understandable to the decision-making processes in management.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To Understand the characteristics of different types of decision-making environments.

CO2: Identify and develop operational research models from the verbal description of the real system.

CO3: To recognize the basic type of queuing model, derive and calculate steady state system performance characteristics and analyze projects with a view to managing resources, minimizing costs, and coping with uncertainty.

CO4: To design new simple models, like: CPM to improve decision –making and develop critical thinking and objective analysis of decision problems.

Theory 4hr/Week

Unit	Topic	Hours
1	**Introduction:** Basics of Operations Research **Linear Programming-** Introduction & Scope, Problem formulation, Graphical Method, Simplex methods, primal & dual problem sensitivity analysis.	10
2	**Transportation & Assignment problems**. **Deterministic Dynamic Programming-** Multistage decision problems & solution, Principle of optimality.	8
3	**Decision theory-** Decision under various conditions. **Game Theory-** Two Person Zero sum game, Solution with / without Saddle point, Dominance Rule, Different Methods like Algebraic, Graphical, Liner Programming **Sequencing-** Basic assumption, n Jobs through two / three machines, 2 Jobs on m machines.	15
4	**Stochastic inventory models-** Single & multi period models with continuous & discrete demands, Service level & reorder policy **Simulations-** Use, advantages& limitations, Monte-carlo simulation, Application to queuing, inventory & other problems.	15
5	**Queuing models-** Characteristics of Queuing Model, M/M/1 & M/M/S system, cost consideration **Project Management**: Basic concept, Rules for drawing the network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations; resource allocation	15

Textbooks

- Operation Research, Er. Prem Kumar Gupta , Dr. D. S. Hira , S. Chand.

Reference Books

- Operations Research by : Wangner
- Operations Research by : Taha
- Introduction to Management Science by: Hiller & Hiller
- Operations Research by : Wayne L. Winston.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**
CO2	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**
CO3	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**
CO4	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: MANAGEMENT INFORMATION SYSTEM	**Course Code:** ME-704 A

Course Description: Course will help the students to learn about the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Relate the basic concepts and technologies used in the field of management information systems

CO2: Compare the processes of developing and implementing information systems, outline the role of the ethical, social, and security issues of information systems.

CO3: Translate the role of information systems in organizations, the strategic management processes,with the implications for the management.

CO4: Apply the understanding of how various information systems like DBMS work together toaccomplish the information objectives of an organization.

Theory 4hr/Week

Unit	Topic	Hours
1	Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, Various channels of information & MIS.	10
2	Foundation of Information System : Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc.	15
3	Business application of information technology, electronic commerce, Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage	15
4	Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.	8
5	Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, and Procurement Management System Object Oriented modeling case studies.	15

Textbooks

- Bansal, "Information System Analysis & Design", TMH.
- Jawadegar, "Management Information System", TMH.

Reference Books

- O.Brian, "Introduction to Information System", Mc-Graw Hill.
- O.Brian, "Management Information System", TMH.
- Alter, "Information Systems : A Management Perspective", Addison Wesley.
- Arora & Bhatia, "Information Systems for Managers", Excel
- Murdick, "Information System for Modern Management", PHI.
- Alexis Leon, "Enterprise Resource Planning", TMH.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

(i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**
CO2	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**
CO3	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**
CO4	**1**	**1**	**1**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: ADVANCED FLUID MECHANICS	**Course Code:** ME-704 B

Course Description: Course will help the students to learn about theunderstand the limitations and advantages of various experimental techniques for fluid mechanics, and also have a sound understanding of the physics underpinning these techniques

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Apply the techniques of particle image velocimetry and hot-wire anemometry to investigate complex fluid flows.

CO2: Understand how the equations of fluid motion are applied to flows near walls and understand the importance of the boundary layer in engineering applications.

CO3: To Understand the role of turbulence in engineering applications.

CO4: Apply contemporary data analysis for experiments in the area of fluid mechanics, especially for experiments relating to boundary layers and turbulence.

Theory 4hr/Week

Unit	Topic	Hours
1	Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress.	10
2	**Non-viscous incompressible flow-** Equation of continuity, Euler's equation of motion, Bernoulli's equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of source-sink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoils.	8
3	**Boundary layer Concept-**Introduction to boundary layer formation, Novier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication.	15
4	**Compressible flow-** Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables.	15
5	**Flow with normal shock waves-** Development of shock wave, rarefaction wave, governing equations, Prandtle-Meyer relation. Thermodynamic properties across shock. Wind tunnels. **Flow in constant area duct with friction-**Fanno curves, Fanno flow equations, Solution of fanno flow equations. Variation of flow properties. Tables & charts for Fanno flow. **Flow in constant area duct with heat transfer-** Rayleigh line, Fundamental equations, Rayleigh flow relation, Variation of flow properties. Tables & Charts for Rayleigh flow.	15

Textbooks

- Fluid Mechanics by Som & Biswas.
- Fluid Mechanics by K.L. Kumar.
- Fluid Mechanics by A.K. Jain.

Reference Books

- Fluid Mechanics by White.
- Fluid Mechanics by Streeter.
- Fluid Mechanics by Robert W. Fox & Alan T. Mc Donald, Wiley Students Edition.

- Fundamentals of Compressible flow by S.M. Yahya.
- Gas Dynamics by Z. Hussain.
- Viscous fluid flow by White.
- Computational Fluid Dynamics by Anderson.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**1**	**1**
CO2	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**3**	**3**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: ADVANCED DYNAMICS OF MACHINERY	**Course Code:** ME-704 C

Course Description: Course will help the students to learn about the Understand the forces, torques and energy involved in different machine members.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To analyze the effect of a gyroscope on ships, aeroplanes and automobile.

CO2: To explain the working of important machine elements like clutches, brakes, flywheels, governors.

CO3: To analyze the theory involved in balancing of rotating and reciprocating members.

CO4: To estimate the unbalanced forces in a multi-cylinder reciprocating engine.

Theory 4hr/Week

Unit	Topic	Hours
1	**Dynamic Analysis of Mechanisms and Machines:** Introduction, Motion of Rigid Body under a System of Forces, Principle of Virtual Work, D'Alembert's Principle and Dynamic Equilibrium, Dynamic Force Analysis, Stresses in Moving Members, Motion Analysis, Equivalent Force and Mass Method.	15

2	**Dynamics of Direct Acting Engine Mechanisms:** Introduction, Piston Motion, Turning Moment on Crank-Shaft, Dynamically Equivalent Link, Approximate Expression for Turning Moment, Correction to the Approximate Expression, Turning Moment Diagram, Fluctuation of Crank-Shaft Speed, Flywheel Analysis.	15
3	**Balancing of Inertia Force and Moments in Machines:** Introduction, Balancing of Rotating Masses, Two-Plane Balancing, Determination of Balancing Masses, Balancing of Internal Combustion Engines.	8
4	**Gyroscopic action in Machines:** Introduction, Motion of a Rigid Body in Three-Dimensions, Principal Axes, Angular Velocity and Momentum about Principal Axes, Euler's Equation of Motion, Euler's Modified Equation, Simple Precession of a Symmetrical Gyroscope in Angular Precession, Gyroscopic Effects in Machines, Gyroscopic Stabilization.	15
5	**Dynamics of Rotating Shafts:** Introduction, Critical Speed, Shaft with an Unbalanced Disc at Mid-Span, Generalized Forces, Lagrange's Equation of Motion, Gyroscopic Effect on Critical Speed.	8

Textbooks

- Theory of Mechanisms and Machines by Amitabh Ghosh and Ashok Kumar Malik, Affiliated East- West Press Pvt. Ltd, New Delhi.

Reference Books

- Theory of Machines and Mechanisms by Joseph Edward Shigley and John Joseph Uicker, J.R. International Student Edition, Mc-Graw Hill International Company.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO2	**3**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO3	**3**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**
CO4	**3**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**3**	**3**

DEPARTMENTAL ELECTIVE-III

Program: B.Tech (ME)	**Semester:** 7th
Course Title: NON-CONVENTIONAL ENERGY RESOURCES	**Course Code:** ME-705

Course Description: Course will help the students to demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells and Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Describe the basic /technical concepts of the solar radiation.

CO2: Describe the use of solar energy collectors and identify the appropriate methods of energy storage and perform thermal analysis.

CO3: Describe the energy conversion from wind energy and ocean energy to thermal energy.

CO4: Differentiate types of direct energy conversion methods.

Theory 4hr/Week

Unit	Topic	Hours
1	**Energy resources and their utilization :** Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. **Solar radiations:** Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.	15
2	**Solar energy:** Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing .Solar thermal energy storage, Different systems, Solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants. **Solar photovoltaic system:** Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system	10
3	**Biogas**: Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India. **Wind energy:** Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development.	15
4	**Electrochemical effects and fuel cells:** Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating	8

	characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells . **Tidal power:** Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. **Hydrogen Energy:** Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.	
5	**Thermoelectric systems:** Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. **Geothermal energy:** Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion. **Ocean energy;** Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics . Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.	15

Textbooks

- Rai G.D, "Non-Conventional energy Sources", Khanna Publishers.
- Kothari D.P., "Renewable energy resources and emerging technologies", Prentice Hall of India Pvt. Ltd.

Reference Books

- Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata Mc Graw Hill.
- Ashok V. Desai, "Nonconventional Energy", New Age International Publishers Ltd.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**
  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**2**	**2**	**2**	**2**
CO2	**2**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**2**	**2**	**2**	**2**
CO3	**2**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**2**	**2**	**2**	**2**
CO4	**2**	**1**	**1**	**0**	**2**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: FUNDAMENTALS OF BIOMEDICAL ENGINEERING	**Course Code:** ME-705 A

Course Description: The course provides an introduction to several areas of research found in Biomedical Engineering. Topics include basic biomechanics, bioinstrumentation systems, circuit elements and concepts, linear network analysis, bio-potentials, biosensors, various imaging techniques, fundamentals of bioinformatics and molecular engineering

Course Outcomes

CO1: Learning to apply course material to improve thinking, problem solving, and decision making in analyzing Biomedical Engineering problems using proper assumptions and simplifications

CO2: Gaining knowledge about the mechanics, materials and operation of the human system

CO3: Apply knowledge of basic engineering to solve the problems at the interface of engineering and biology

CO4: Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Theory 4hr/Week

Unit	Topic	Hours
1	**Biomechanics** Statics and dynamics of the musculoskeletal system, forces and	15

	moments. Acting in the skeletal system and the various techniques used to describe them. Forces and moments with in the body such as forces acting at hip and knee joint and in the extremities. Analysis of pathological situations of human joints.	
2	**Biomaterials** Stress strain behaviour of bone. The mechanical properties including elasticity, hardness, viscoelasticity, surface and fatigue properties of skin; soft tissues; bone; metals; polymers and ceramics. Biocompatible materials and its applications. The effects of degradation and corrosion.	15
3	**Bio Fluid Flow** Fluids-laminar and turbulent flow, boundary layer, non-newtonian and pulsatile models, blood rheology, circulatory system, blood-flow in arteries, veins and heart, synovial fluid, joint friction.	8
4	**Bioinstrumentation** Fundamentals of producing a medical image, image collection techniques, image reconstruction algorithms, detailed examination of the four main areas of medical imaging : Nuclear Medicine and positron Emission Tomography, Ultrasound, Diagnostic Radiology, Magnetic Resonance and its clinical applications. Physiological signals, noise, and available sensors and transducers and their characteristics.	15
5	**Computing for Biomedical Engineers** Health care information and communications, Including telemedicine, medical informatics, networks and privacy. Data Collection, Medical coding and classification. Standards for medical data interchange. Aspects of database design, client/server topologies.	8

Textbooks

- Biomaterials Science- An Introduction to Materials in Medicine. Buddy D.Rattner, Allan S.Hoffman, Frederick J.Schoen, Jack E.Lemmons, Editors, Academic Press.
- Biomaterials: An Introduction(second edition) Joon B.Park & Roderic S.Lakes, Plenum Press, 1992.

Reference Books

- Basic orthopedic biomechanics, Editors-VC Mow & Wc Hayes, Lippincott Raven Publishers.
- Biofluid Mechanics, Jagan N.Mezumdar; World Scientific Pub.Co.,NJ 1992
- Handbook of Biomedical Instrumentation, RS Khandpur.
- Mthematical models in biology and medicine- J.N.Kapur, Affliated East West Press Pvt. Ltd., NewDelhi-India
- Bone Mechanism – W.C.Heys, CRC Press
- Computers in Medicine- Lele.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
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96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	0	2	0	1	0	0	3	0	3	2	2	2	2
CO2	1	2	1	0	2	0	1	0	0	3	0	3	2	2	2	2
CO3	1	2	1	0	2	0	1	0	0	3	0	3	2	2	2	2
CO4	1	2	1	0	2	0	1	0	0	3	0	3	2	2	2	2

Program: B.Tech (ME)	**Semester:** 7th
Course Title: ENERGY MANAGEMENT	**Course Code:** ME-705 B

Course Description: Course will help the students to learn about the policy makers and technology providers have been working towards the cause of energy efficiency and its overall management and to educate students on the various dimensions of energy management across the entire value chain.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: Obtain knowledge about energy conservation policy, regulations and business practices and analyze energy systems from a supply and demand perspective

CO2: Apply knowledge of Energy Conservation Opportunities in a range of contexts

CO3: Recognize opportunities for enabling rational use of energy

CO4: Develop innovative energy efficiency solutions and demand management strategies.

Theory 4hr/Week

Unit	Topic	Hours

1	Introduction to energy, Sources of energy, Forms of energy, Energy reserves, renewable energy sources, Unites of energy and the laws of thermodynamics,, Energy consumption and GDP, energy database , Energy demand analysis, Costs of exploration and utilization of depletable resources, energy pricing, National energy plan.	15
2	Energy audit concepts, Energy audit based on 1^{st} law and 2^{nd} law of thermodynamics, Mass and Energy balances, Availability analysis, Evaluation of energy conserving opportunities, Economic analysis and life cycle costing..	10
3	Energy conservation areas, Energy transmission and storage, Plant wide energy optimization Models, Data base for energy management , Energy conservation through controls, Computer aided energy management, Program organization and methodology.	10
4	Electrical energy conservation in building lighting, heating, ventilating and air conditioning, Energy efficient motor, power factor improvement in power systems, Energy audit of Combustion process, Boilers, Turbines, compressors, Pumps, Heat exchangers, Condensers, Use of industrial, wastes.	15
5	Energy environment interaction, Environmental issues, Global warning, Carbon dioxide emissions, Depletion of ozone layer, Government's regulations, and Energy economy interaction.	10

Textbooks

- Thermodynamics, By Kenneth Wark, Tata Mc Graw Hill Publishers.
- Energy and Power Risk Management: New Developments in Modeling, Pricing and Hedging, buy Alexander Eydeland, John Wiley & Sons.
- Renewable Energy Sources and their Environment Impact, by Abbasi & Abbasi, Prentice Hall of India.

Reference Books

- Energy Management and condevtion, by Clive Beggs, Butterwoth- Heinemann Elsevier Science.
- Optimising Energy Efficiency in the Industry, By Rajan, Tata Mc Graw Hill Publishers.
- Guide to energy Management, By C.L Capehart, Fairmont Press.
- Environmental Risks and Hazards by Cutter, Prentice Hall of India.
- Energy Management Handbook by, Wayne C. Turner.
- Exergy Analysis of Thermal, Chemical and Metallurgical Process, By Jan Szargut, David R. Morris, Frank R. Steward, Hemisphere Pub, Springer Verlag Publisher.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**2**	**2**	**2**	**2**
CO2	**2**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**2**	**2**	**2**	**2**
CO3	**2**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**2**	**2**	**2**	**2**
CO4	**2**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**1**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:** 7th
Course Title: NON-DESTRUCTIVE TESTING	**Course Code:** ME-705 C

Course Description: Course will help the students to learn about thenon-destructive testing and make them understand various types of non- traditional practices available for manufacturing organizations.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To select an appropriate NDT technique as per requirement.

CO2: To set various process parameters and control the NDT process for the desired output parameters.

CO3: To find the internal flaws in the material by NDT and take measures to eliminate them.

CO4: To solve various problems encountered like leakage cracks, blowholes with the manufacturing process by analyzing the data

Theory 4hr/Week

Unit	Topic	Hours

1	**Introduction** Scope and advantages of NDT. Comparison of NDT with DT. Some common NDT methods used since ages, Terminology. Flaws and Defects, Visual inspection, Equipment used for visual inspection. Ringing test chalk test (oil whitening test). Attractive uses of above tests in detecting surface cracks, bond strength & surface defects.	10
2	**Common NDT methods Die penetrate test** (liquid penetrate inspection), Principle, scope. Equipment & techniques, Tests stations, Advantages, types of penetrant and developers. Illustrative examples – Heavy castings of large size, frame of jet engine, porosity testing of nickel alloys, leak testing. Zyglo test. **Magnetic particle Inspection** Scope, principle, Ferro Magnetic and Non-ferro magnetic materials, equipment & testing. Advantages, limitations Interpretation of results. DC & AC magnetization, Skin Effect, use of dye & wet powders for magna glow testing, different methods to generate magnetic fields, Applications.	15
3	**Radiographic methods** X-ray radiography principle, equipment & methodology. Applicability, types of radiations, limitations. Interpretation of Radiographs, limitations of γ-ray radiography –principle, equipment. Attenuation of electro magnetic radiations, source of radioactive materials & technique. Photo electric effect, Rayleigh's scattering (coherent scattering), Compton's scattering (Incoherent scattering). Pair production, Beam geometry, Scattering factor. Advantages of γ-ray radiography over X-ray radiography Precautions against radiation hazards. Case Study ─ X-ray of human body.	15
4	**Ultrasonic testing methods** Introduction, Principle of operation, Piezoelectricity. Ultrasonic probes, CRO techniques, advantages, Limitation & typical applications. Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements. Case Study – Ultrasonography of human body.	10
5	**Eddy Current Inspection** Principle, Methods, Advantages, Scope and limitations. Types of Probes. Case Studies.	10

Textbooks

- Bray, Don E. and Stanley, Roderic K., Nondestructive Evaluation: A Tool in Design, Manufacturing, and Service. Revised Edition 1997, CRC Press New York.

Reference Books

- ASM Handbook Vol. 11, 8^{th} Edition – Non-destructive Testing & Evaluation
- Research Techniques in NDT Vol.3, R.S. Shah, Academic
- Industrial Quality Control, Webstar.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Mid-Term Exams (MSE) = 40 Marks**
- **Continuous A ssessment (CA)= 20 Marks in the form of:-**

  (i) Assignments = 15 Marks (ii) Attendance = 05 Marks

Attendance percentage	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:7th**
Course Title : CAD/CAM LAB	**Course Code:** ME-751

Course Description: Course will help the students to learn about the CNC machining program codes for different geometrical operations like drilling, boring etc.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To acquire the knowledge about characteristic features of CNC machine.
CO2: To acquire the knowledge about part programme for machining given profile.
CO3: Analyze the Part modeling using some of the modeling technique.
CO4: Analyze the part-programming on CNC machines.

Sr No.	Experiment Title
1.	Line Drawing or Circle Drawing experiment: Writing and validation of computer program.
2.	Geometric Transformation algorithm experiment for slation /rotation/scaling: Writing and

	validation of computer program.
3.	Component assembly in CAD and generating and modifying Drawings.
4.	CAD exercises using Auto Cad software
5.	Part-programming on CNC machines
6.	Execution of part programme for machining given profile.
7.	Programming of robots for various applications.
8.	Part modeling using some of the modeling technique
9.	To study the characteristic features of CNC machine.
10.	Experiment on difference between ordinary and NC machine, study or retrofitting.
11.	Experiment on Robot and programs

Textbooks

- Printed Manual supplied to the students.

Reference books

- Computer Integrated Design and Manufacturing by D.D. Bedworth, M.R Henderson & P.M. Wolfe, Tata MCGraw Hill Pub. Co.
- CAD/CAM - theory and Practice by Zeid Ibraham, Tata McGraw Hill Pub Co.
- CAD/CAM by Groover & Simmers, Prentice Hall of India.
- Automation, Production Systems and computer integrated manufacturing by Groover, Prentice Hall of India.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks. (Practical File = 10 Marks , Viva-Voce = 10 Marks)**
- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**
CO2	**2**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**1**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:7th**
Course Title : AUTOMOBILE LAB	**Course Code:** ME-752

Course Description: Course will help the students to learn about the Understand the Construction, working and other details about Internal Combustion Engines used in automobiles. Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems. Understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc. Identify Modern technology and safety measures used in Automotive Vehicles

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To acquire the knowledge about basics of principles of actual automobile systems.

CO2: Students will be able to understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc

CO3: Analyze the working of various Automobile Systems.

CO4: To know some modern trends in Automotive Vehicles.

Sr No.	Experiment Title

1.	Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
2.	Determination of Indicated H.P. of I.C. Engine by Morse Test.
3.	Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
4.	Study & experiment on Valve mechanism.
5.	Study & experiment on Gear Box. Study & experiment on Differential Gear Mechanism of Rear Axle.
6.	Study & experiment on Steering Mechanism.
7.	Study & experiment on Automobile Braking System.
8.	Study & experiment on Chassis and Suspension System.
9.	Study & experiment on Ignition system of I.C. Engine.
10.	Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.
11.	Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
12.	Study & experiment on Air Conditioning System of an Automobile.
13.	Comparative study of technical specifications of common small cars (such asMaruti Swift, Hyundai i20, Chevrolet Aveo, Tata Indica, Ford Fusion etc.
14.	Comparative study & technical features of common scooters & motorcycles available in India.
15.	Visit of an Automobile factory.
16.	Visit to a Modern Automobile Workshop.
17.	Experiment on Engine Tuning.
18.	Experiment on Exhaust Gas Analysis of an I.C. Engine.

Textbooks

- Printed Manual supplied to the students.

Reference books

- Automobile Engineering, Kripal Singh.
- Automobile Engineering , Dr. D.S. Kumar , Katson Books
- Automotive Engineering- Hietner
- Automobile Engineering - Narang.
- Automotive Mechanics- Crouse
- Automobile Engineering - Newton and Steeds.

Assessment Process (Internal)

Internal assessment = 30 Marks

- **Practical work Performance = 20 Marks.**

- **Attendance = 10 Marks**

Attendance percentage	Marks
Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**2**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO2	**3**	**2**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**

Program: B.Tech (ME)	**Semester:7th**
Course Title : Project	**Course Code:** ME-753

Course Description: Course will help the students to learn about to implement the principles of engineering learnt by them in practical applications with innovative ideas and thus enable them to have a practical exposure.

Course Outcomes: Students will be able to understand and solve following particular problems by the end of this course:-

CO1: To provide an opportunity to work in group on a topic / problem / experimentation.
CO2: To encourage creative thinking process.
CO3: To acquire and apply fundamental principles of planning and carrying out the work plan of the project through observations, discussions and decision making process.
CO4: To provide an opportunity to analyze and discuss the results to draw conclusions.

Assessment Process (Internal)

Internal assessment = 60 Marks

- **Project Performance = 60 Marks. (Project Work = 40 Marks , Viva-Voce = 20 Marks)**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	0	2	3	1	0	0	0	0	3	2	2	2	2
CO2	3	3	1	0	3	0	1	0	0	0	0	0	2	2	2	2
CO3	3	3	1	0	2	0	1	0	3	0	0	0	2	2	2	2
CO4	3	3	1	0	2	0	1	0	0	1		0	2	2	2	2