Department: Mechanical Engineering

Curriculum Structure & Syllabus

(Effective from 2018-19 admission batch)

Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

1st Semester								
Sl No	**Course Type**	**Course Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 101	Mathematics -I	3	1	0	4	4
2	BS	CH 101/ PH 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	ES	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							**12**	**12**
B. PRACTICAL								
5	BS	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	1.5
6	ES	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	1.5
7	ES	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	1.5
8	PROJ	PR 191	PROJECT-IA	0	0	1	1	0.5
9	PROJ	PR 192	PROJECT-IB	0	0	1	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 181	Induction Program	0	0	0	0	
Total of Theory, Practical & Mandatory Activities/Courses							**23**	**17.5**

Syllabus- 1st Semester

Course Name: Mathematics-I
Course Code: M 101
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra and calculus.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes:

CO1	Recall the distinctive characteristics of matrix algebra and calculus.
CO2	Understand the theoretical working of matrix algebra and calculus.
CO3	Apply the principles of matrix algebra and calculus to address problems in their disciplines.
CO4	Examine the nature of system using the concept of matrix algebra and calculus.

Course Content:

Module I: Matrix Algebra (11)

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

Module II: Differential Calculus and Infinite Series (10)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) - I (9)

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian.

Module IV: Multivariable Calculus (Differentiation) - II (7)

Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directional derivatives, Gradient, Divergence, Curl.

Module V: Integral Calculus (11)

Evolutes and involutes; Evaluation of definite integrals and its applications to evaluate surface areas and volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	1	-	-	-	-	-	-	-	-	1

Course Name: Physics –I
Course Code: PH 101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre requisites: Knowledge of Physics up to 12^{th} standard.

Course Objective:
The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.

Course Outcomes:

CO1: Describe various types mechanical resonance and its electrical equivalence
CO2: Explain basic principles of Laser, Optical fibers and various types of semiconductors
CO3: Apply superposition to explain interference and diffraction as well as apply wave mechanics to attainment of Heisenberg's uncertainty principle
CO4: Analyze importance of light as a carrier of information and examine different crystallographic structures according to their co-ordination number and packing factors
CO5: Justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

Course Content:

Module 1 (6L):
Waves & Oscillations:
Simple Harmonic Motion (only preliminary idea), damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems.

Module 2 (8L):
Classical Optics:
2.01- Interference of light: Huygens's principle, superposition of waves, conditions of sustained interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems.

2.02- Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems.

Module 3 (8L):
Quantum Mechanics-I:

3.01 Quantum Theory: Inadequacy of classical physics and its modifications by Planck's quantum hypothesis-qualitative (no deductions), particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment.

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems.

Module 4 (7L):
Solid State Physics-I:
4.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.

4.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction.

Module 5 (7L):
Modern Optics-I:
5.01- Laser: Concepts of various emission and absorption process, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser.

5.02-Fibre optics: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems.

Text Books:

Waves & Oscillations:
1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh (S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:
1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler

8. Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

Reference Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.

CO-PO Mapping:

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

Course Name: Basic Electronics Engineering
Course Code: EC101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
Electric current and voltage-D.C and A.C., Complex impedance, conductivity, resistivity, transformer charging and discharging of capacitor, active and passive elements.

Course Objective:

1. To understand the behavior of Conductors, Insulators, and Semiconductors based on energy-band theory and relevant problems.
2. To instill the knowledge of working principles of P-N Junction Diode, Zener diode and analyze their applications in the rectifier, clipper, clamper, regulator etc.
3. To familiarize with the characteristics of Bipolar junction transistor(BJT) under CE, CE, CC mode of operation and its biasing mechanisms.
4. To understand working principles of JFET, MOSFET and perform operations under CG, CS, CD configurations for parametric observation.
5. To determine the parameters due to the effect of feedback in amplifier to ,adder circuit , integrator and differentiator circuit using Operational Amplifier

Course Outcomes:

CO1	Students able to describe the fundamentals of Semiconductors
CO2	Students able to explain V-I characteristics of P-N Junction Diode, zener diode , working of diode rectifier, clipper, clamper, and regulator circuit
CO3	Students able to analyze characteristics of Bipolar junction transistor(BJT) under CE, CB, CC mode of operation and its biasing therein
CO4	Students able to illustrate the operations of JFET, MOSFET and the CS,CD , CG configuration using JFET
CO5	Students able to determine parameters due to effect of feedback in amplifier
CO6	Students able to construct inverting amplifier circuit , non-inverting amplifier circuit ,adder circuit , integrator and differentiator circuit using Operational Amplifier IC

Course Content:

Module-I: Basics of semiconductor (6L)
Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems.

Module-II: P-N Junction Diode and its applications (8L)
p-n junction formation and depletion region, energy band diagram of p-n junction at equilibrium and

barrier energy, built in potential at p-n junction, energy band diagram and current through p-n junction at forward and reverse bias, Static and Dynamic resistance of Diode, Transition capacitance and diffusion capacitance, V-I characteristics and current expression of diode, temperature dependencies of V-I characteristics of diode, p-n junction breakdown – conditions, avalanche and Zener breakdown, Concept of Junction capacitance, Zener diode and characteristics.

Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation ($I_{DC,}$ I_{rms}, $V_{Dc,}$ $V_{rms)}$, ripple factor without filter, efficiency, PIV, TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III: Bipolar junction transistor (6L)
Concept of "Transistor", Formation of PNP/NPN Transistors, energy band diagram, current conduction mechanism, CE, CB, CC configurations, transistor static characteristics in CE, CB and CC mode, junction biasing condition for active, saturation and cut-off modes, current gain α, β and γ, early effect.
Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias, D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.
BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (6L)
Concept of "field effect", Classification of FETs-JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

Module-V: Feedback and Operational Amplifier (8L)
Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.
Operational amplifier – electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages; bias current; offset current; Slew rate; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non-inverting amplifier, Concept of virtual ground, Applications op-amp – summing amplifier; differential amplifier; voltage follower; basic differentiator and integrator, Numerical Problems.

Module-VI: Cathode Ray Oscilloscope (2L)
Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Text Books :
1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3.Sedra & Smith, Microelectronics Engineering

Reference Books :
1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B.Gupta, Basic Electronics, S.K. Kataria.
3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	2	-	1
CO2	3	3	3	1	-	-	-	-	1	1	1	2
CO3	3	1	1	1	-	-	-	-	1	1	1	1
CO4	3	2	1	1	-	-	-	-	1	1	2	2
CO5	3	2	3	1	-	-	-	-	1	1	1	2
CO6	3	3	3	1	-	-	-	-	2	1	2	3

Course Name: English
Course Code: HU101
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Prerequisites: The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills.

Course Objectives: The basic objectives of this course are to impart professional communication skills in the globalized workplace context, to enable functional competence in reading and writing so as to create industry-ready personnel.

Course Outcomes:

CO1: Know about and employ communication in a globalized workplace scenario.
CO2: Understand and apply functional grammar, reading skills and sub-skills.
CO3: Acquire a working knowledge of writing strategies, formats and templates of professional writing.
CO4: Apply and make use of the modalities of intercultural communication.

Course Content:

Module 1: Communication in a Globalized World **4L**
1.1 Definition, Process, Types of Communication
1.2 Verbal and Non-Verbal Communication
1.3 Barriers to Communication
1.4 Workplace Communication

Module 2: Functional Grammar **4L**
2.1Articles, Prepositions and Verbs
2.2 Verb-Subject Agreement
2.3 Voice, Modality and Modifiers
2.4 Direct and Indirect Speech
2.5 Common Errors in English

Module 3: Vocabulary and Reading **6L**
3.1 Word Roots, Prefixes and Suffixes
3.2 Antonyms, Synonyms and one word Substitution
3.3 Reading—Purposes and Skills (Skimming, Scanning & Intensive Reading)
3.4 Reading Comprehension (Fictional and Non-fictional prose)

Module 4: Professional Writing **10L**
4.1Writing Functions: Describing, Defining, Classifying
4.2 Structuring—coherence and clarity
4.3 Business Writing—Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).
4.4 E-mails—types, conventions, jargons and modalities.

4.5 Reports and Proposals
4.6 Précis writing
4.7 Essay writing
4.8 Punctuation and its importance in writing
4.9 Writing for an Audience

Text Books:

1. Ruskin Bond: The Night Train at Deoli OR Khushwant Singh: The Portrait of a Lady
2. Roald Dahl: Lamb to the Slaughter OR Somerset Maugham: The Man with the Scar
3. Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944 and 13th February 1944) OR Jawaharlal Nehru: "How Britain Ruled India" (Glimpses of World History, Chap 112)

Reference Books:

1. Raymond Murphy. English Grammar in Use. 3rd Edn. CUP, 2001.
2. A. J Thomson and A. V. Martinet. A Practical English Grammar Oxford: OUP, 1980.
3. Michael Swan. Practical English Usage. Oxford: OUP, 1980.
4. Simeon Potter. Our Language. Oxford: OUP, 1950.
5. Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed. London: Longman, 2001.
6. Ben Heasley and Liz Hamp-Lyons. Study Writing. Cambridge: CUP, 2006.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	3	-	-	-	-	-	1	-	-	3	-	2
CO2	2	3	2	-	-	2	2	-	-	3	-	3
CO3	1	3	-	-	-	3	3	-	-	3	-	3
CO4	-	-	-	-	-	3	3	-	-	3	-	3

Course Name: Physics I Lab
Course Code: PH 191
Contact: 0:0:3
Credits: 1.5

Pre requisites: Knowledge of Physics up to 12^{th} standard.

Course Outcomes:

CO1 : Demonstrate experiments allied to their theoretical concepts
CO2 : Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spctrometer
CO3 : Participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO4 : Analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

List of Experiments:

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 6 to be performed from the following experiments

Experiments on Waves & Oscillations:
1. Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)

Experiments on Classical Optics:
3. Determination of wavelength of light by Newton's ring method.
4. Determination of wavelength of light by Laser diffraction method.

Experiments on Quantum Physics-I:
5. Determination of Planck's constant using photoelectric cell.
6. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
7. Determination of Stefan's Constant

Experiments on Solid State Physics-I:
8. Determination of Band gap of a semiconductor

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:
1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
3. Study of dispersive power of material of a prism.

4. Study of viscosity using Poiseullie's capillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory**.**

CO-PO Mapping:

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

Course Name: Basic Electronics Engineering Lab
Course Code: EC 191
Contact: 0:0:3
Credit: 1.5

Prerequisites: A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohm's law, Ampere's law.

Course Objective:
The objectives of this course are

1. To prepare the students to have a basic knowledge of active and passive components.
2. To build knowledge to distinguish pure and impure DC signals.
3. To grow measuring ability of signals through multi meter and CRO
4. To understand characteristics of proper biasing for BJT and FET.
5. To encourage in developing circuits using diodes, transistors, FETs and OPAMPs.

Course Outcomes:

CO1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
CO2	Analyse the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of Rectifier Circuits.
CO3	Determination of input-offset voltage, input bias current and Slew rate, Common- mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
CO4	Able to know the application of Diode, BJT & OPAMP.

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

Text Books:
1.D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2.Millman & Halkias, Integrated Electronics, Tata McGraw Hill.

3.Sedra & Smith, Microelectronics Engineering

Reference Books:

1.John D. Ryder, Electronic Fundamentals and Applications, PHI
2.J.B. Gupta, Basic Electronics, S.K. Kataria.
3.Malvino: Electronic Principle.
4.Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO-PO Mapping:

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

Course Name: Workshop/Manufacturing Practices
Course Code: ME 192
Contact: 0:0:3
Credit: 1.5

Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry

Course Objectives:
To understand the basic knowledge of Workshop Practice and Safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/fabrication processes

Course Outcomes:
CO1: Fabricate components with their own hands.
CO2: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.
CO3: Produce small devices of their interest for project or research purpose.

Course Content:
(i) Theoretical discussion & videos: (3P)
Detailed contents:
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting.

(ii) Workshop Practice:
Module 1 - Machine shop (6P)

Typical jobs that may be made in this practice module:
i. To make a pin from a mild steel rod in a lathe.
ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop (6P)
Typical jobs that may be made in this practice module:
i. To make a Gauge from MS plate.

Module 3 - Carpentry (6P)
Typical jobs that may be made in this practice module:
i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) (3P)
Typical jobs that may be made in this practice module:
i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arcwelding.

ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics (3P)
House wiring, soft Soldering

Module 6 – Smithy (3P)
Typical jobs that may be made in this practice module:
i. A simple job of making a square rod from a round bar or like.

For further study (Optional)
Module 7 - Casting
Typical jobs that may be made in this practice module:
i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting (3P)
Typical jobs that may be made in this practice module:
i. For plastic moulding, making at least one simple plastic component should be made.
ii. At least one sample shape on glass should be made using laser cutting machine.
Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:
1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of WorkshopTechnology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:
1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C.Sen and A.Bhattacharya, New Central Book Agency, Kolkata.

CO-PO Mapping:

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

Curriculum for B.Tech 2nd Semester

Under Autonomy (GR A: ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

2nd Semester								
Sl No	**Course Type**	**Course Code**	**Theory**	**Credit Hours /Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 201	Mathematics -II	3	1	0	4	4
2	BS	CH 201/ PH 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	3	0	0	3	3
3	ES	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	CS291	Programming for Problem Solving Lab	0	0	3	3	1.5
7	BS	CH 291/	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	1.5
8	ES	EE 291/	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	1.5
9	ES	ME 291/	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing	0	0	3	3	1.5
10	HS	HU 291	Language Lab	0	0	2	2	1
11	PROJ	PR 291	Project-II	0	0	1	1	0.5
12	PROJ*	PR 292	Innovative activities-I	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**34**	**24**

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Syllabus- 2nd Semester

Course Name: Mathematics - II
Course Code: M 201
Contact: 3:1:0
Total Contact Hours: 48
Credit: 4

Prerequisites: The students to whom this course will be offered must have the concept of (10+2) standard calculus.

Course Objectives: The objective of this course is to disseminate the prospective engineers with techniques in multivariable calculus, ordinary differential equations and Laplace transform. It aims to equip the students with concepts and tools at an intermediate to advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes:

CO1	Use mathematical tools to evaluate multiple integrals and vector integrals
CO2	Apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
CO3	Recall the properties of Laplace Transform to evaluate multiple integrals and their usage
CO4	Understand the concept of Laplace transform to solve ordinary differential equations.

Course Content:

Module I: Multivariable Calculus (Integration): (12 L)

Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module II: First Order Ordinary Differential Equations: (10 L)

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for p, solvable for y solvable for x and Clairaut's equation.

Module III: Second Order Ordinary Differential Equations: (12 L)

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module IV: Laplace Transform: (14L)

Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t f(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of f (t), LT of $\int f(t)dt$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1

Course Name: Chemistry
Course Code: CH201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Pre requisites: Knowledge of Chemistry up to 12^{th} standard.

Course Objective:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Course Outcomes:

CO1: Able to describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table

CO2: Able to apply fundamental concepts of thermodynamics in different engineering applications.

CO3: Able to apply the knowledge of water quality parameters, corrosion control & polymers to different industries.

CO4: Able to determine the structure of organic molecules using different spectroscopic techniques.

CO5: Capable to evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

Course Content:

Module I: Inorganic Chemistry (9 L)

(i) Atomic structure (5 L)

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.

(ii) Periodic properties (4 L)

Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

Module II: Physical Chemistry (8 L)

(i) Use of free energy in chemical equilibria (6 L)

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2^{nd} Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

(ii) **Real Gases (2 L)**

Reason for deviation of real gases from ideal behavior, Equations of state of real gases, Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

Module III: Organic Chemistry (8 L)

(i) **Stereochemistry (4 L)**

Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.

(ii) **Organic reactions (4L)**

Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction)

Module IV: Industrial Chemistry 8L

(i) **Water (2 L):** Hardness, alkalinity, numerical

(ii) **Corrosion. (2 L):** Types of corrosion: wet & dry, preventive measures

(iii) **Polymers (3 L):** Classification of polymers, conducting polymers, biodegradable polymers

(iv) **Synthesis of a commonly used drug molecule. (1 L):** Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry (3L)

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, ^{1}H Nuclear magnetic resonance spectroscopy, chemical shift

Text Books

(i) A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl

(ii) General & Inorganic Chemistry, P.K. Dutt

(iii) General & Inorganic Chemistry, Vol I, R.P. Sarkar

(iv) Physical Chemistry, P.C. Rakshit

Reference Books

(v) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell

(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(v) Physical Chemistry, by P. W. Atkins

(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

CO-PO Mapping:

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

Course Name: Basic Electrical Engineering
Course Code: EE201
Contact: 3:0:0
Total Contact hours: 36
Credits: 3

Prerequisites:

- Basic 12th standard Physics and Mathematics.
- Concept of components of electric circuit.

Course Objective:
To introduce the students to basic principles of DC and AC circuits, Electrical Machines and Electrical Systems.

Course Outcomes:

CO1: To understand Basic Electrical circuits, Power distribution and Safety measures.
CO2: To analyze an apply DC network theorems.
CO3: To analyze and apply concept of AC circuits of single-phase and three-phase.
CO4: To analyze and apply concepts of AC fundamentals in solving AC network problems.
CO5: To understand basic principles of Transformers and Rotating Machines.

Course contents:

Module I: DC Circuits (9L)
Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

Module II: AC Fundamentals (9L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R-L-C in series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and power triangle, Power factor, concept of resonance, Power in AC circuit, simple problems (series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement.

Module III: Single-Phase Transformer (5L)
Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit.

Module IV: Electrical Rotating Machines (8L)
a)DC Machines (4L)
Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

b) Three-Phase Induction Motor (4L)
Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problem.

Module V: General Structure of Electrical Power System (1L)

Power generation to distribution through overhead lines and underground cables with single line diagram.

Module VI: Electrical Installations (4L)

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger.

Text books:

1. D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
3. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4. Chakrabarti,Nath & Chanda, Basic Electrical Engineering, TMH.
5. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education**.**

Reference books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Printice Hall India, 1989.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	-	-	-	2	-	-	-	2	2	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	2	3	1	-	-	-	-	-	-	-	1	1
CO4	1	2	3	1	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1

Course Name: Programming for Problem Solving
Course Code: CS 201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Number system, Boolean Algebra

Course Outcomes:

CO1	Understand and differentiate among different programming languages for problem solving.
CO2	Describe the way of execution and debug programs in C language.
CO3	Define, select, and compare data types, loops, functions to solve mathematical and scientific problem.
CO4	Understand the dynamic behavior of memory by the use of pointers.
CO5	Design and develop modular programs using control structure, selection structure and file.

Course Content:

Fundamentals of Computer: (8 L)
History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number. Arithmetic – Addition and Subtraction (using 1's complement and 2's complement). 2L

Overview of Procedural vs Structural language, compiler and assembler (basic concepts) 1L

Problem solving- Algorithm & flow chart. 2L

C Fundamentals: (28 L)
Variable and Data Types:
The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. 2L

C Operators & Expressions:
Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity.
Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bit fields. 4L

Branching and Loop Statements:
Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue. 4L

Fundamentals and Program Structures:
auto, external, static and register variables Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro. 5L

Arrays, Strings and Pointers:
One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a

function Character array and string, array of strings, Passing a string to a function, String related functions, Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation. 7L

Structures and Unions:

Basic of structures, arrays of structures, structures and pointers, structures and functions. 3L

Files handling with C:

formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function. 3L

Text book:

Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition
Kanetkar Y. - Let us C, BPB Publication, 15th Edition

Reference Books:

E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition
K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition
Reema Thareja – INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITY PRESS, 2nd Edition

CO – PO Mapping:

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

Course Name: Engineering Mechanics
Course Code: ME 201
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Basic Concept of Physics

Course Objective:

This course teaches students how to apply Newtonian physics to relatively simple real life applications. This course covers statics, dynamics and elementary part of strength of materials.

Course Outcomes:

CO1: To understand representation of force, moments for drawing free-body diagrams and analyze friction based systems in static condition
CO2: To locate the centroid of an area and calculate the moment of inertia of a section.
CO3: Apply of conservation of momentum & energy principle for particle dynamics and rigid body kinetics
CO4: Understand and apply the concept of virtual work, rigid body dynamics and systems under vibration.

Course Content:

Module 1: Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. 6L

Module 2: Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. 2L

Module 3: Basic Structural Analysis: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. 3L

Module 4: Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. 5L

Module 5: Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. 5L

Module 6: Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular,

path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique). 5L

Module 7: Introduction to Kinetics of Rigid Bodies: Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. 5L

Module8: Mechanical Vibrations: Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. 5L

Text books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

Reference books:

1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

CO – PO Mapping:

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

Course Name: Programming for Problem Solving Lab
Course Code: CS291
Contacts: 0:0:3
Credits: 1.5

Prerequisites: Number system, Boolean Algebra.

Course Outcomes:

CO1	Learn the concept of DOS system commands and editor.
CO2	To formulate the algorithms for simple problems and to translate given algorithms to a working and correct program.
CO3	To be able to identify and correct syntax errors / logical errors as reported during compilation time and run time.
CO4	To be able to write iterative as well as recursive programs.
CO5	Learn the concept of programs with Arrays, Pointers, Structures, Union and Files.

List of Experiment:

- Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
- Writing C Programs on variable, expression, operator and type-casting.
- Writing C Programs using different structures of if-else statement and switch-case statement.
- Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
- Writing C Programs demonstrating concept of Single & Multidimensional arrays.
- Writing C Programs demonstrating concept of Function and Recursion.
- Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
- Writing C Programs demonstrating concept of structures, union and pointer to structure.
- Writing C Programs demonstrating concept of String and command line arguments.
- Writing C Programs demonstrating concept of dynamic memory allocation.
- Writing C Programs demonstrating concept of File Programming.

CO-PO Mapping:

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

Course Name: Chemistry Lab
Course Code: CH 291
Contact: 0:0:3
Credits: 1.5

Prerequisites: Knowledge of Physics up to 12^{th} standard.

Course Objective:

- Study the basic principles of pH meter and conductivity meter for different applications.
- Analysis of water for its various parameters & its significance in industries.
- Learn to synthesis Polymeric materials and drugs.
- Study the various reactions in homogeneous and heterogeneous medium.

Course Outcomes:

CO1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2: Able to analyse and determine the composition of liquid and solid samples working as an individual and also as an team member
CO3: Able to analyse different parameters of water considering environmental issues
CO4: Able to synthesize drug and polymer materials.
CO5: Capable to design innovative experiments applying the fundamentals of chemistry

List of Experiment:

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Determination of hardness of water
- Determination of chloride content of water
- Determination of the rate constant of a reaction
- Determination of cell constant and conductometric tritration
- pH metric titrations
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal

Innovative experiments (any one)

- Synthesis of silver nano particles
- Green synthesis

CO-PO Mapping:

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

Course Name: Basic Electrical Engineering Laboratory
Course Code: EE291
Contact: 0:0:3

Credits: 1.5

Prerequisites:

- Basic Physics and applied physics.
- Basic Mathematics.
- Basic concept of Electric Circuit

Course Objective:

To impart and apply knowledge about the Basic Electrical Components, Machineries, Instruments and Safety measures.

Course Outcomes:

CO1: Identify and use common electrical components.

CO2: To develop electrical networks by physical connection of various components and analyze the circuit behavior.

CO3: Apply and analyze the basic characteristics of transformers and electrical machines.

List of Experiments:

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter method.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	-	-	-	-	2	-	-	-	-	-	1
CO2	2	3	-	-	-	-	-	-	-	-	1	1
CO3	3	-	-	-	-	-	-	-	-	-	-	1

Course Name: Engineering Graphics & Design
Course Code: ME 291
Contact: 0:0:3
Credits: 1.5

Prerequisites: Basic knowledge of geometry

Course Objectives:
To learn detailed drawing and modeling of a system, component, or process which meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Course Outcomes:
CO1: Get introduced with Engineering Graphics and visual aspects of design.
CO2: Know and use common drafting tools with the knowledge of drafting standards.
CO3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO4: Produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

List of Drawing:

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing
Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids
Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only)

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial

Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics
Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering
Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, Changing line lengths (extend/lengthen); Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and non parametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models.

Module 6:
Demonstration of a simple team design project
Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, Use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:
1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

1. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO Mapping:

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

Course Name: Lang. Lab. and Seminar Presentation
Course Code: HU 291

Contact: 0:0:2
Credit: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objective: To train the students in acquiring interpersonal communication skills by focussing on language skill acquisition techniques and error feedback.

Course Outcomes:

CO1: Able to understand advanced skills of Technical Communication in English through Language Laboratory.
CO2: Able to apply listening, speaking, reading and writing skills in societal and professional life.
CO3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.
CO4: Able to analyze communication behaviours.
CO5: Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Content:

Module 1: Introduction to the Language Lab
a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 2: Active Listening
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Academic Listening vs Business Listening
d. Listening in Business Telephony
e. Study of Contextualized Examples based on Lab Recordings

Module 3: Speaking
a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice

Module 4: Lab Project Work
a. Making a brief Animation film with voice over (5 minutes)OR
b. Making a brief Documentary film (10 minutes)

Reference Books:
1.IIT Mumbai**, Preparatory Course in English** syllabus
2. IIT Mumbai, **Introduction to Linguistics** syllabus
3. Sasikumar et al. *A Course in Listening and Speaking*. New Delhi: Foundation Books, 2005.
4. Tony Lynch, *Study Listening*. Cambridge: Cambridge UP, 2004.

CO – PO Mapping :

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

Course Name: NSS/Physical Activities/ Meditation & Yoga/ Photography/Nature Club
Course Code: MC 281
Contact: 0:0:3

Course Objectives:

- To increase student awareness about the weaker and unprivileged sections of society
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

List of Activities:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness ``
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes: 1.Adult education 2. Children's education

Proposal for local slum area development : One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

• Resource conservation – Awareness to be developed on water, energy,soil.
• Preservation of heritage monuments- Marches, poster campaigns
• Alternative energy consciousness amongst younger school-children.
• Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
• Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution of rations, medicine, clothes etc.;
h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

3RD SEM CURRICULUM

3rd Semester								
SL No	Course Type	Course Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	ME 301	Engineering Thermodynamics	3	0	0	3	3
2	PC	ME 302	Strength of Material	3	0	0	3	3
3	PC	ME 303	Fluid Mechanics	3	0	0	3	3
4	PC	ME 304	Materials Engineering	3	0	0	3	3
5	BS	M 301	Mathematics -III	3	1	0	4	4
6	BS	PH(ME)301	Physics - II	3	0	0	3	3
Total of Theory							**19**	**19**
B. PRACTICAL								
7	PC	ME 391	Material Testing Lab	0	0	3	3	1.5
8	PC	ME 392	Machine Drawing	0	0	3	3	1.5
9	BS	PH(ME)391	Physics – II Lab	0	0	2	2	1
10	PROJ	PR 391	Project-III	0	0	2	2	1
11	PROJ*	PR 392	Innovative activities-II	0	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 301	Environmental Science	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**32**	**24.5**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Syllabus- 3rd Semester

Course Name: Engineering Thermodynamics

Course Code: ME 301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Physics (10+2 level)

Course Objectives:

- To learn about work and heat interactions, and balance of energy between system and its surroundings
- To learn about application of I law to various energy conversion devices
- To evaluate the changes in properties of substances in various processes
- To understand the difference between high grade and low grade energies and II law limitations on energy conversion

Course Outcomes:

CO1: Learn about the interrelationship of heat and work to draw an energy balance between a system and its surroundings.
CO2: Understand the second law limitation of energy conversion and differentiate realistic and unrealistic thermodynamic systems.
CO3: Carry out Entropy and Exergy analysis of thermal systems to evaluate sustainability of practical equipments in industries.
CO4: Evaluate the performance of energy conversion devices using utility thermodynamic cycles.

Course Contents:

Module	Syllabus	Contact Hrs
1 - Fundamentals	System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.	4
2 - Temperature & First Law of Thermodynamics	Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.	4
3- Pure substance	Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states &	7

4 – First Law for Flow Processes	Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control	5
5 – Second law of Thermodynamics	Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale	5
6 – Entropy and its application	Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy from steam tables- Principle of increase of entropy; Illustration of processes in Ts coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles. Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.	7
7 – Thermodynamic cycles	Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.	4
	Total Contact Hours	**36 lectures**

Text Books:

1. Yunus A. Cengel , Michael A. Boles , 2014, 8th Edition, Thermodynamics**:** An Engineering Approach, McGraw-Hill Education.
2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

CO-PO Mapping:

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

Course Name: Strength of Materials
Course Code: ME 302
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Engineering Mechanics

Course Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
- To calculate the elastic deformation occurring in various simple geometries for different types of loading

Course Outcomes:

CO1: Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components
CO2: Evaluate the strains and deformation in materials that will result due to the elastic stresses developed within the materials for simple types of loading.
CO3: Quantify mechanical integrity and failure in materials
CO4: Analyze application of materials with respect to their strength and weakness.

Course Contents:

Module	Syllabus	Contact Hrs
1 - Deformation in solids	Hooke's law, stress and strain- tension, compression and shear stresses, elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.	**7**
2 – Failure Theorie	Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb Theory	**4**
3 – Beams	Beams and types of transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.	**7**
4 – Moment of inertia	Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.	**6**
5 – Torsion	Torsional stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.	**6**
6 – Pressur e	Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure	**6**
Total Hours (36 lectures)		

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi 2005.

CO – PO Mapping:

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

Course Name: Fluid Mechanics
Course Code: ME 303
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites: Physics and Mechanics (10+2 level)

Course Objectives: To introduce and explain fundamentals of Fluid Mechanics which is useful in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics, Heat Transfer, Power Plant etc.

Course Outcomes:
CO1: Get knowledge about fluid flow properties and analyze hydrostatic forces on flat or curved surfaces.
CO2: Explore the detailed analysis of kinematics and dynamics of fluid for laminar and turbulent flow and exploit the conservation equations for the flow regimes of practical interest.
CO3: Learn about boundary layer theory for a variety of constraints and understand the basics of a turbulent flow.
CO4: Explain the basics of compressible flow and apply for dimensional analysis for practical prototyping.

Course Contents:

Module No.	Syllabus	Contact Hrs.
1- Introduction	Introduction to Fluid Mechanics - Fluid, Fluid types, Newton's law of viscosity, surface tension	02
2- Analysis of Fluid Motion	**Fluid statics:** Forces on submerged surfaces; forces or vertical, horizontal, inclined and curved surfaces, Center of pressure. Stability of floating bodies. **Fluid kinematics:** fluid flow and classifications. Continuity equation in 1D & 3D. Potential flow & Stream function; types of flow lines. **Dynamics of fluid:** equations of motion; Euler's equation; Navier-Stokes equation; Bernoulli's equation; Applications of Bernoulli's equation.	03 03 03
3- Viscous and Turbulent Flow	Flow through circular pipes, Flow between parallel plates, momentum and energy correction factors**,** Reynold's experiment, characteristics of turbulent flow, velocity distribution in turbulent flow through pipes in terms of average velocity.	05
4- Flow through pipes	Fluid friction in pipes, head loss due to friction. Darcy–Weisbach equation of friction loss; hydraulic grade line and total energy line. Variation of friction factor with wall roughness – Moody's chart. Minor losses in pipes.	04

4- Flow Measurement	Orifices, notches and weirs: Basic principle for flow through orifices, rectangular and V-notches, rectangular and trapezoidal weir.	03
5- Boundary layer flow	Definition; Boundary layer separation – basic concept. Drag force on a flat plate due to boundary layer, Turbulent layer on a flat plate, displacement thickness, momentum thickness and energy	04
6- Submerged bodies	Flow of fluid and forces around submerged bodies; basic concepts of drag and lift.	03
7- Dimensional Analysis	Dimensions and dimensional homogeneity, Importance and use of dimensional analysis. Buckingham's π theorem with applications. Geometric, Kinematic and Dynamic similarity, Non Dimensional Numbers, Model studies	03
8- Compressible Flow	Thermodynamic relations, Basic equations of compressible flow, velocity of pressure wave in a fluid, Mach number, Stagnation properties, area velocity relationship, flow of compressible fluid through orifices and nozzles fitted to a large tank.	03

Text Books:

1. Introduction to Fluid Mechanics & Fluid Machines – Som & Biswas, TMH
2. Fluid Mechanics & Machinery – R.K.Bansal, Luxmi Publications.
3. A textbook on Fluid Mechanics and Hydraulic Machines – Sukumar Pati, TMH
4. Fluid Mechanics & Turbo Machines – M.M.Das, PHI, 2010.

Reference Books:

1. Introduction to Fluid Mechanics – Fox & Macdonald, Wiley.
2. Fluid Mechanics – Fundamentals & Applications – Cengel & Cimbala, TMH.
3. Mechanics of Fluid – Bernard Massey, Taylor & Francis.

CO – PO Mapping:

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

Course Name: Materials Engineering
Course Code: ME 304
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Engineering Physics and Engineering Chemistry.

Course Objectives:

a. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
b. To provide a detailed interpretation of equilibrium phase diagrams
c. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Course Outcomes:

CO1: Identify crystal structures for various materials and understand the defects in such structures
CO2: Analyze the effect of heat treatment of mechanical properties of a material
CO3: Understand how to tailor material properties of ferrous and non-ferrous alloys
CO4: Learn about advanced materials useful in modern industrial application.

Course Contents:

Module	Syllabus	Contact Hrs
1 – Crystal Structure	Unit cells, Metallic crystal structures, Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.	**6**
2 – Mechanical Property measurement	Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell, Vickers and their relation to strength.	**7**
3 – Metals & Alloys	Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; Iron - Iron-carbide phase diagram, and microstructure analysis of ferrous materials, cast iron, steel.	**6**
4 – Heat treatment	Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction	**7**
5 – Alloying of steel	Properties of stainless steel and tool steels, maraging steels- cast irons; - copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al -Cu –Mg alloys- Nickel based superalloys and Titanium alloys	**5**
6- Ceramics and Advanced Materials	Structure, properties and application of ceramics, Composite Types, Types and properties of main composition, Smart Materials, Ferroelastic and Piezoelectric materials, Nanomaterials, Biomaterials, Shape memory alloys	**5**
	Total Contact Hours	**36 L**

Text Books:

1. W. D. Callister, 2006, Materials Science and Engineering-An Introduction, 6th Edition, Wiley India.
2. V. Raghavan, Material Science and Engineering, Prentice Hall of India Private Limited, 1999.

3. U. C. Jindal, Engineering Materials and Metallurgy, Pearson, 2011.

Reference Books:

1. Kenneth G. Budinski and Michael K. Budinski, Engineering Materials, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.

CO – PO Mapping:

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

Course Name: Mathematics- III
Course Code: M 301
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard calculus, basic probability and differential equations.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with advanced techniques for solving ordinary differential equations and basic techniques for solving partial differential equations. It also aims to equip the students with concepts and tools of calculus of complex variables, Fourier series and Fourier transform, and probability distribution as an intermediate to the advanced level of applications that they would find useful in their disciplines.

Course Outcomes:

CO1	Recall the underlying principle and properties of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.
CO2	Exemplify the variables, functions, probability distribution and differential equations and find their distinctive measures using the underlying concept of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.
CO3	Apply Cauchy's integral theorem and the residue theorem to find the value of complex integration, and compute the probability of real world uncertain phenomena by indentifying probability distribution that fits the phenomena.
CO4	Solve partial differential equation using method of separation of variables and ordinary differential equation using techniques of series solution and special function (Legendre's and Bessel's).
CO5	Find the Fourier series and Fourier transform of functions by organizing understandings of underlying principles and also evaluate the integral using Parseval's identity.

Course Content:

MODULE I: Fourier series and Fourier Transform: (12 L)

Fourier series: Dirichlet's Conditions; Euler's Formula for Fourier Series; Fourier Series for functions of period 2π; Sum of Fourier series (examples); Theorem for the convergence of Fourier series (statement only); Fourier series of a function with its periodic extension; Half range Fourier series: Construction of half range Sine series and half range Cosine Series; Parseval's identity (statement only) and related problems.

Fourier Transform: Fourier Transform, Fourier Cosine Transforms, Fourier Sine Transforms (problems only); Properties of Fourier Transform: Linearity, Shifting, Change of Scale, Modulation (problems only); Fourier Transform of Derivatives (problems only); Convolution Theorem (statement only), Inverse of Fourier Transform (problems only).

MODULE II: Probability Distributions: (12 L)

Random Variable: Discrete and Continuous (definition & examples); Probability Distribution (definition & examples); Probability Mass Function, Probability Density Functionand Distribution Function for a single random variable only (definition, properties & related problems); Expectation, Varianceand Standard Deviation for a single random variable only (definition, properties & related problems); Binomial Distribution, Poisson Distribution, Binomial Approximation to Poisson Distribution and Normal Distribution (problems only), Mean, Variance and Standard Deviation of Binomial, Poisson and Normal Distribution (problems only).

MODULE III: Calculus of Complex Variable: (12 L)

Functions of a Complex Variable (definition and examples); Concept of Limit, Continuity and Differentiability (problems only); Analytic Functions (definition and examples); Cauchy-Riemann Equations (statement only& related problems); Sufficient condition for a function to be analytic (statement only & related problems).

Concept of Simple Curve, Closed Curve, Smooth Curve & Contour; Some elementary properties of complex integrals (problems only); Cauchy's Theorem (statement only & related problems); Cauchy's Integral Formula(statement only & related problems); Cauchy's Integral Formula for the derivative of an analytic function(statement only & related problems); Cauchy's Integral Formula for the successive derivatives of an analytic function (statement only & related problems); Taylor's series and Laurent's series (problems only).

Zero of an Analytic Function and its order (definition & related problems); Singularities of an Analytic Function: Isolated Singularity and Non-isolated Singularity (definition & related problems); Essential Singularities, Poles (Simple Pole and Pole of Order □) and Removable Singularities (definition & related problems); Determination of singularities and their nature (problems only); Residue (definition & examples); Determination of the residue of a given function; Cauchy's Residue theorem (statement only & related problems).

MODULE IV: Partial Differential Equation (PDE) and Series Solution of Ordinary Differential Equation (ODE): (12 L)

Solution of PDE: Method of Separation of Variables.

Solution of Initial Value & Boundary Value Problem: One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation.

Series solution of ODE: General method to solve $□_0 □'' + □_1 □' + □_2 □ = 0$ and related problems to Power series method**,** Bessel's Function, Legendre Polynomial.

Text Books:

1. Herman, R. L. *An Introduction to Fourier Analysis*, Chapman and Hall/CRC, 2016.
2. Grafakos, L. *Classical Fourier Analysis*, Springer, India, Private Ltd.
3. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
4. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
5. Mathews, J. H. and Howell, R. W. *Complex Analysis for Mathematics & Engineering,* Jones & Bartlett Pub, 2006.
6. Chowdhury, B. *Elements of Complex Analysis*, New Age International, 1993.
7. Raisinghania, M .D. *Advanced Ordinary & Partial Differential. Equation*; S. Chand Publication.
8. Ross, S. L. *Differential Equations*, John Willey & Sons.
9. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
10. Kreyszig, E. *Advanced Engineering Mathematics*, John Wiley & Sons, 2006.

Reference Books:

6. Gray, R. M. and Goodman, J. *Fourier Transforms: An Introduction for Engineers*, Springer, US, 1995.
7. Lipschutz & Lipson, *Schaum's Outline in Probability (2ndEd)*, McGraw Hill Education.
8. Spiegel, M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*, McGraw Hill Book Co.
9. Goon, A.M., Gupta M .K. and Dasgupta, B. *Fundamental of Statistics*, The World Press Pvt. Ltd.

10. Soong, T. T. *Fundamentals of Probability and Statistics for Engineers*, John Wiley & Sons Inc, 2004.
11. Delampady, M. *Probability & Statistics*, Universities Press.
12. Spiegel, M. R. *Theory and Problems of Complex Variables (Schaum's Outline Series)*, McGraw Hill Book Co.
13. Sneddon, I. N. *Elements of Partial Differential Equations,* McGraw Hill Book Co.
14. Boyce, W. E. and DiPrima, R. C. *Elementary Differential Equations and Boundary Value Problems*, Wiley India, 2009.
15. Rao, B. *Differential Equations with Applications & Programs*, Universities Press.
16. Murray, D. *Introductory Courses in Differential Equations*, Universities Press.

CO-PO Mapping:

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

Course Name: Physics - II
Course Code: PH (ME)301
Contact: 3:0:0
Total contact hours: 36
Credits: 3

Prerequisites: Physics I

Course Outcomes:

CO1: Explain electron transport in semiconductors using energy and theory.
CO2: Apply Schrödinger equation in variety of atomic scale problems including nanomaterials.
CO3: Analyze the physics of various kinds of electric and magnetic materials
CO4: Justify the importance of Fermi energy level in turning electronic properties of various semiconductors

Course Contents:

Module 1: Electric and Magnetic properties of materials (7L) Module
1.01: Insulating materials:
Dielectric Material: Concept of Polarization, the relation between **D, E** and **P**, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), internal field, Claussius Mossotti equation, ferroelctric and piezoelectrics (Qualitative study). 3L
Module 1.02: Magnetic materials and storage devices:
Magnetic Field & Magnetization M, relation between **B, H, M**. Bohr magneton, susceptibility, Diamagnetism- & Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of θp , Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) **4L**

Module 2: Ultrasound and infrasound (4L)
Ultrasound-Introduction, definition and properties –Production of ultrasonics by Piezo-electric crystal and magnetostriction method; Detection of ultrasonics; Engineering applications of Ultrasonics (Non-destructive testing, cavitations, measurement of gauge), **Infrasound** – Introduction and definition, production, application: 4L

Module 3: Quantum Mechanics-II (7L)
Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation.4L
Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only $E<V_0$). 3L

Module 4: Statistical Mechanics (4L)
Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. 4L

Module 5: Solid state physics (8L)
5.1 : Introduction to Band theory (mention qualitatively improvement over free electron theory)-Kronig-Penny model (qualitative treatment)-Energy-band (E-k) diagram, formation of allowed and forbidden energy bands, Concept of effective mass – electrons and holes, crystal momentum. 3L
5.2 : Defects: Point defects; line defects; Dislocations, Types of dislocations, Planar defects, stacking faults, twins, grain boundaries, defect propagation (qualitative). 3L
5.3 : Vibration in solids: Lattice vibrations – Mono and diatomic lattice, concept of phonon, specific heat of solids-Dulong-Pettit law, Einstein, Debye theory (qualitative discussion). 2L

Module 6: Physics of Nanomaterials (3L)
Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, grapheme,electronic, environment, medical). 3L

CO-PO Mapping:

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

Course Name: Materials Testing Laboratory
Course Code: ME 391
Contact: 0:0:3
Credits: 1.5

Prerequisites: Engineering Chemistry.

Course Objective:
To measure the mechanical properties of a material to understand the deformation behavior of

materials and observe the microstructure of a material sample under heat treatment.

Course Outcomes:

1. To understand the deformation behavior of materials
2. To observe the microstructure of a material sample under heat treatment.
3. To measure the mechanical properties of a material

List of experiments:

At least 6 experiments need to be conducted.

1. Uniaxial tension test on mild steel rod
2. Torsion test on mild steel rod
3. Impact test on a metallic specimen
4. Brinnell and Rockwell hardness tests on metallic specimen
5. Bending deflection test on beams
6. Strain measurement using Rosette strain gauge
7. Microscopic examination of heat-treated and untreated metallic samples

CO – PO Mapping:

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

Course Name: **Machine Drawing**
Course Code: **ME 392**
Contact: **0:0:3**
Credits: **1.5**

Prerequisite: Basic knowledge of Machine elements, engineering drawing/drafting

Course Objecive: The objective of this lab is to practically demonstrate the failure criteria of different mechanical elements or bodies.

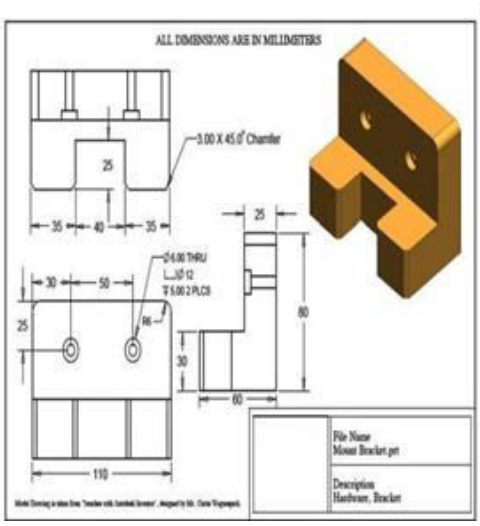
Course Outcomes:

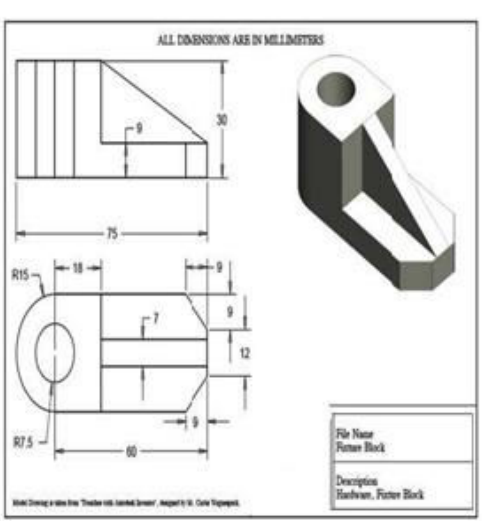
CO1: Gain knowledge about the isometric views of a given three dimensional object/part.
CO2: Understand and draw the orthogonal projection of a solid body and assemble drawing using part drawings.
CO3: Learn and practice 3D modeling of machine parts using AutoCAD/Solidworks/Catia.
CO4: Draft the shape and structure of different types of screws, keys and Couplings

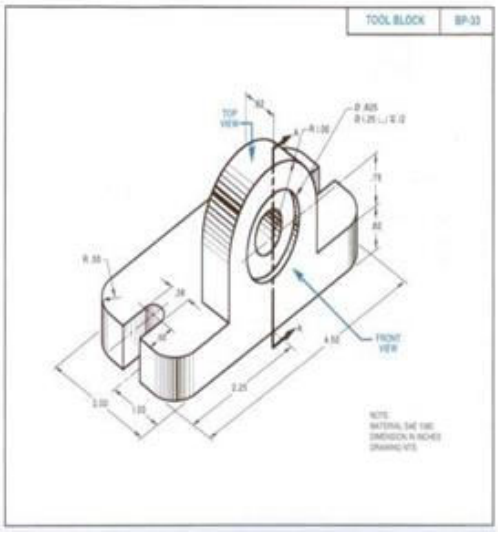
List of Drawing:

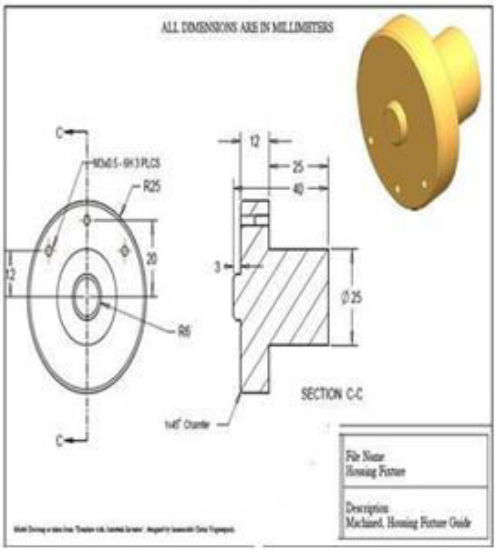
Experiment No.	Description
1	Schematic product symbols for standard components in welding and pipe joints
2	Orthographic projections of machine elements, different sectional views- full, auxiliary sections, Isometric projection of components (Manual and CAD)
3	Assembly and detailed drawings of a mechanical assembly (Manual Drafting) a) Plummer block b) Tool head of a shaping machine c) Tailstock of a lathe d) Welded pipe joints indicating work parts before welding

Experiment No.	Description
4	Basic 3D modeling practice of simple machine elements using AutoCAD or SolidWorks (At least 10, samples given)









Text Books:

1. Text Book on Engineering Drawing, Narayana/Kannaia H, Scitech
2. Mechanical Engineering Drawing and Design, S. Pal and M. Bhattacharyya
3. Machine Drawing by N.D. Bhatt
4. Machine Drawing by P.S. Gill
5. Engineering Drawing and Graphics + AutoCAD by K. Venugopal, New Age International Pub.
6. Engineering Drawing with an Introduction to AutoCAD by D.A. Jolhe, Tata-McGraw-Hill Co.
7. Introduction to Solid Modeling Using SolidWorks 2008, Joseph C. Musto and William E. Howard
8. SOLIDWORKS 2016 Basic Tools, Paul Tran.

CO-PO Mapping:

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

Course Name: Physics – II Lab
Course Code: PH(ME)391
Contacts: 0:0:2
Credit: 1

Prerequisite: Physics – II Theory

Course Objectives: To enable students carry out several experiments on applied physics and apply the knowledge in innovative solution in mechanical engineering.

Course Outcomes:
CO1: Demonstrate experiments allied to their theoretical concepts
CO2: Conduct experiments using semiconductors , dielectric and ferroelectrics, ultrasounds
CO3: Classify various types of magnetic materials
CO4: Participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO5: Analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

List of Experiments:

Experiments on Module 1: Electric and Magnetic properties of materials (9L)

1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent)/Measurement of losses in a dielectric using LCR circuits.

Experiments on Module 2: Ultrasound and infrasound (4L)
6. Determination of velocity of ultrasonic wave using piezoelectric crystal.

Experiments on Module 3: Quantum Mechanics-II (7L)
7. Determination of Stefan's radiation constant.
8. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
9. Measurement of specific charge of electron using CRT.

Experiments on Module 5: Solid state physics (8L)
10. Study of lattice dynamics.
11. Determination of band gap of a semiconductor.
12. Determination of Hall co-efficient of a semiconductor and measurement of Magneto-resistance of a given semiconductor

In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:
1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.

2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO Mapping:

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

Course Name: Environmental Science
Course Code: MC301
Contact: 3:0:0
Total Contact Hours: 36

Prerequisite: Basic Chemistry

Course Objective:

- Be able to understand the natural environment and its relationships with human activities.
- Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcomes

CO1: Able to understand the natural environment and its relationships with human activities.
CO2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3: To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course Content:

1. General **11 L**

1.1 Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy
1.2 Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography
1.3 Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)
1.4 Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web,
Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems
1.5 Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

2. Air pollution and control **10L**
2.1 Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant
2.2 Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

2.3 Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion
2.4 Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion
2.5 control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury),

3. Water Pollution **9L**
3.1 Classification of water (Ground & surface water)
3.2 Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.
3.3 Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD
Lake: Eutrophication [Definition, source and effect].
3.4 Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)
3.5 Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride
3.7 Layout of waste water treatment plant (scheme only).

4. Land Pollution **3L**
4.1 Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste
4.2 Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).
4.3 Waste management: waste classification, waste segregation, treatment & disposal

5. Noise Pollution **3L**
5.1 Definition of noise, effect of noise pollution on human health,
5.2 Average Noise level of some common noise sources
5.3 Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L10$ (18 hr Index) .
5.4 Noise pollution control.

Text Books:

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited
2. Environmental Studies, Dr. J P Sharma, University Science Press
3. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO – PO Mapping:

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

DEPARTMENT OF MECHANICAL ENGINEERING
REGULATION 2018 - Syllabus of 4th Semester ME-UG Program

4th Semester								
Sl No	**Course Type**	**Course Code**	**Theory**	**Contact Hours /Week**				**Credit Points**
				L	**T**	**P**	**Tota**	
A. THEORY								
1	PC	ME401	Fluid Machinery	3	0	0	3	3
2	PC	ME402	Manufacturing Process	3	0	0	3	3
3	PC	ME403	Kinematics & Dynamics of Machines	3	0	0	3	3
4	PC	ME404	Applied Thermodynamics	3	0	0	3	3
5	ES	ME405	Data Structure and algorithm	2	0	0	2	2
6	ES	M(ME)401	Numerical Methods	2	0	0	2	2
Total of Theory							**16**	**16**
B. PRACTICAL								
7	PC	ME491	Fluid Mechanics & Fluid Machines	0	0	3	3	1.5
8	PC	ME492	Manufacturing Process Lab	0	0	3	3	1.5
9	PC	ME493	Dynamics of Machine Lab	0	0	3	3	1.5
10	PROJ	PR 491	Project-IV	0	0	2	2	1
11	PROJ*	PR 492	Innovative activities-III	0	0	0	0	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC401	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							**30**	**22**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Program Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Fluid Machinery
Course Code: ME 401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Fluid Mechanics

Course Outcomes:

CO1: Understand the mechanism of jet propulsion for a variety of conditions and analyze it's effects for practical applications.
CO2: Learn the design and working principle of hydraulic turbines and apply in a practical case study or project work on hydel plants.
CO3: Analyze the working of various pumps and evaluate their performance of practical interest in a plethora of applications.
CO4: Utilize knowledge of various modern hydraulic machines for varied industrial applications.

Course Contents:

Module No.	Syllabus	Contact Hrs.
1.	Impact of Jets and Jet Propulsions: Force exerted by a liquid jet on a stationary flat plate, force exerted by a liquid jet on a stationary curved vane, force exerted by a liquid jet on a hinged plate, force exerted by a liquid jet on moving flat plates, force exerted by a liquid jet on moving curved vane, jet propulsion.	4
2.	Hydraulic Turbines: Essential element of a hydroelectric power plant; head and efficiencies of hydraulic turbines; classifications of hydraulic turbines, Pelton turbine, reaction turbine, Francis turbine, Kaplan turbine; draft tube; cavitation in hydraulic machines; dimensional analysis and similarity laws for rotodynamic machines; specific speed of hydraulic turbines; unit quantities of hydraulic turbines; characteristic curves of hydraulic turbines; governing of turbines.	8
3.	Centrifugal Pump: Components of a centrifugal pump, working principle, work done, different heads in a pumping system, different efficiencies, characteristics, minimum speed for starting a centrifugal pump, multistage centrifugal pumps, specific speed, model testing, cavitation, net positive suction head.	8
4.	Positive Displacement Pump: Components of a reciprocating pump, working principle, types of reciprocating pumps, discharge and power requirement, slip and coefficient of discharge, variation of velocity and acceleration in the suction and delivery pipes due to acceleration of the piston, frictional head on suction and delivery pipes, indicator diagram, air vessels. Introduction gear pump, lobe pump, vane pump, piston pump,	8

5.	Miscellaneous Hydraulic Machines: Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic ram, hydraulic lift, hydraulic crane, hydraulic coupling, hydraulic torque converter, hydraulic actuators, hydraulic valves.	8
Total Contact Hours		**36 L**

Text Books:

1. A textbook on Fluid Mechanics and Hydraulic Machines – Sukumar Pati, TMH
2. Fluid Mechanics & Machinery – R. K. Bansal, Luxmi Publications.
3. Introduction to Fluid Mechanics & Fluid Machines – Som Biswas, Chakraborty, TMH.
4. Fluid Mechanic s & Turbo Machines – M.M. Das, PHI, 2010.

Reference Books:

1. Fluid Mechanics & Machinery – C. Ratnam, A.V. Kothapalli, I.K. International Publishing House Ltd, 2010.
2. Fluid Mechanics & Machinery – C.S.P Ojha, R. Berndtsson, P.N. Chandramouli, OUP.
3. Introduction to Fluid Mechanics – Fox & Macdonald, Wiley.
4. Fluid Mechanics – Fundamentals & Applications – Cengel & Cimbala, TMH.

CO – PO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	1	-
CO2	2	3	2	2	-	1	-	-	-	-	1	1
CO3	2	2	1	1	-	1	-	-	-	-	1	-
CO4	2	3	2	-	1	1	1	-	-	-	1	2

Course Name: Manufacturing Processes
Course Code: ME 402
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Materials Engineering

Course Outcomes:

CO1: Understand the basics of manufacturing processes and concerned behavior of material properties.
CO2: Explain various casting processes for different molding designs and forming techniques for metal works.
CO3: Understand welding methods and analyze solid or liquid state joining
CO4: Analyze the principle of cutting tools and practice machining processes

Course Contents:

Module	Syllabus	Contact Hrs
1– Metal Casting	Casting and Molding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.	**8**
2– Metal Forming	Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending), principles of powder metallurgy.	**8**
3– Joining Processes	Physics of welding, brazing and soldering; Design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.	**10**
4– Metal Cutting	Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids; Turning, Drilling, Milling and finishing processes, Coating	**10**
	Total Contact Hours	**36 L**

Text Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems.
3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing

CO – PO Mapping:

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

Course Name: Kinematics & Dynamics of Machines
Code: ME 403
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Physics successful completion of this course Students will be able to

Course Outcomes:

CO1: Understand the kinematics and rigid- body dynamics of kinematically driven machine components
CO2: Understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
CO3:. Design and analyze cam and gear based mechanisms to generate specified output motion
CO4: Explore the mechanism of bearings and understand vibration based systems

Course Contents:

Module	Syllabus	Contact Hrs
1– Mechanisms	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms	6
2– Velocity & Acceleration	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coincident points- Coriolis component of acceleration- introduction to linkage synthesis three position graphical synthesis for motion and path generation	**8**
3– Cam Drive	Classification of cams and followers- Terminology and definitions- Displacement diagrams, Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers	**6**
4- Gear Drive	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.	**6**
5- Friction & Bearings	Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication friction clutches- belt and rope drives- friction in brakes	**6**

6 - Vibration	Natural and Transverse vibration, Free and forced Vibration, Damping, Torsional vibration	**4**
Total Contact Hours		**36**

Text Books:

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
2. CleghornW.L. , Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata Mc Graw Hill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East West Pvt. Ltd, New Delhi, 1988.

CO – PO Mapping:

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

Course Name: Applied Thermodynamics
Course Code: ME 404
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Engineering Thermodynamics

Course Outcomes:

CO1: Get a good understanding of various practical power cycles and heat pump cycles.
CO2: Analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers.
CO3: Understand phenomena occurring in high speed compressible flows and study the functioning and application of compressors.
CO4: Learn the concepts, types and working principles and define their different types of efficiencies

Course Contents:

Module	Syllabus	Contact Hrs
I – Fuels and combustion analysis	Introduction to solid, liquid and gaseous fuels – Stoichiometry, exhaust gas analysis - First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and composition calculations using free energy	**6**
II – Vapor Based Cycles	Vapor power cycles, Rankine cycle with superheat, reheat and regeneration, exergy analysis. Supercritical and ultra-supercritical Rankine cycle - Vapor compression refrigeration cycles, refrigerants and their properties.	**8**
III – Gas Based Cycles	Gas power cycles, Air standard Otto, Diesel and Dual cycles - Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles	**8**
IV– Psychrometry	Properties of dry and wet air, use of psychrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.	**4**
V – Reciprocating compressors	Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.	**5**
VI – Nozzle and Diffuser	Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- Flow of steam and refrigerant through nozzle, supersaturation, compressible flow in diffusers, efficiency of nozzle and diffuser	**5**
Total Contact Hours		**36**

Text Books:

1.Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of Thermodynamics*, John Wiley and Sons.
2. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd

Reference Books

1. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
2. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.

CO – PO Mapping:

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

Course Name: Data Structure and Algorithm
Course Code: ME 405
Contact: 2:0:0
Total Contact hours: 24
Credits: 2
Prerequisite: C language

Course outcomes:

CO1: For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
CO2: For a given Search problem (Linear Search and Binary Search) student will able to implement it.
CO3: For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
CO4: Students will able to write algorithms and practice programming in C++.

Course contents:

Module	Syllabus	Contact Hrs
I – Introduction	Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	**5**
II – Stacks and Queues	ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	**5**
III – Linked Lists and Trees	Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.	**8**
IV– Sorting and Hashing	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.	**4**

V – C++	Object oriented Programming using C++	**2**
Total Contact Hours		**24**

Text Book:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Reference books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	-	-	-	1	1
CO2	1	1	-	-	-	-	-	-	-	-	1	1
CO3	1	1	-	-	-	-	-	-	-	-	1	1
CO4	2	1	1	2	-	-	-	-	-	-	2	1

Course Name: Numerical Methods
Course Code: M(ME) 401
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Prerequisite: Concept of differential Calculus and Algebra

Course Outcomes:

CO1	Recall the distinctive characteristics of various numerical techniques and the associated error measures
CO2	Understand the theoretical workings of various numerical techniques to solve the engineering problems and demonstrate error
CO3	Apply the principles of various numerical techniques to solve various problems

Course Content:

Module	**Syllabus**	**Contact Hours**
Approximation in numerical computation	Truncation and rounding errors, Propagation of errors, Floating-point arithmetic.	(2L)
Interpolation	Calculus of Finite Differences, Newton forward and backward interpolation, Newton's divided difference interpolation, Lagrange's interpolation.	(8L)
Numerical Integration	Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule, Expression for corresponding error terms.	(4L)
Numerical solution of a system of linear equations:	Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method.	(4L)
Solution of transcendental equations	Bisection method, Regula-Falsi method, Newton-Raphson method.	(3L)
Numerical solution of ordinary differential equation	Euler's method, Modified Euler method, Fourth order Runge-Kutta method.	(3L)
Total Contact Hours		**24**

Text Books:

1. Shishir Gupta & S. Dey, Numerical Methods, TMH
2. C.Xavier: C Language and Numerical Methods, New Age International Publishers.
3. Jain, Iyengar & Jain: Numerical Methods (Problems and Solution), New Age International Publishers.
4. S. S. Sastry: Introductory methods of numerical analysis, PHI

References Books:

1.Balagurusamy: Numerical Methods, McGraw Hill Education.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.
6. Numerical Analysis, Shastri, PHI
7. Numerical Analysis, S. Ali Mollah
8. Numerical Analysis, James B. Scarbarough
9. Numerical Methods for Mathematics, Science & Engg., Mathews, PHI
10. Numerical Analysis,G.S.Rao, New Age International

CO-PO Mapping:

PO / COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1

Course Name: Fluid Mechanics & Fluid Machines Lab
Course Code: ME 491
Contact: 0: 0: 3
CreditS: 1.5

Prerequisite: Fluid Mechanics and Fluid Machines

Course Outcomes:

CO1: Recall the coefficient of discharge for several flow measuring devices to explore the reasons of differences in theoretical calculation and practical measurements.
CO2: Demonstrate hydraulic turbine and carry out their performance.
CO3: Examine and understand pump working characteristics under given constraints.
CO4: Estimate frictional forces applicable in a flow channel to determine major and minor losses.

List of Experiments:

1. Measurement of Coefficient of Discharge of an Orifice
2. Measurement of Coefficient of Discharge of a Venturimeter
3. To verify the Bernoulli's Theorem
4. To find the critical Reynolds number for pipe flow
5. To determine friction factor for a flow through pipe
6. Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe
7. Determination of the performance characteristics of a centrifugal pump
8. Determination of the performance characteristics of a Pelton Wheel
9. Determination of the performance characteristics of a Francis Turbine.
10. Determination of the performance characteristics of a Kaplan Turbine

CO – PO Mapping:

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

Course Name: Manufacturing Process Lab
Course Code: ME 492
Contacts: 0: 0: 3
CreditS: 1.5

Prerequisite: Manufacturing Process

Course Outcomes:

CO1: Fabricate basic parts and assemblies using machine shop equipment
CO2: Ascertain product and process quality levels through the use of precision measurement tools and statistical quality control charts.
CO3: Practice basic welding and forming techniques and modern improvements for sophisticated metal works.

List of Experiments:

Experiment No.	Description
1	To determine the percentage of clay content in dry sand
2	To determine the grain fineness number of dry and clay free sand.
3	To determine the moisture content quickly is fresh sand and mounding sand.
4	To determination the compressive strength, splitting strength and shearing strength of green sand by Pendulum Type Universal Strength Testing Machine
5	To determine the permeability number of Green sand, Core sand and Raw sand.
6	Mould preparation and casting of metals after preparation of suitable moulds.
7	Study of post casting operation like fettling, cleaning, deburring and polishing.
8	Practicing smithy or forging of carbon steels and testing for its property changes.
9	Laboratory experiments in Fabrication processes to observe effects of varying process parameters in GMAW and SMAW and Testing for Joint defects.
10	Machining practice in a Lathe, Shaping, Milling, Drilling machine.

CO – PO Mapping:

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

Course Name: Dynamics of Machines Lab
Course Code: ME 493
Contact: 0:0:3
Credits: 1.5

Prerequisite: Kinematics & Theory of Machines

Course Outcomes:

CO1: Select several type of vibrating systems by using measuring instruments regarding vibration of continuous systems and random vibrations.
CO2: Demonstrate methods of balancing of rigid rotors, reciprocating machines, flywheels, planar linkages and instruments.
CO3: Define the working principle of gyroscope and governors to apply in future projects
CO4: Get practical knowledge on Cam dynamics used in various industrial applications.

List of Experiment:

1. Velocity ratios of simple, compound, epicyclic and differential gear trains
2. Kinematics of four bar, slider crank, crank rocker, double crank, double rocker and oscillating cylinder mechanisms
3. Study of Cam & follower motion
4. Determination of natural frequency and damping coefficient for a Single DOF Spring-mass-damper system
5. Determination of torsional natural frequency of single and double rotor systems- undamped and Damped natural frequencies

CO – PO Mapping:

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

Course Name: Constitution of India
Course Code: MC401
Contact: 3: 0: 0
Total Contact Hours: 36

Course Contents:

Module	Syllabus	Contact Hrs
1 – Indian Constitution	Sources and Constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	**6**
2 – Government and Administration	Union government and its administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State Secretariat: Organization, Structure and Functions.	**10**
3 – Court and Law	Supreme court: Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL	**10**
4– Local Administration	Districts administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level.	**10**
Total Contact Hours		**36**

Text book

1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.