ST. ANDREWS INSTITUTE OF TECHNOLOGY & MANAGEMENT
Approved by AICTE I Govt. of India I Affiliated to Maharshi Dayanand University
Khurrampur, Farrukh Nagar - Haily Mandi Road, Gurugram, Haryana - 122506 Delhi NCR (India)
Ph. : +91-8505 937 771-5, +91-9050 381 616
Email : standrews@saitm.org I Web: www.saitm.ac.in

SCHEME OF EXAMINATION

&

SYLLABUS

Of

B.TECH (BACHELOR OF TECHNOLOGY)

MECHANICAL ENGINEERING

ACADEMIC SESSION

MAHARSHI DAYANAND UNIVERSITYROHTAK (HARYANA)

M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

Bachelor of Technology

Scheme effective from 2018-19

SEMESTER 1st (COMMON FOR ALL BRANCHES)

Sr. No.	Category	Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
					L	T	P			Mark of Class work	Theory	Practical	Total	
1	Basic Science Course	A	Refer to Table 1	Physics-1	3	1	0	4	4	25	75		100	3
		B	BSC-CH-101G	Chemistry-1	3	1	0	4	4	25	75		100	3
2	Basic Science Course	C	Refer to Table 2	Mathematics-I	3	1	0	4	4	25	75		100	3
3	Engineering Science Course	A	ESC-EE-101G	Basic Electrical Engineering	3	1	0	4	4	25	75		100	3
	Engineering Science Course	B	Refer to Table 3	Programming for Problem Solving	3	0	0	3	3	25	75		100	3
4	Engineering Science Course	A	ESC-ME-101G	Engineering Graphics & Design	1	0	4	5	3	25		75	100	3
		B	ESC-ME-102G	Workshop Technology	1	0	0	1	1	25	75		100	3
5	Basic Science Course	A	Refer to Table 1	Physics Lab-1	0	0	3	3	1.5	25		25	50	3
		B	BSC-CH-102G	Chemistry Lab-1	0	0	3	3	1.5	25		25	50	3
6	Engineering Science Course	A	ESC-EE-102G	Basic Electrical Engineering Lab	0	0	2	2	1	25		25	50	3

		B	Refer to Table 3	Programming in C Lab	0	0	4	4	2	25		25	50	3
7	Engineering Science Course	B	ESC-ME-103G	Manufacturing Practices Lab	0	0	4	4	2	25		25	50	3
8	Humanities and Social science including Management courses	C	HSMC-ENG-101G	English	2	0	0	2	2	25	75		100	3
TOTAL CREDIT									**19.5**	**175/200**	**300/375**	**125/75**	**600/650**	

M.D. UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

Bachelor of Technology

Scheme effective from 2018-19

SEMESTER 2nd (COMMON FOR ALL BRANCHES)

Sr. No.	Category	Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
					L	T	P			Mark of Class work	Theory	Practical	Total	
1	Basic Science Course	B	Refer to Table 1	Physics-1	3	1	0	4	4	25	75		100	3
		A	BSC-CH-101G	Chemistry-1	3	1	0	4	4	25	75		100	3
2	Basic Science Course	C	Refer to Table 2	Mathematics-II	3	1	0	4	4	25	75		100	3
3	Engineering Science Course	B	ESC-EE-101G	Basic Electrical Engineering	3	1	0	4	4	25	75		100	3
	Engineering Science Course	A	Refer to Table 3	Programming for Problem Solving	3	0	0	3	3	25	75		100	3
4	Engineering Science Course	B	ESC-ME-101G	Engineering Graphics & Design	1	0	4	5	3	25		75	100	3
		A	ESC-ME-102G	Workshop Technology	1	0	0	1	1	25	75		100	3
6	Basic Science Course	B	Refer to Table 1	Physics Lab-1	0	0	3	3	1.5	25		25	50	3
		A	BSC-CH-102G	Chemistry Lab-1	0	0	3	3	1.5	25		25	50	3
7	Engineering Science Course	B	ESC-EE-102G	Basic Electrical Engineering Lab	0	0	2	2	1	25		25	50	3

		A	Refer to Table 3	Programming in C Lab	0	0	4	4	2	25		25	50	3
8	Humanities and Social science including Management courses	C	HSMC-ENG-102G	Language Lab	0	0	2	2	1	25		25	50	3
9	Engineering Science Course	A	ESC-ME-103G	Manufacturing Practices Lab	0	0	4	4	2	25		25	50	3
TOTAL CREDIT									**18.5**	**200/175**	**225/300**	**175/75**	**600/500**	

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Important Notes:

1. Significance of the Course Notations used in this scheme
   C = These courses are common to both the groups (Group-A and Group –B).
   A = Other compulsory courses for Group-A.
   B = Other compulsory courses for Group-B.

Course code for different branches

Table 1

Sr. No.	Course Name	Course Code	Branch
1.	Introductionto Electromagnetic Theory	BSC-PHY-101G	• Electronics and Communication Engineering • Electronics and Computer Engineering • Electronics and Telecommunication Engineering • Mechanical Engineering • Fire Technology and Safety Engineering • Mechanical and Automation Engineering • Automobile Engineering
2.	WavesandOptics& QuantumMechanics	BSC-PHY-102G	• Electrical Engineering • Electronics and Electrical Engineering
3.	Semiconductor Physics	BSC-PHY-103G	• Computer Science Engineering • Information Technology • Computer Science and Information Technology
4.	Mechanics	BSC-PHY-104G	• Civil Engineering • Printing Technology
5.	Optics, Optical Fibre, Magnetism and Quantum Mechanics	BSC-PHY-105G	• Bio-Technology Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering
6.	Introduction to Electromagnetic Theory (IEMT) Lab	BSC-PHY-111G	• Electronics and Communication Engineering • Electronics and Computer Engineering • Electronics and Telecommunication Engineering • Mechanical Engineering • Fire Technology and Safety Engineering • Mechanical and Automation Engineering • Automobile Engineering
7.	Wave Optics & Quantum Mechanics Lab	BSC-PHY-112G	• Electrical Engineering • Electronics and Electrical Engineering
8.	Semiconductor Physics Lab	BSC-PHY-113G	• Computer Science Engineering • Information Technology • Computer Science and Information Technology
9.	Mechanics Lab	BSC-PHY-114G	• Civil Engineering • Printing Technology
10.	Optics, Optical Fibre,	BSC-PHY-115G	• Bio-Technology Engineering

	Magnetism and Quantum Mechanics (OFMQ		• Textile Technology • Textile Chemistry • Fashion and Apparel Engineering

Table 2

Sr. No.	Course Name	Course Code	Branch
1.	Math-I (Calculus and Matrices)	BSC-MATH-101G	• Mechanical Engineering • Electronics and Communication Engineering • Civil Engineering • Electrical Engineering • Electronics and Electrical Engineering • Printing Technology • Automobile Engineering • Mechanical and Automation Engineering • Electronics and Computer Engineering • Fire Technology and Safety Engineering • Electronics and Telecommunication Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering
2.	Math-I (Calculus and Linear Algebra)	BSC-MATH-103G	• Computer Science Engineering • Information Technology • Computer Science and Information Technology
3.	Math-I (Series, Matrices and Calculus)	BSC-MATH-105G	• Bio-Technology Engineering
4.	Math-II (Multivariable Calculus, Differential equations and Complex Analysis)	BSC-MATH-102G	• Mechanical Engineering • Electronics and Communication Engineering • Civil Engineering • Electrical Engineering • Electronics and Electrical Engineering • Printing Technology • Automobile Engineering • Mechanical and Automation Engineering • Electronics and Computer Engineering • Fire Technology and Safety Engineering • Electronics and Telecommunication Engineering • Textile Technology • Textile Chemistry

			• Fashion and Apparel Engineering
5.	Math-II (Probability and Statistics)	BSC-MATH-104G	• Computer Science Engineering • Information Technology • Computer Science and Information Technology
6.	Math-II (Vector Calculus, Differential equations and Laplace Transform)	BSC-MATH-106G	• Bio-Technology Engineering

Table 3

Sr. No.	Course Name	Course Code	Branch
1.	Programming for Problem Solving	ESC-CSE101G	• Computer Science and Engineering • Electronics and communication Engineering • Information Technology • Computer Science and Information Technology • Electronics and Electrical Engineering
		ESC-CSE102G	For all remaining branches of B.Tech
2.	Programming in C Lab	ESC-CSE103G	• Computer Science and Engineering • Electronics and communication Engineering • Information Technology • Computer Science and Information Technology • Electronics and Electrical Engineering
		ESC-CSE104G	For all remaining branches of B.Tech

I. **Mandatory Induction program**

(Please refer **Appendix-A** for guidelines. Details of Induction program also available in the curriculum of Mandatory courses.)
[Induction program for students to be offered right at the start of the first year.]

3 weeks duration

- Physical activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to local Areas
- Familiarization to Dept./Branch & Innovations

Course code	BSC-PHY-101G				
Category	Basic Science Course				
Course title	**Introduction to Electromagnetic Theory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**		**4**	
Branches (B. Tech.)	• Electronics and Communication Engineering • Electronics and Computer Engineering • Electronics and Telecommunication Engineering • Mechanical Engineering • Fire Technology and Safety Engineering • Mechanical and Automation Engineering • Automobile Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT – I

Electrostatics in vacuum and linear dielectric medium

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential Boundary conditions of electric field and electrostatic potential; energy of a charge distribution and its expression in terms of electric field.

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement.

UNIT - II

Magnetostatics

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating It for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Magnetostatics Ina linear magnetic medium: Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on **B** and **H**. Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials.

UNIT - III

Faraday's law and Maxwell's equations

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law; energy stored in a magnetic field.

Continuity equation for current densities; Modified equation for the curl of magnetic field to satisfy continuity equation; displacement current and magnetic field arising from time-dependent electric field; Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector.

UNIT - IV

Electromagnetic waves

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Suggested Reference Books

1. David Griffiths, Introduction to Electrodynamics, Pearson Education
2. ICFAI, Electricity and Magnetism, Pearson Education
3. Halliday and Resnick, Physics
4. W. Saslow, Electricity, magnetism and light
5. S.K. Chatterjee, Fundamentals of Electricity and Magnetism- PHI
6.A Mahajan, A Rangwala, Electricity and Magnetism

Course code	BSC-PHY-102G				
Category	Basic Science Course				
Course title	**Waves and Optics & Quantum Mechanics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**		**4**	
Branches (B. Tech.)	• Electrical Engineering • Electronics and Electrical Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT – I

Wave and Light Motion

Waves: Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator

Non-dispersive transverse and longitudinal waves: Transverse Wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves.

Light and Optics: Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave.

UNIT – II

Wave Optics and Lasers

Wave Optics: Huygens' principle, superposition of waves and interference of light by wave-front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

UNIT – III

Introduction to Quantum Mechanics

Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

Solutionofstationary-stateSchrodingerequationforonedimensionalproblems–particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Scattering from a potential barrier and tunneling; related examples like alpha- decay, field-ionization and scanning tunneling microscope, tunneling in semiconductor structures.

UNIT – IV

Introduction to Solids and Semiconductors

Free electron theory of metals, Fermi level, density of statesin1, 2 and 3 dimensions, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p -n junction.

References:

1. E. Hecht, "Optics", Pearson Education
2. D. J. Griffiths, "Quantum mechanics", Pearson Education
3. B.G. Streetman, "Solid State Electronic Devices", Pearson Education
4. G. Main, "Vibrations and waves in physics", Cambridge University Press
5. H. J. Pain, "The physics of vibrations and waves", Wiley
6. A. Ghatak, "Optics", McGraw Hill Education,
7. O. Svelto, "Principles of Lasers", Springer Science & Business Media,
8. R. Robinett, "Quantum Mechanics", OUP Oxford
9. D. McQuarrie, "Quantum Chemistry", University Science Books
10. D. A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago
11. E.S. Yang, "Microelectronic Devices", McGraw Hill, Singapore

Course code	BSC-PHY-103G				
Category	Basic Science Course				
Course title	**Semiconductor Physics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**		**4**	
Branches (B. Tech.)	• Computer Science Engineering • Information Technology • Computer Science and Information Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Prerequisite: "Introduction to Quantum Mechanics" Desirable

UNIT - I
Electronic Materials

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

UNIT - II
Semiconductors

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

UNIT - III
Light-Semiconductor Interaction

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

UNIT - IV
Measurements & Engineered Semiconductor Materials

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.

Densityofstatesin2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Heterojunctions and associated band-diagram.

References:

1. Pierret, Semiconductor Device Fundamental,
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Pearson Education
3. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-HillInc.
4. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
5. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley
6. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York.
7. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
8. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

Course code	BSC-PHY-104G				
Category	Basic Science Course				
Course title	**Mechanics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**		**4**	
Branches (B. Tech.)	• Civil Engineering • Printing Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Prerequisites: (i) High-school education

UNIT I

Vector Mechanics of Particles

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates.

UNIT II

Mechanics of Particles in Motion and Harmonic Motion

Potential energy function; F=-Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a forcefield; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite maneuvers.

Non-inertial frames of reference; Rotating coordinate system: Five-term acceleration formula. Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum;

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance.

UNIT III

Rigid Body Mechanics

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

Introduction to three-dimensional rigid body motion—only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and(b) Moment of inertia tensor; Three-dimensional motion of a rigid body where in all points move in a coplanar manner: e.g. Rod exe cutting conical motion with center of mass fixed—only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.

UNIT IV
Statics of Solids

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases; Force-displacement relationship; Geometric compatibility for small deformations; Illustrations through simple problems on axially loaded members like trusses.

Suggested Reference Books

1. Shames/Rao: Engineering Mechanics: Statics and Dynamics, Pearson Education
2. Hibbler, Engineering Mechanics, Pearson Education
3. Engineering Mechanics, 2^{nd}ed. — MK Harbola
4. Sinha, Engineering Mechanics, Pearson Education
5. Introduction to Mechanics — MK Verma
6. An Introduction to Mechanics — D Kleppner& R Kolenkow
7. Principles of Mechanics — JL Synge & BA Griffiths
8. Mechanics — JP Den Hartog
9. Engineering Mechanics - Dynamics, 7^{th}ed. - JL Meriam
10. Mechanical Vibrations — JP Den Hartog
11. Theory of Vibrations with Applications — WT Thomson

Course code	BSC-PHY-105G				
Category	Basic Science Course				
Course title	**Optics, Optical Fibre, Magnetism and Quantum Mechanics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**		**4**	
Branches (B. Tech.)	• Bio-Technology Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objectives:

Basic concepts of optics and its applications, electricity and magnetism, and quantum physics.

UNIT – I

Optics

Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications.

Polarisation: Introduction, polarization by reflection, polarization by double refraction, scattering of light, circular and elliptical polarisation, optical activity.

UNIT – II

Fibre Optics and Lasers

Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.

Lasers: Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of laser: solid state, semiconductor, gas; application of lasers.

UNIT – III

Electromagnetism and Magnetic Properties of Materials

Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, applications of dielectric

Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

UNIT – IV

Quantum Mechanics

Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in 1-D box.

Course outcomes

Students will be familiar with

·Bragg's Law and introduced to the principles of lasers, types of lasers and applications

·Various terms related to properties of materials such as, permeability, polarization, etc.

·Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials

·Simple quantum mechanics calculations

References:

1.I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.

2.H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.

3.E. Hecht, "Optics", Pearson Education, 2008.

4.A. Ghatak, "Optics", McGraw Hill Education, 2012.

5.O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

6.D. J. Griffiths, "Quantum mechanics", Pearson Education, 2014.

7.R. Robinett, "Quantum Mechanics", OUP Oxford, 2006.

8.D. McQuarrie, "Quantum Chemistry", University Science Books, 2007.

9. D. A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.

10.E.S. Yang, "Microelectronic Devices", McGraw Hill, Singapore, 1988.

11.B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.

Course code	BSC-PHY-111G				
Category	Basic Science Lab Course				
Course title	**Introduction to Electromagnetic Theory (IEMT) Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
			3	**1.5**	
Branches (B. Tech.)	• Electronics and Communication Engineering • Electronics and Computer Engineering • Electronics and Telecommunication Engineering • Mechanical Engineering • Fire Technology and Safety Engineering • Mechanical and Automation Engineering • Automobile Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and **will have to perform at least ten subject related experiments in a semester.**

Basic experiments on least count and error estimation (during orientiation)

- To aware about the least count of varnier calliper and screw gauge and to find the thickness of a slide using varnier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:

1. To study Hall effect in semiconductors and measure the Hall coefficient.

2. To find frequency of AC mains using sonometer.

3. To study the magnetic properties of materials using B-H curve.

4. To study the Curies temperature of materials using Dielectric set up.

5. To verify the inverse square law with the help of a photovoltaic cell.

6. To determine Planks constant using photocell.

7. To study the characteristics of Solar cell and find out the fill factor.

8. To design and study Active and Passive filters.

9. To find impedance and Q factor using LCR circuit.

10. To study resonance phenomena in LCR circuit.

11. To measure e/m of electron using helical method.

12. To find temperature co-efficient of platinum using Callender Griffith bridge.

13. To study the forward and reverse characteristics of P-N junction diode.

14. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.

Course code	BSC-PHY-112G				
Category	Basic Science Course				
Course title	**Wave Optics & Quantum Mechanics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
			3	**1.5**	
Branches (B. Tech.)	• Electrical Engineering • Electronics and Electrical Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and **will have to perform at least ten subject related experiments in a semester.**

Basic experiments on least count and error estimation (during orientation)

- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:

1. To find out wavelength of monochromatic light using Newton's ring experiment.
2. To find out wavelength of monochromatic light using Diffraction grating.
3. To find out wavelength of monochromatic light using Freshnel's bi-prism
4. To study interference phenomena using Michelson's Interferometer and to find out wavelength of monochromatic light.
5. To find specific rotation of sugar using Polarimeter
6. To find thickness of hair using He-Ne laser.
7. To find Cauchy's constants of a prism by using spectrometer.
8. To find resolving power of a telescope
9. To determine Planks constant using photocell.
10. To study the characteristics of solar cell and find out the fill factor.
11. To verify the inverse square law with the help of a photovoltaic cell.
12. To study Zeeman splitting using EPS/ ESR.

Course code	BSC-PHY-113G				
Category	Basic Science Course				
Course title	**Semiconductor Physics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
			3	**1.5**	
Branches (B. Tech.)	• Computer Science Engineering • Information Technology • Computer Science and Information Technology				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and **will have to perform at least ten subject related experiments in a semester.**

Basic experiments on least count and error estimation (during orientation)

- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:

1. To study the forward and reverse characteristics of P-N junction diode.
2. To study the characteristics of transistor in common base configuration.
3. To study the characteristics of transistor in common emitter configuration.
4. To study the characteristics of Junction field effect (JFET) transistor.
5. To study the characteristics of Metal oxide semiconductor field effect (MOSFET) transistor.
6. To study the characteristics of Solar cell and find out the fill factor.
7. To design and study Active and Passive filters.
8. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.
9. To determine Planks constant using photocell.
10. To measure e/m of electron using helical method.
11. To find capacitance of condenser using fleshing and quenching experiment.
12. To find temperature co-efficient of platinum using Callender Griffith bridge.
13. To find out low resistance by Carry Foster bridge.
14. To find resistance of galvanometer by post office box.
15. To compare the capacitance of two capacitors using De'Sauty Bridge.

Course code	BSC-PHY-114G				
Category	Basic Science Course				
Course title	**Mechanics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
			3	**1.5**	
Branches (B. Tech.)	• Civil Engineering • Printing Technology				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and **will have to perform at least ten subject related experiments in a semester.**

Basic experiments on least count and error estimation (during orientation)

- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:

1. To find the moment of inertia measurement of a fly wheel.
2. To find acceleration due to gravity using bar pendulum.
3. To study resonance phenomena in mechanical oscillators.
4. To examine the behaviour of coupled pendulum.
5. To examine air track experiment and study Collisions between objects, governed by the laws of momentum and energy.
6. To find the modulus of rigidity of a wire using Maxwell's Needle.
7. To determine the moment of inertia of the given disc using Torsion pendulum.
8. To perform experiment on Rotation and Gyroscopic Precession.
9. To measure spring constant using Hook's Law.
10. To measure height of a distant object using sextant.

Course code	BSC-PHY-115G				
Category	Basic Science Course				
Course title	**Optics, Optical Fibre, Magnetism and Quantum Mechanics (OFMQ) Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
			3	**1.5**	
Branches (B. Tech.)	• Bio-Technology Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Students will be required to learn to take readings of vernier calliper, screw gauge, spherometer, spectrometer etc. during their orientation labs at the starting and **will have to perform at least ten subject related experiments in a semester.**

Basic experiments on least count and error estimation (during orientation)

- To aware about the least count of vernier calliper and screw gauge and to find the thickness of a slide using vernier calliper and diameter of wire using screw gauge.
- Calculation of radius of curvature of a convex surface using spherometer.
- Angel measurement using spectrometer.

List of Subject related Experiments:

1. To study Hall effect in semiconductors and measure the Hall coefficient.

2. To find frequency of AC mains using sonometer.

3. To study the magnetic properties of materials using B-H curve.

4. To study the Curies temperature of materials using Dielectric set up.

5. To verify the inverse square law with the help of a photovoltaic cell.

6. To determine Planks constant using photocell.

7. To study the characteristics of Solar cell and find out the fill factor.

8. To design and study Active and Passive filters.

9. To find impedance and Q factor using LCR circuit.

10. To study resonance phenomena in LCR circuit.

11. To measure e/m of electron using helical method.

12. To find temperature co-efficient of platinum using Callender Griffith bridge.

13. To study the forward and reverse characteristics of P-N junction diode.

14. To study the reverse characteristics of Zener diode and voltage regulation using Zener Diode.

Course code	BSE-CHE-101G				
Category	Basic Science Course				
Course title	**Chemistry I (Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**	**0**	**4**	
Course Outcome	1. To analyse microscopic chemistry 2. Understand the concept of hardness of water and phenomenon of corrosion 3. Rationalise periodic properties 4. Distinguish the ranges of the electromagnetic spectrum				

Duration of Exam **3 Hrs**	Class Work 25 Marks Theory Exam 75 Marks Total 100 Marks

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Atomic and molecular structure: Schrodinger equation(Introduction and concept only).. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations(derivation excluded). Molecular orbital energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene. Crystal field theory and the energy level diagrams for transition metal ions . Band structure of solids and the role of doping on band structures.

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states. (12)

UNIT-II

Stereochemistry: Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal Compounds.

Organic reactions and synthesis of a drug molecule :Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization (mechanism excluded). Synthesis of commonly used drug molecules (Asprin &Paracetamol). (10)

UNIT-III

Intermolecular forces: Ionic, dipolar and Van der Waals interactions. Equations of state of real gases and critical phenomena.

Water Chemistry and Corrosion: Hardness of water- Introduction, Types, Measurement of hardness by EDTA method, Methods of water softening (Lime soda process, Zeolite Process, Demineralisation process). Corrosion: Introduction, Types, Factor affecting corrosion and methods of prevention. (10)

UNIT-IV

Spectroscopic techniques and applications: Basic concept of spectroscopy, Principle and Applications of different spectroscopic techniques (UV-Visible and IR spectroscopy). Nuclear magnetic resonance and magnetic resonance imaging, Elementary discussion on Flame photometry. (10)

Suggested Text Books:

(i) University Chemistry, Bruce M. Mahan, Pearson Education.

(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

(iii) Essentials of Analytical Chemistry, Shobha Ramakrishnan and Banani Mukhopadhyay, Pearson Education.

(iv)Fundamentals of Molecular Spectroscopy, by C. N. Banwell

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

Krishnan

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

(vii) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th

Edition.

Course Outcomes

The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Understand the concept of hardness of water and phenomenon of corrosion.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electron affinity.

Course code	BSC-CHE-102G				
Category	Basic Science Course				
Course title	**Chemistry I (Practical)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	0	**0**	**3**	**1.5**	
Course Outcome	5. Estimate rate constants of reactions 6. Synthesize a small drug molecule 7. Measure surface tension , viscosity and conductance 8. To analyse a salt sample 9. Determine hardness and chloride content of water				

Duration of Exam **3 Hrs**	Internal Practical 25 Marks External Practical 25 Marks Total 50 Marks

Paper No. CHE-103
03 Hrs./ week

Credit: 1 ½
Max. Marks: 25+25
Duration of Exam: 03 Hrs.

LIST OF EXPERIMENTS:-

1 .Determination of surface tension of given liquid by drop number method.

2. Determine the viscosity of given liquid by using Ostwald's viscometer / Redwood viscometer.

3. Calculate the Rf value of given sample using Thin layer chromatography / Paper chromatography.

4. Removal of Ca^{2+} and Mg^{2+} hardness from given water sample using ion exchange column.

5. Determination of chloride content in given water sample.

6.Calculate the strength of strong acid by titrating it with strong base using conductometer.

7. Calculate the emf value of given cell.

8. To prepare the of urea formaldehyde and phenol formaldehyde resin.

9. To determine the rate constant of a reaction.

10. To Prepare iodoform.

11. Calculate the saponification value / acid value of given oil sample.

12. Chemical analysis of two anions and two cations in given sample of salt.

13. Determination of the partition coefficient of a substance between two immiscible liquids.

14. To determine the total hardness of given water sample by EDTA method.

15.Study the adsorption phenomena using acetic acid and charcoal.

16. Lattice structures and packing of spheres.

Course Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will be able to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time.
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
- Synthesize a small drug molecule and analyse a salt sample.

Note: At least 10 experiments are to be performed by the students.
1.Each laboratory class/section shall not be more than about 20 students.
2.To allow fair opportunity of practical hands on experience to each student,each experiment may either done by each student individually or in groupofnotmore than 3-4 students. Larger groups be strictly discouraged/disallowed.
3.Pre-experimental &post experimentalquiz/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

Suggested Books:

1. A Text book on Experiments and Calculation –Engineering Chemistry by S.S.Dara, S.Chand & Company Ltd.
2. Essentials of Analytical Chemisty, Shobha Ramakrishnan, Pearson Education.
3. Essential of Experimental Engineering chemistry, Shashi Chawla, Dhanpat Rai Publishing Co.
4. Theory & Practice Applied Chemistry – O.P.Virmani, A.K. Narula (New Age).
5. Engineering Chemistry, K.Sesha Maheswaramma and Mridula Chugh, Pearson Education.

Math-I (Calculus and Matrices)
BSC-MATH-101G

Course code	BSC-MATH-101G				
Category	Basic Science Course				
Course title	Math-I (Calculus and Matrices)				
Scheme and Credits	L	T	P	Credits	Semester-I
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Calculus: Indeterminate forms and L'Hospital's rule, Maxima and Minima, Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders, Evolutes and Involutes, Evaluation of definite and improper integrals, Applications of definite integrals to evaluate surface areas and volumes of revolutions, Beta and Gamma functions and their properties.

Unit-II

Sequences and Series: Convergence of sequence and series, Tests for convergence, Power series: Taylor's series, series for exponential, trigonometric and logarithm functions, Fourier series: Half range sine and cosine series, Parseval's theorem.

Unit-III

Multivariable Differential Calculus: Limit, Continuity and Partial derivatives, Total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers, Gradient, Directional derivatives, Curl and Divergence.

Unit-IV

Matrices: Inverse and rank of a matrix, Rank-nullity theorem, System of linear equations, Symmetric, skew-symmetric and orthogonal matrices and Orthogonal transformation, Determinants, Eigenvalues and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill Publishing Company Limited.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
5. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.

7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

Course Outcomes

The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

Math-I (Calculus and Linear Algebra)
BSC-MATH-103G

Course code	BSC-MATH-103G				
Category	Basic Science Course				
Course title	Math-I (Calculus and Linear Algebra)				
Scheme and Credits	L	T	P	Credits	Semester-I
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Calculus: Indeterminate forms and L'Hospital's rule, Maxima and Minima, Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders, Evolutes and Involutes, Evaluation of definite and improper integrals, Applications of definite integrals to evaluate surface areas and volumes of revolutions, Beta and Gamma functions and their properties.

Unit-II

Matrices: Matrices, Vectors: addition and scalar multiplication, Matrix multiplication, Linear systems of equations, Linear Independence, Rank of a matrix, Determinants, Cramer's Rule, Inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Unit-III

Vector spaces I: Vector Space, Linear dependence of vectors, Basis, Dimension, Linear transformations (maps), Range and kernel of a linear map, Rank and nullity, Inverse of a linear transformation, Rank nullity theorem, Matrix associated with a linear map, Composition of linear maps.

Unit-IV

Vector spaces II: Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric and Orthogonal Matrices, Eigenbases, Diagonalization, Inner product spaces, Gram-Schmidt orthogonalization.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. D. Poole, Linear Algebra: A Modern Introduction, Brooks Cole.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. V. Krishnamurthy, V.P. Mainra and J. L. Arora, An introduction to Linear Algebra, Affiliated East–West Press Private limited.

8. Seymour Lipschutz and Marc Lipson, Linear algebra, Schaum's Outline, Tata McGraw-Hill Publishing Company Limited.
9. Kenneth Hoffman and Ray Kunze, Linear algebra, Pearson Education.

Course Outcomes

The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.
- The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

Math-I (Series, Matrices and Calculus)
BSC-MATH-105G

Course code	BSC-MATH-105G				
Category	Basic Science Course				
Course title	Math-I (Series, Matrices and Calculus)				
Scheme and Credits	L	T	P	Credits	Semester-I
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Infinite series: Introduction of Arithmetic and Geometric Series**,** Convergence and divergence, Comparison Tests, D' Alembert's Ratio Test, Integral Test, Raabe's Test, Logarithmic and Cauchy root Tests, Gauss's test, Alternating Series, Absolute and Conditional Convergence.

Unit-II

Matrices & Its Application: Elementary Matrices, Elementary Transformations, Inverse using elementary transformations, Rank of a matrix, Normal form of a matrix, Linear dependence and independence of vectors, Consistency of linear system of equations, Linear and Orthogonal Transformations, Eigenvalues and Eigenvectors, Properties of eigenvalues, Cayley-Hamilton Theorem, Diagonalization of Matrices.

Unit-III

Differential Calculus: Limit, Continuity and Differentiability of function of single variable, Successive Differentiation, Leibnitz Theorem, Taylor's and Maclaurin's Series for Single Variable function, Partial derivatives, Homogeneous functions, Euler's Theorem, Jacobian, Maxima-Minima of function of two variables, Lagrange's Method of undetermined multipliers.

Unit-IV

Integral Calculus: Basic concepts of integration and properties of definite integrals, Applications of single integration to find volume of solids and surface area of solids of revolution, Double integral, Change of order of integration, Double integral in Polar Co-ordinates, Applications of double integral to find area enclosed by plane curves, Triple integral, Beta and Gamma functions.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill Publishing Company Limited.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
5. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.

6. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

Course Outcomes The students will learn:

- To deal with the nature of infinite series that is essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner
- The tools of differentiation and integration of functions of univariate and multivariate that are used in various techniques dealing engineering problems.
- The mathematical tools needed in evaluating multiple integrals and their usage.
- To apply differential and integral calculus to find volume of solids and surface area of solids of revolution. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

Math-II (Multivariable Calculus, Differential equations and Complex Analysis)
BSC-MATH-102G

Course code	BSC-MATH-102G				
Category	Basic Science Course				
Course title	Math-II (Multivariable Calculus, Differential equations and Complex Analysis)				
Scheme and Credits	L	T	P	Credits	Semester-II
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Multivariable Integral Calculus: Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities), Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds, Scalar line integrals, Vector line integrals, Scalar surface integrals, Vector surface integrals, Theorems of Green, Gauss and Stokes.

Unit-II

Ordinary differential equations of first and higher orders: Exact, Linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Second order linear differential equations with variable coefficients, Method of variation of parameters, Cauchy-Euler equation, Power series solutions, Legendre polynomials, Bessel functions of the first kind and their properties.

Unit-III

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, Analytic functions, Harmonic functions, Finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm) and their properties, Conformal mappings, Mobius transformations and their properties.

Unit-IV

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof), Taylor's series, Zeros of analytic functions, Singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.

2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India.
4. S. L. Ross, Differential Equations, Wiley India.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India.
6. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
9. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
10. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.

Course Outcomes The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Math-II (Probability and Statistics)
BSC-MATH-104G

Course code	BSC-MATH-104G				
Category	Basic Science Course				
Course title	Math-II (Probability and Statistics)				
Scheme and Credits	L	T	P	Credits	Semester-II
	3	1		4	
Branches (B. Tech.)	• Information Technology • Computer Science Engineering • Computer Science and Information Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Random variables and discrete probability distributions: Conditional probability, Probability spaces, Discrete random variables, Independent random variables, Expectation of discrete random variables, Sums of independent random variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality, The multinomial distribution, Poisson approximation to the binomial distribution, Infinite sequences of Bernoulli trials.

Unit-II

Continuous and Bivariate probability distribution: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities, Bivariate distributions and their properties, Distribution of sums and quotients, Conditional densities, Bayes' rule.

Unit-III

Basic Statistics: Measures of Central tendency: Moments, Skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions; Correlation and regression – Rank correlation; Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Unit-IV

Applied Statistics: Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations; Small samples: Test for single mean, difference of means and correlation coefficients; Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
3. S. Ross, A First Course in Probability, Pearson Education.

4. W. Feller, An Introduction to Probability Theory and its Applications, Wiley.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill Publishing Company Limited.

Course Outcomes

The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The basic ideas of statistics including measures of central tendency, correlation and regression.
- The statistical methods of studying data samples.

Math-II (Vector Calculus, Differential equations and Laplace Transform)
BSC-MATH-106G

Course code	BSC-MATH-106G				
Category	Basic Science Course				
Course title	Math-II (Vector Calculus, Differential equations and Laplace Transform)				
Scheme and Credits	L	T	P	Credits	Semester-II
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit-I

Vector Calculus: Differentiation of vectors, Scalar and vector point functions, Gradient of a scalar field and Directional derivative, Divergence and Curl of a vector field and their physical interpretations, Integration of vectors, Line integral, Surface integral, Volume integral, Green, Stoke's and Gauss theorems (without proof) and their applications.

Unit-II

Ordinary Differential Equations: Exact differential equations, Equations reducible to exact differential equations, Applications of differential equations of first order & first degree to simple electric circuits, Newton's law of cooling, Heat flow and Orthogonal trajectories, Linear Differential equations of second and higher order, Complete solution, Complementary function and Particular integral, Method of variation of parameters to find particular integral, Cauchy's and Legendre's linear equations.

Unit-III

Laplace Transforms and its Applications: Laplace transforms of elementary functions, Properties of Laplace transforms, Existence conditions, Transforms of derivatives, Transforms of integrals, Multiplication by t^n, Division by *t*, Evaluation of integrals by Laplace transforms, Laplace transform of unit step function, Unit impulse function and Periodic function, Inverse transforms, Convolution theorem, Application to linear differential equations.

Unit-IV

Partial Differential Equations: Formation of partial differential equations, Lagrange' linear partial differential equation, First order non-linear partial differential equation, Charpit's method, Method of separation of variables.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.

4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
7. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India.
8. S. L. Ross, Differential Equations, Wiley India.
9. R. K, Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication House Private Limited.

Course Outcomes The students will learn:

- The mathematical tools needed in evaluating vector calculus and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- To deal with the Laplace transform and its application that is essential in most branches of engineering
- The essential tool of partial differential equation in a comprehensive manner.

BASIC ELECTRICAL ENGINEERING

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**ESC-EE-101G**		
Category	**Engineering Science Course**		
Course title	Basic Electrical Engineering (Theory)		
Scheme	**L**	**T**	**P**
	3	**1**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section A

DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws with their applications (Nodal and Mesh Analysis), analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Section B

Transformers

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, transformer tests regulation and efficiency. Auto-transformer and three-phase transformer connections.

Polyphase Circuits

Three phase balanced circuits, voltage and current relations in star and delta connections. Power Measurement by two wattmeter method.

Section C

Electrical Machines

Generation of rotating magnetic fields, construction, working, starting and speed control of single-phase induction motor. Construction and working of a three-phase induction motor. Construction, working, torque-speed characteristic and speed control of dc motor. Construction and working of synchronous generators.

Section D

Measuring Instruments

Construction, operating and uses of moving iron type and moving coil type, induction type voltmeter, Ammeter, watt meter, energy meter.

Electrical Installations

Components of LT Switchgear: Introduction to Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

(i) E. Hughes, "Electrical and Electronics Technology", Pearson Education.
(ii) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(iii) S. K Sahdev, Basic of Electrical Engineering, Pearson Education, 2015.
(iv) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(v) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(vi) V. D. Toro, "Electrical Engineering Fundamentals", Pearson Education.

Course Outcomes:

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and Transformers.
- To study various type of measuring instruments.
- To introduce the components of low voltage electrical installations

BASIC ELECTRICAL ENGINEERING LABORATORY

Class Work: 25
Exam : 25
Total : 50

Course Code	**ESC-EE-102G**		
Category	**Engineering Science Course**		
Course title	Basic Electrical Engineering (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

List of Experiments:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Practical resistors, capacitors and inductors.
2. To verify KCL and KVL.
3. To verify Thevenin's and Norton theorems.
4. To verify Maximum power transfer and Superposition theorems.
5. To perform direct load test of a transformer and plot efficiency Vs load characteristic.
6. To perform O.C. and S.C. tests of a transformer.
7. Measurement of power in a 3-phase system by two wattmeter method.
8. Measurement of power by 3 voltmeter/3 Ammeter method.
9. Measuring the response of R-L, R-C, and R-L-C circuits to a step change in voltage. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
10. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
11. Torque Speed Characteristic of shunt dc motor.
12. Speed control of dc motor.

Laboratory Outcomes

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.

Course Code	**ESC-CSE-101G**			
Category	**Engineering Science Course**			
Course title	**Programming for Problem Solving**			
Scheme and Credits	**L**	**T**	**P**	**Credits**
	3	**0**	**0**	**1.5**
Pre-requisites (if any)	**-**			

Course Outcomes:

The course will enable the students:

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional ranching, iteration and recursion.
- To decompose a problem into functions
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems
- To apply programming to solve simple numerical method problems, namely differentiation of function and simple integration.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit 1

Introduction to Programming:
Idea of Algorithm: Steps to solve logical and numerical problems. Representation of
Algorithm: Flowchart/Pseudocode with examples.
C Programming: Keywords, Variables and Data Types: basic, derived and user defined, Type Conversions, Header Files, Basic Input and Output Functions and Statements, Compilation, Syntax and Logical Errors in compilation, Object and Executable Code, Storage Classes, Arithmetic Expressions and Precedence**.**

Unit 2

Preprocessors, Conditional and Branching Statements, Loops/ Iterative Statements**,** Writing and evaluation of conditionals and consequent branching.

Unit 3

Arrays (1-D, 2-D), Character Arrays and Strings, Arrays with Pointers, Functions (including using built in libraries), Parameter passing in functions, Call by Value, Call by Reference, Passing arrays to functions, Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

Unit 4

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, Introduction to Dynamic Memory Allocation and its Methods, Structures, Union, Defining Structures and Array of Structures, File Handling.

Suggested Text Books:

Ajay Mittal, Programming in C, 'A Practical Approach', Pearson Education.

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Yashavant Kanetkar, Let Us C, BPB Publication.

Suggested Reference Books

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code	**ESC-CSE-103G**			
Category	**Engineering Science Course**			
Course title	**Programming in C Lab**			
Scheme and Credits	**L**	**T**	**P**	**Credits**
	0	**0**	**4**	**2**
Pre-requisites (if any)	**-**			
Remarks	The lab component should have one hour of tutorial followed or preceded by laboratory assignments.			

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self-referential structures.
- To be able to create, read and write to and from simple text files.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations: To be able to create, read and write to and from simple text files.

Course Code	**ESC-CSE-102G**			
Category	**Engineering Science Course**			
Course title	**Programming for Problem Solving**			
Scheme and Credits	**L**	**T**	**P**	**Credits**
	3	**0**	**0**	**1.5**
Pre-requisites (if any)	**-**			

Course Outcomes:

The course will enable the students:

- To learn various number systems
- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional ranching, iteration and recursion.
- To decompose a problem into functions
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Unit 1

Introduction to computers and its functional units, Number System: Binary, Octal, Decimal, Hexadecimal and their inter conversion methods. Operations on number systems: Addition, Subtraction, Complement etc.

Unit 2

Introduction to Programming: Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.

C Programming: Keywords, variables, data types, header files, basic input and output functions and statements, Compilation, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence**.**

Unit 3

Conditional statements, branching and Loops**,** Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Unit 4

Arrays (1-D, 2-D), Character arrays and Strings, Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

Suggested Text Books:

Ajay Mittal, Programming in C, ‘A Practical Approach’, Pearson Education.

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Yashavant Kanetkar, Let Us C, BPB Publication.

Suggested Reference Books

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education.

Course Code	**ESC-CSE-104G**			
Category	**Engineering Science Course**			
Course title	**Programming in C Lab**			
Scheme and Credits	**L**	**T**	**P**	**Credits**
	0	**0**	**4**	**2**
Pre-requisites (if any)	**-**			
Remarks	The lab component should have one hour of tutorial followed or preceded by laboratory assignments.			

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Course Code	**ESC-ME-102G**				
Category	**ENGINEERING SCIENCE COURSE**				
Course Title	**WORKSHOP TECHNOLOGY**				
Scheme and Credits	**L**	**T**	**P**	**CREDITS**	**Semester-I /II**
	1	**0**	**0**	**1**	
Pre-Requisites(if any)					
Theory-75 Marks	**Internal Assessment-25 Marks**		**Total-100 Marks**		**Duration of Exam-3 Hrs**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-1

Manufacturing Processes:

Introduction to Manufacturing Processes and their Classification, , additive manufacturing Industrial Safety; Introduction, Types of Accidents, Causes and Common Sources of Accident, Methods of Safety, First Aid, Objectives of Layout, Types of Plant Layout and their Advantages.

UNIT-II

Carpentry, Fitting & Forming Processes

Basic Principle of Hot & Cold Working, Hot & Cold Working Processes, Rolling, Extrusion, Forging, Drawing, Wire Drawing and Spinning, Sheet Metal Operations: Measuring Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining. Advantages of timber, types of timber, defects in timber, carpentry tools, classification of metals, fitting tools, fitting operations, glass cutting

UNIT-III

Casting and Machine Tools

Introduction to Casting Processes, Basic Steps in Casting Processes, Pattern: Types of Pattern and Allowances, Sand Casting: Sand Properties, Constituents and Preparation. Gating System. Melting of Metal, Cupola Furnace, Casting Defects & Remedies, plastic moulding, lathe machine, lathe operations, CNC machining, Shaper and planner machine.

UNIT-1V

Welding :

Introduction to welding, Classification of Welding Processes, GAS Welding : Oxy-Acetylene Welding, Resistance Welding : Spot and Seam Welding, Arc Welding : Metal Arc, TIG & MIG, Welding Defects and Remedies, Soldering & Brazing.

Suggested Text/Reference Books:

(i) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 7th Edition, Pearson Education, 2018.
(ii) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of

Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
(iii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Processes for Engineering Materials, Pearson Education.
(iv) Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.
(v) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Pearson Education.
(vi) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials

Course Code	**ESC-ME-103G**				
Category	**ENGINEERING SCIENCE COURSE**				
Course Title	**MANUFACTURING PRACTICES**				
Scheme and Credits	**L**	**T**	**P**	**CREDITS**	**Semester-I /II**
	0	**0**	**4**	**2**	
Pre-Requisites(if any)					
External Practical-25 Marks	**Internal Practical-25 Marks**		**Total-50 Marks**	**Duration of Exam-3 Hrs**	

List of Experiments/ Jobs

1. To study different types of measuring tools used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.
2. To study different types of machine tools (lathe, shaper, planer, milling, drilling machines)
3. To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off.
4. To study different types of fitting tools and marking tools used in fitting practice.
5. To prepare lay out on a metal sheet by making and prepare rectangular tray pipe shaped components e.g. funnel.
6. To prepare joints for welding suitable for butt welding and lap welding.
7. To study plastic moulding and glass cutting process
8. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
9. To prepare simple engineering components/shapes by forging.
10. To prepare mold and core assembly.
11. To prepare horizontal surface/vertical surface/curved surface/slats or V-grooves on a shaper/planner.
12. To prepare a job involving side and face milling on a milling
13. To study electric machines, electronic components and power tools.

Note :

At least ten experiments/jobs are to be performed/prepared by the students in the semester.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

Course Code	**ESC-ME- 101G**				
Category	**ENGINEERING SCIENCE COURSE**				
Course Title	**ENGINEERING GRAPHICS & DESIGN**				
Scheme and Credits	**L**	**T**	**P**	**CREDITS**	**Semester-I /II**
	1	**0**	**4**	**3**	
Pre-Requisites(if any)					
External Practical-75 Marks	**Internal Practical/Class Marks-25 Marks**		**Total-100 Marks**	**Duration of Exam-3 Hrs**	

UNIT-I

Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT-II

Module 3: Projections of Regular Solids

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids

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

Module 5: Isometric Projections

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT-III

Module 6: Overview of Computer Graphics

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]

UNIT-IV

Module 7: Annotations, layering & other functions

Applying dimensions to objects, applying annotations to drawings; layers to create drawings, orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies.

Drawing of Engineering objects like coupling, crankshaft, pulley.

Module 8: Demonstration of a simple team design project that illustrates

Geometry and topology of engineered components, Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

(i) Shah, M.B. & Rana B.C., Engineering Drawing, Pearson Education
(ii)Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for

Engineering practice The student will learn :

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling

Course Code : HSMC-ENG-101G
Category : Humanities
Course Title : English Language Skills

L	T	P	Credits			
2	0	0	2			

Internal Assessment	**:**	**25 Marks**
ExternalAssessment	**:**	**75 Marks**
Total	**:**	**100 Marks**
Duration of Exam	**:**	**03 Hours**

Course Objective:
To equip the students with English language skills needed in academic and professional world and to inculcate human/ethical values in them
Course Outcome:
The students will acquire basic proficiency in English with special emphasis on reading and writing skills, and writing practices along with an inclination to become better human beings.
Course Contents:

Section: A
Basic Writing skills

Subject Verb Agreement, Noun Pronoun Agreement, Governance of Nouns through Prepositions, Basic Verb Patterns (V, SV, SVO, SVOO, SVC, SVOC, SVOA)

Section: B
Vocabulary Building& Creating Grammatical Cohesion

One word substitution, Phrasal Verbs,Commonly used Idioms, Foreign words, Referring Time in Language (Tenses), Use of Active and Passive Voice

Section: C
Phonetics
Basic concept –Vowels, Consonants, Phonemes, Syllable, Transcription of words

Section: D
Reading and Writing Practices

(a)Literary Texts:

i. “Patriotism beyond politics and Religion’ by Abdul Kalam Azad
ii. “The Secret of Work” by Swami Vivekananda
iii. “An Outline of Intellectual Rubbish” by Bertrand Russell
iv. “Mother Teresa” by Khushwant Singh

(b) Writing official Letters- Issues Concerning Students’ academic and social life
(c) Essay Writing
(d) Paragraph Writing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Recommended Readings:

1. Nitin Bhatnagar and Mamta Bhatnagar, *Communicative English for Engineers and Professionals*. Pearson Education.

2.Bhatnagar, k. Manmohan.Ed. *The Spectrum of Life: An Anthology of Modern Prose*. Delhi: Macmillan India Ltd., 2006.

3 C. Murlikrishna& Sunita Mishra, Communication Skills for Engineers, Pearson Ed.

4 Sinha, R.P.*Current English Grammar and Usage*. OUP.

5.Rizvi, M. Ashraf.*Effective Technical Communication*. McGraw Hill Education (India) Pvt. Ltd., 2014.

6.Eastwood, John.*Oxford Guide to English Grammar*.OUP, 2010.

7.Kumar, Sanjay and PushpLata. *Communication Skills*. OUP, 2011.

8. Raman, Meenakshi and Sangeeta Sharma.*CommunicationSkills*.NewDelhi:OUP,2011.

9.Hill, L.A.*A Guide to Correct English*.London:OUP,1965.

10.*Oxford Dictionary of English Idioms*. New Delhi: OUP, 2009

11*http://yousigma.com/religionandphilosophy/swamivivekananda/thescecretofwork.pdf

Course Code : HSMC-ENG-102 G
Category : Humanities
Course Title : English Language Lab

L	T	P	Credit/s			
0	0	2	1	Internal Assessment	:	25 Marks
				ExternalAssessment	:	25 Marks
				Total	:	50 Marks
				Duration of Exam	:	03 Hours

Course Objective:
The course aims at developing the desired English language skills of students of Engineering and Technology so that they become proficient in communication to excel in their professional lives. The course has been sodesigned as to enhance their linguistic and communicative competence.

Course Outcome:
The students will acquire basic proficiency in English with special emphasis on listening, comprehension and speaking skills both at social and professional platforms.

Course Contents:

(i) Listening comprehension
(ii) Recognition of phonemes in International Phonetic Alphabet
(iii) Self introduction and introduction of another person
(iv)Conversation and dialogues in common everyday situations
(v) Communication at work place (Standard phrases and sentences in various situations)
(vi)Telephonic communication
(vii) Speeches for special occasions (Welcome speeches, Introduction speeches, Felicitation
speeches and Farewell speeches)
(viii) Tag Questions
(ix)Formal Presentations on literary texts prescribed in theory paper

Note: Three hour time to each segment is recommended for instruction and practice.

Scheme of End Semester Practical Exam:

1. A small passage may be read out to the examinees and they will have to write the answers to the questions asked at the end of the passage.Questions will be short answertype.
2. Examinees may be asked to identify the sounds of phonemes in given words.
3. Examinees may be asked to introduce themselves or others, participate in role play activities in mock situations, give short responses, engage in hypothetical telephonic conversation or supply the tag questions to statements etc.
4. Examinees may also be asked to deliver speeches on given situations or make presentation on the literary texts prescribed in Unit IV of theory paper.

Recommended Readings:

1. Bhatnagar, Nitin andMamta Bhatnagar.*Communicative English for Engineers and Professionals*.Pearson Education, 2013.
2. Swan, Michael.*Practical English Usage*. OUP, 1995.
3. Gangal, J.K. *Practical Course in Spoken English*. New Delhi: PHI Learning, 2015.

4. Konar,Nira. *Communication Skills for Professionals*. New Delhi: PHI Learning Pvt. Ltd., 2009.
5. Bansal, R.K. and J.B. Harrison. *Spoken English*. Orient Longman, 1983.
6. Sharma, Sangeeta and Binod Mishra. *Communication Skills for Engineers and Scientists*. Delhi: PHI Learning Pvt. Ltd., 2015.

M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (MECHANICAL ENGINEERING)

SEMESTER 3rd & 4th

Scheme effective from 2019-20

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Examination for Semester III (Second Year)

B.Tech (MECHANICAL ENGINEERING)w.e.f. 2019-20

Sr. No.	Category Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Mark of Class work	Theory	Practical	Total	
1	Basic Science course	BSC-ME-201G	Physics II(Optics & Waves)	3	0	0	3	3	25	75		100	3
2	Basic Science course	BSC-ME-203G	Mathematics-III	3	1	0	4	4	25	75		100	3
3.	Basic Science course	BSC-BIO-205G	Biology	2	1	0	3	3	25	75		100	3
4.	Engineering Science course	ESC-ECE-207G	Basics of Electronics Engg.	2	0	0	2	2	25	75		100	3
5.	Engineering Science course	ESC-ME-209G	Engineering Mechanics	3	0	0	3	3	25	75		100	3
6.	Engineering Science course	ESC-ME-211G	Basics of Mechanical Engg.	2	0	0	2	2	25	75		100	3
7.	Professional Core courses	PCC-ME-213G	Thermodynamics	3	1	0	4	4	25	75		100	3
8.	Engineering Science course	LC-ME-215G	Basics of Mechanical Engg. lab	0	0	2	2	1	25		25	50	3
TOTAL CREDIT								**22**				**750**	

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Examination for Semester IV (Second Year)

B.Tech.(MECHANICAL ENGINEERING)w.e.f. 2019-20

Sr. No.	Category Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Mark of Class work	Theory	Practical	Total	
1	Professional Core courses	PCC-ME-202G	Applied Thermodynamics	3	1	0	4	4	25	75		100	3
2	Professional Core courses	PCC- ME-204G	Fluid Mechanics	3	1	0	4	4	25	75		100	3
3	Professional Core courses	PCC- ME-206G	Strength of materials	3	1	0	4	4	25	75		100	3
4	Professional Core courses	PCC- ME-208G	Materials Engineering	3	0	0	3	3	25	75		100	3
5	Professional Core courses	PCC- ME-210G	Instrumentation & Control	3	0	0	3	3	25	75		100	3
6	Professional Core courses	LC- ME-212G	Applied Thermodynamics Lab	0	0	2	2	1	25		25	50	3
7	Professional Core courses	LC- ME-214G	SOM Lab	0	0	2	2	1	25		25	50	3
8	Professional Core courses	LC- ME-216G	Fluid Mechanics Lab	0	0	2	2	1	25		25	50	3
9	Professional Core courses	LC- ME-218G	Materials Lab	0	0	2	2	1	25		25	50	3
10	Professional Core courses	LC- ME-220G	Instrumentation Lab	0	0	2	2	1	25		25	50	3
11	Mandatory course	*MC-106G	Environment Science	3	0	1	-		25	75		-	4
TOTAL CREDIT								**23**				**750**	

*__MC-106G__ is a mandatory non –credit course in which the students will be required passing marks in theory.

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

Course code	**BSC-ME- 201G**				
Category	Basic Science course				
Course title	**Physics-II (Optics and Waves)**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	3	0	0	3	
Objectives:	➢ To acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature ➢ To be able to identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail. ➢ To be able to make approximate judgements about optical and other wave phenomena when necessary				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-1

Simple harmonic motion, damped and forced simple harmonic oscillator, Mechanical and electrical simple harmonic oscillators, differential equation of simple harmonic motion, damped harmonic oscillator , quality factor, forced mechanical and electrical oscillators, steady state motion of forced damped harmonic oscillator.

UNIT-2

Sinusoidal waves (concept of frequency and wavelength), types of waves, the one dimensional wave, transverse vibrations of stretched strings. Longitudinal sound wave in solid, The matrix method in paraxial optics (unit plane and nodal plane) wave group and group velocity, Fermat's principle and its applications (mirage effect, laws of reflection and refraction), Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle and total internal reflection.

UNIT-3

Wave optics

Huygen's principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting, Young's double slit experiment, Newton's rings, Michelson interferometer, Fraunhofer's diffraction from a single slit, the Rayleigh criterion for limit of just resolution and its application to vision, Diffraction grating (Transmission), its dispersive and resolving power.

UNIT-4

Lasers

Stimulated and spontaneous emission, Einstein's theory of matter-radiation interaction, Einstein's coefficients, amplification of light by population inversion, Pumping in lasers, three and four level laser systems, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and intensity, laser speckles, applications of lasers in science, engineering and medicine.

Course Outcomes: On successful completion of this course, students should be able to:

1. Calculate wave properties from a microscopic model.
2. Analyze optical systems (diffraction and interference).

References:

1. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.

2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.

3. E. Hecht, "Optics", Pearson Education, 2008.

4. A. Ghatak, "Optics", McGraw Hill Education, 2012.

5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

Course code	**BSC-ME- 203G**				
Category	Basic Science course				
Course title	**Mathematics III (PDE, Probability & Statistics)**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	3	1	0	4	
Objectives:	(1) To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering (2) To provide an overview of probability and statistics to engineers				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation;

UNIT-II

Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

UNIT-III

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums

and quotients, conditional densities, Bayes' rule.

UNIT-IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chisquare test for goodness of fit and independence of attributes.

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Course code	**BSC-BIO-205G**				
Category	Basic Science Course				
Course title	**Biology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III/ V/ VII**
	2	**1**		**3**	
Branches (B. Tech.)	**All Branches**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

To convey that Biology as an important scientific discipline.

To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
The molecular basis of coding and decoding genetic information is universal.
How to analyse biological processes at the reductionist level

UNIT – I

Introduction to living world: Concept and definition of Biology; Aspect of biology. Need to study biology. Characteristic features of living organisms; Cell theory, Structure of Prokaryotic and Eukaryotic cell. Distinguish between animal and plant cell. Concept of single celled organisms, Ecological aspects of single celled organisms, Types of microbes and their important properties. Economic importance of microbes.

Genetics : Mendel's laws of inheritance, Concept of allele. Concepts of recessiveness and dominance . Gene interaction , Epistasis.
Cell division- Mitosis and Meiosis. Evidence of nucleic acid as a genetic material. Concept of genetic code, Central Dogma.

UNIT – II

Introduction to Biomolecules: Definition, structure and important functions of carbohydrates (glucose, fructose, disaccharides, starch and cellulose), lipids (phospholipid, cholesterol), Amino acids. Proteins- structure and function. Primary secondary, tertiary and quaternary structure.

Nucleic acid- Structure of DNA and RNA, types of RNA, Watson and Crick model of DNA

UNIT – III

Introduction to Genetic Engineering: Concept of genetic engineering. Tools used in recombinant DNA Technology. Restriction enzymes and DNA modifying enzymes, ligases. Gene cloning; plasmid vector. Transgenic plants and animals

UNIT – IV

Applications of Biotechnology: Applications of biotechnology in Agriculture, Medicine, Environment (sewage treatment), enzyme technology.

Course Outcomes

After studying the course, the student will be able to:
Understand about living organisms, type of cells and microbes.
Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
Identify DNA as a genetic material in the molecular basis of information transfer.

References:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

6) https://onlinecourses.nptel.ac.in/noc18_bt23 by K. Suraishkumar and Madhulika Dixit

7) Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
8) Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013).

Course code	**ESC-ECE-207G**				
Category	Engineering Science course				
Course title	**Basics of Electronic Engineering**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	2	0	0	2	
Objectives:	To provide an overview of electronic device components to Mechanical engineering students.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

UNIT-II

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

UNIT-III

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

UNIT-IV

Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation
schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

Text /Reference Books:

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001

Course code	**ESC-ME- 209G**				
Category	Basic Science course				
Course title	**Engineering Mechanics**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	3	0	0	3	
Objectives:	1. To understand the basic force system. 2. To learn about Applying principles of particle kinematics. 3. To understand the concepts of particle dynamics. 4. To Learn energy methods & momentum methods.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application

Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.

UNIT-II

Truss and Frames:Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems. Centroid , Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

UNIT-III

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.

Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems.

UNIT-IV

Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem.

Shear Force and Bending Moment Diagram for statically determinant beams Classification of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem.

Course Outcomes (COs): At the end of the course, the student shall be able to:

1. Understand the basic force system.
2. Apply principles of particle kinematics.
3. Grasp the concepts of particle dynamics.
4. Learn energy methods & momentum methods.

Recommended Books:-

Engineering Mechanics – Irving H. Shames, PHI Publication
Engineering Mechanics – U.C.Jindal, Galgotia Publication
Engineering Mechanics – A.K.Tayal, Umesh Publication

Course code	**ESC-ME-211G**				
Category	Engineering Science courses				
Course title	**Basics of Mechanical Engineering**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	2	0	0	2	
Objectives:	1. To Learn Manufacturing Processes. 2. To Understand Basic Refrigeration & Air Conditioning Processes. 3. To Understand Hydraulic Turbines & Pumps. 4. To learn power transmission methods.				
Class work mark	25 Marks				
Practical mark	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Commonly used Machine Tools in a Workshop : Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting. Basic concept of thermodynamics Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics,Concept of internal energy, enthalpy and entropy, Problems.

Properties of Steam & Steam Generator: Formation of steam under constant pressure, Thermodynamic properties of steam, use of steam tables, measurement of dryness fraction by throttling calorimeter.

UNIT-II

Refrigeration & Airconditioning: Introduction to refrigeration and air-conditioning, Rating of refrigeration machines, Coefficient of performance, simple refrigeration vapour compression cycle, Psychrometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps : Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

UNIT-III

Power Transmission Methods and Devices : Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains : Introduction, Concept & types of stresses and strains, Poison's ratio, stresses and strains in simple and compound bars under axial loading, flexure & torsional loading, Stress-strain diagrams. Hook's law, Elastic constants & their relationships.

UNIT-IV

Introduction to Manufacturing Systems, Fundamentals of Numerical Control (NC). Advantage of NC systems, Classifications of NC, Comparison of NC and CNC.

Course Outcomes: At the end of the course, the student shall be able to:

1. Understand the principles and applications of various manufacturing processes.
2. Understand the concept of strain and strain for the strength of materials.
3. Grasp the concepts of power transmission devices.
4. Understand methods of thermodynamics, refrigeration & air conditioning in mechanical system.
5.

Text Books :

1. Elements of Mechanical Engineering- R.K. Rajput LAkmi Pub., Delhi.
2. Elements of Mechanical Engineering- D.S. Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics - P.K. Nag TMH, New Delhi.
4. Refrigeration & Airconditioning- Arora & Domkundwar, Dhanpat rai & Co. Pvt. Ltd.
5. Worshop Technology Volt. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture- Lindberg, R.A. Prentice Hall of India, New Delhi.
7. Principles of Manufacturing Materials and Processes- Compbell, J.S. - McGraw Hill.

Reference Books :

1. Strength of Materials- Popov, Pub. - PHI, New Delhi.
2. Hydraulic Machines- Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials- G.H. Ryder, Pub. ELBS.
4. Hydraulic and Fluid Mechanics- Modi and Seth, Pub.- Standara Book House, New Delhi.
5. Engineering Thermodynamics- C.P. Arora, Pub. - TMH, New Delhi.
6. Refrigeration & Airconditioning- C.P. Arora, Pub. -TMH, New Delhi.
7. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, East-West Press.
8. Manufacturing Process and Systems- Ostwaid, Munoz, John Wiley.
9. Workshop Technology, Vol. 1, 2, & 3- Chapman, WAJ Edward Amold.

Course code	**PCC-ME 213G**				
Category	Professional Core Courses				
Course title	**Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	
	3	1	0	4	
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				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

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.

Temperature, 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.

UNIT-II

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 & determination of properties, Mollier's chart.

UNIT-III

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 volume.

Second law - 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.

UNIT-IV

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 s 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.

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.

Course Outcomes:

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Students can evaluate changes in thermodynamic properties of substances
3. The students will be able to evaluate the performance of energy conversion devices
4. The students will be able to differentiate between high grade and low grade energies.

Text 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.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Course code	LC-ME-215G				
Category	Engineering Science courses				
Course title	Basics of Mechanical Engg. Lab				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	To understand various basic issues of Mechanical Engineering like IC engines, machines and mechanics of machines.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments

1. To study various types of boilers & also study mountings and accessories in boilers.
2. To study various types of internal Combustions Engines.
3. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of single start, Double start and Triple start worm & Worm Wheel.
4. To find the Mechanical Advantage, velocity Ratio and Efficiency of a Differential Wheel and Axle.
5. To find Moment of Inertia of a Fly Wheel.
6. Verification of reciprocal theorem of deflection using a simply supported beam.
7. Verification of moment area theorem for slopes and deflections of the beam.
8. Deflections of a truss-horizontal deflections & vertical deflections of various joints of a pin-jointed truss.
9. Elastic displacements (vertical & horizontal) of curved members.
10. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
11. Experimental and analytical study of behavior of struts with various end conditions.
12. To determine elastic properties of a beam.
13. Experiment on a two-hinged arch for horizontal thrust & influence line for Horizontal thrust.
14. Experimental and analytical study of a 3 bar pin jointed Truss.
15. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.

Course Outcomes: The students who have undergone the course will be able to understand working of IC engines, types of boilers and accessories and understand the basic mechanics.

Note:

1. At least ten experiments are to be performed in the Semester.

SEMESTER-IV

SYLLABUS

Course code	**PCC-ME 202G**				
Category	Professional Core Courses				
Course title	**Applied Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	1	0	4	
Objectives:	(1)To learn about of I law for reacting systems and heating value of fuels (2)To learn about gas and vapor cycles and their first law and second law efficiencies (3) To understand about the properties of dry and wet air and the principles of psychrometry (4) To learn about gas dynamics of air flow and steam through nozzles (5) To learn the about reciprocating compressors with and without intercooling (6) To analyze the performance of steam turbines				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

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 equilibrium composition calculations using free energy.

UNIT-II

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Supercritical and ultra super-critical Rankine cycle- 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- Vapor compression refrigeration cycles, refrigerants and their properties.

UNIT-III

Properties of dry and wet air, use of pschyrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.
Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation compressible flow in diffusers, efficiency of nozzle and diffuser.

UNIT-IV

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.
Analysis of steam turbines, velocity and pressure compounding of steam turbines

Course Outcomes:

1. After completing this course, the students will get a good understanding of various practical power
cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air
coolers, nozzles, diffusers, steam turbines and reciprocating compressors
3. They will be able to understand phenomena occurring in high speed compressible flows

Text 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.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

Course code	**PCC-ME-204G**				
Category	Professional Core Courses				
Course title	**Fluid Mechanics**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	1	0	4	
Objectives:	• To learn about the application of mass and momentum conservation laws for fluid flows • To understand the importance of dimensional analysis • To obtain the velocity and pressure variations in various types of simple flows				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, and properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium, Problems. Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net, Problems.

UNIT-II

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation, venturimeter, orifices, orificemeter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications, Problems. Compressible Fluid Flow: Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles,diffusers,injectors,Problems..

UNIT-III

Viscous Flow: Flow regimes and Reynolds's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems. Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, Problems.

UNIT-IV

Boundary Layer Flow: Boundary layer concept, displacement, momentum and energy thickness, von-karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies lift and drag on a cylinder and an airfoil, Problems. Turbulent Flow: Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes, Problems.

Course Outcomes: At the end of the course, the student shall be able to:

1. Expedite the properties of fluid along with pressure measurement techniques and concept of stability.
2. Understand the characteristics of fluid and application of continuity and Bernoulli's equation.
3. Conceptualisation of boundary layer, laminar and turbulent flow.
4. Analyse flows through pipes and open channels.

TEXT BOOKS:

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill

REFERENCES BOOKS:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi

Course code	**PCC-ME-206G**				
Category	Professional Core Courses				
Course title	**Strength of Materials**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	1	0	4	
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				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresseselastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

UNIT-II

Beams and types 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.

UNIT-III

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. Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical.

UNIT-IV

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.
Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure.

Slope & Deflection: Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical.

Course Outcomes:

1. After completing this course, the students should be able to recognise various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components
2. The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading

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 McGrawHill Publishing Co. Ltd., New Delhi 2005.

Course code	**PCC-ME-208G**				
Category	Professional Core Courses				
Course title	**Materials Engineering**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	0	0	3	
Objectives:	1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria. 2. To provide a detailed interpretation of equilibrium phase diagrams 3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

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 and Vickers and their relation to strength.

UNIT-II

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stressintensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to non-destructive testing (NDT)

UNIT-III

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.TTT-curve

UNIT-IV

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 hardening, vacuum and plasma hardening

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures
2. Understand how to tailor material properties of ferrous and non-ferrous alloys
3.How to quantify mechanical integrity and failure in materials

Text Books:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

Course code	**PCC-ME-210G**				
Category	Professional Core Courses				
Course title	**Instrumentation and Control**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	0	0	3	
Objectives:	1. To provide a basic knowledge about measurement systems and their components 2. To learn about various sensors used for measurement of mechanical quantities 3. To learn about system stability and control 4. To integrate the measurement systems with the process for process monitoring and control				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Measurement systems and performance – accuracy, range, resolution, error sources; Instrumentation system elements – sensors for common engineering measurements; Signal processing and conditioning;

Instruments and Their representation : Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration..

UNIT-II

Transducer Elements : Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamic, Eddy Current,

Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, PiezoElectric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Volatic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

UNIT-III

Motion, Force and Torque Measurement : Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter. Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements.

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

UNIT-IV

Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers; System models, transfer function and system response, frequency response; Nyquist diagrams and their use.
Practical group based project utilizing above concepts.

Pressure and Flow Measurement : Pressure & Flow Measurement, Introduction : Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Course Outcomes:

Upon completion of this course, the students will be able to understand the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.

Text Books:

1.Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 200
2.Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007
3.Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999.

Course code	**LC-ME-212G**			
Category	Professional Core Courses			
Course title	**Applied Thermodynamics Lab**			
Scheme and Credits	L	T	P	**Credits**
	0	0	2	1
Objectives:	1. To understand Vapour power cycles. 2. To understand steam boilers, their types and components. 3. To learn fundamentals of flow of steam through a nozzle. 4. To understand Steam turbines ,condensers and compressors.			
Class work mark	25 Marks			
Practical mark	25 Marks			
Total	50 Marks			
Duration of Exam	03 Hours			

List of Experiments:

1.To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To study the working of impulse and reaction steam turbines.
5. To find dryness fraction of steam by separating and throttling calorimeter.
6. To find power out put & efficiency of a steam turbine.
7. To find the condenser efficiencies.
8. To study and find volumetric efficiency of a reciprocating air compressor.
9. To study cooling tower and find its efficiency.
10. To find calorific value of a sample of fuel using Bomb calorimeter.
11. Calibration of Thermometers and pressure gauges.

Course Outcome (COs): At the end of the course, the student shall have practical exposure of:

1. Vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
2. Steam boilers, their types and components.
3. Fundamentals of flow of steam through a nozzle.
4. Steam turbines and can calculate their work done and efficiencies.
5. Types and working of condensers and compressors and define their different types of efficiencies

Note:

1. At least eight experiments should be performed from the above list.

Course code	**LC-ME-214G**			
Category	Professional Core courses			
Course title	**Strength of Materials Lab**			
Scheme and Credits	L	T	P	**Credits**
	0	0	2	1
Objectives:	1. To learn the principles of mechanics of solid and various properties of materials. 2. Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.			
Class work mark	25 Marks			
Practical mark	25 Marks			
Total	50 Marks			
Duration of Exam	03 Hours			

List of Experiments:

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod & Charpy).
6. To study the Universal testing machine and perform the tensile test.
7. To perform compression & bending tests on UTM.
8. To perform the sheer test on UTM.
9. To study the torsion testing machine and perform the torsion test.

Course Outcomes (COs): At the end of the course, the student shall be able to:

1. Learn the principles of mechanics of solid and engineering.
2. Preparation of formal laboratory reports describing the results of experiments.
3. Acquire to operate basic instruments in mechanics of materials lab.
4. Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.

Note:

1. At least Seven experiments are to be performed in the semester.

Course code	**LC-ME-216G**				
Category	Professional Core courses				
Course title	**Fluid Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1. Understand the techniques and concept of stability. 2. Learning continuity and Bernoulli's equation. 3. Learn discharge measuring devices and hydraulic coefficients. 4. Knowledge of different types of pipe losses and determine the velocity profile in a pipe.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orificemeter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.
12. To verify the momentum equation.

Course Outcomes (COs): At the end of the course, the student shall be able to:

1. Understand the techniques and concept of stability.
2. Learning continuity and Bernoulli's equation.
3. Analyse discharge measuring devices and hydraulic coefficients.
4. Knowledge of different types of pipe losses and determine the velocity profile in a pipe.

Note:

1. **At least eight experiments are to be performed in the semester.**

Course code	**LC-ME-218G**				
Category	Professional Core courses				
Course title	**Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1. Learn the principles of materials science and engineering though lab investigation. 2. Understand the basics structure of materials and ability to interpret the data from the experiments.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study microstructure of heat-treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.

Course Outcomes:

1- Learn the principles of materials science and engineering though lab investigation.

2- Prepare formal laboratory reports describing the results of experiments.

3- Operate basic instruments in materials science and engineering.

4- Understand the basics structure of materials and ability to interpret the data from the experiments.

Note:-

1. **At least eight experiments are to be performed in the semester.**

Course code	**LC-ME-220G**				
Category	Professional Core courses				
Course title	**Instrumentation Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1 - To understand about the applications of measurement systems. 2 - To understand about the basics and working principle of pressure, temperature and flow measurement. 3 - Identify the different variation of measurement parameter with various input conditions. 4 - To analyze the primary, secondary and tertiary measurements. 5 - To learn about the various control devices and parts of measurement systems.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments :

1. To Study various Temperature Measuring Instruments
   (a) Mercury – in glass thermometer
   (b) Thermocouple
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. To measure load (tensile/compressive) using load cell on a tutor.
5. To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
6. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
7. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
8. To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell.
9. To test experimental data for Normal Distribution using Chi Square test.
10. Vibration measurement.
11. To study various types of measurement Error.

Course Outcomes:

1 - To understand about the applications of measurement systems.

2 - To understand about the basics and working principle of pressure, temperature and flow measurement.

3 - Identify the different variation of measurement parameter with various input conditions.

4 - To analyze the primary, secondary and tertiary measurements.

5 - To learn about the various control devices and parts of measurement systems

Note:

1. **At least eight experiments are to be performed in the Semester.**

MC-106G : (ENVIRONMENT SCIENCE)

Theory 75 Marks Field Work 25 Marks (Practical/Field visit)

Unit-1 The Multidisciplinary nature of environment studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non-renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3 Ecosystems :

* Producers, consumers and decomposers.

* Energy flow in the ecosystem.

* Ecological succession.

* Food chains, food webs and ecological pyramids.

* Introduction, types, characteristic features, structure and function of the following eco-system :

a. Forest ecosystem.

b. Grassland ecosystem.

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.

* Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

* Biodiversity at global, National and local levels.

* India as a mega-diversity nation.

* Hot-spots of biodiversity.

* Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

* Endangered and endemic species of India.

* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution

c) Soil pollution

d) Marine pollution

e) Noise pollution

f) Thermal pollution

g) Nuclear hazards

* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6 Social issues and the Environment:

* From unsustainable to sustainable development.
* Urban problems related to energy.
* Water conservation, rain water harvesting, watershed management.
* Resettlement and rehabilitation of people : its problems and concerns case studies.
* Environmental ethics : Issues and possible solutions.
* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
* Wasteland reclamation.
* Consumerism and waste products.
* Environment Protection Act.
* Air (Prevention and Control of pollution) Act.
* Water (Prevention and Control of pollution) Act.
* Wildlife Protection Act.
* Forest Conservation Act.
* Issues involved in enforcement of environmental legislation.
* Public awareness. (7 lectures)

Unit-7 Human population and the Environment.

Population growth, variation among nations.

Population explosion- Family Welfare Programme.

Environment and human health.

Human Rights.

Value Education.

HIV/AIDS.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.
* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.
* Study of common plants, insects, birds.
* Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd. Bikaner.
2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net

(R).

3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.
6. De A.K., Environmental Chemistry, WileyEastern Ltd.
7. Down to Earth, Centre for Science and Environment (R).
8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural HistorySociety, Bombay(R).
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge Uni. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).
15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford & TBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C., Harper J. and Michael Begon. Essentials of Ecology, Blackwell Science (TB).
20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).
21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno Science Publications (TR).
22. Wagner K.D., 1998, Environmental Management, W.B. Saunders co. Philadelphia, USA 499p.
23. Atext book environmental education G.V.S. Publishers byDr. J.P. Yadav.

(M) Magazine

(R) Reference

(TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory: 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A: Short Answer Pattern	:	15marks
Part- B : EssayType with inbuilt choice	:	60marks
Part-C : Field Work (Practical)	:	25marks

Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Mechanical Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Course code	**PCC-ME -308G**				
Category	Professional Core Courses				
Course title	**DYNAMICS OF MACHINES**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	1) To understand the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations. 2) Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses. 3) To understand the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Static and Dynamic Force Analysis: Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms.

Dynamics of Reciprocating Engines: engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

UNIT-II

Balancing of Rotating Components: static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing.

Balancing of Reciprocating Parts: Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.

UNIT-III

Governors: introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

Dynamometers: types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

UNIT-IV

Gyroscope: gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the Static and Inertia Force Analysis.
CO 2- Explore the concept of Balancing of rotating and reciprocating masses.
CO 3- Knowledge of concept of Mechanical Governor.
CO 4- Develop the concept of Gyroscope and its application.
CO 5- explore the concept of Mechanical Vibration.

Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, Third Edition Affiliated East-West Press.
2. Theory of Machine: S.S. Rattan, McGraw Hill Higher Education.

References:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati, New age International.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition Mc Graw Hill, Inc .
3. Theory of Machines, Beven, Pearson Indian Education Services, Pvt. Ltd.

Course code	**LC-ME -310G**				
Category	Engineering Science courses				
Course title	**WORKSHOP LAB -I**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	3	1.5	
Objectives:	To study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines,NC,CNC machine etc. To understanding with the practical knowledge required in the core industries and different types of components using the machine tools.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments: (MANUFACTURING TECHNOLOGY –II LAB)

1. Study and Practice of Orthogonal & Oblique Cutting on a Lathe.
2. Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.
3. Study of Tool Life while Milling a component on the Milling Machine.
4. Study of Tool Wear of a cutting tool while Drilling on a Drilling Machine.
5. Study of Speed, Feed, Tool, Preparatory (Geometric) and miscellaneous functions for N. C part programming.
6. Part Programming and proving on a NC lathe for:- a. Outside Turning b. Facing and Step Turning c. Taper Turning d. Drilling e. Outside Threading
7. Part Programming and Proving on a NC Milling Machine:-
    a. Point to Point Programming
    b. Absolute Programming
    c. Incremental Programming
8. Part Programming and Proving for Milling a Rectangular Slot.

Course Outcome (COs): At the end of the course, the student shall have practical exposure of:
CO 1- vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
CO 2- steam boilers, their types and components.
CO 3- fundamentals of flow of steam through a nozzle.
CO 4- steam turbines and can calculate their work done and efficiencies.
CO 5- types and working of condensers and compressors and define their different types of efficiencies

NOTE:

1. At least Six experiments are to be performed in the Semester.

Course code	**LC-ME -312G**				
Category	Engineering Science courses				
Course title	**WORKSHOP LAB -II**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Objectives:	After studying this course, students will be able: Understand the how to prepare the graph between bhp, ihp, fhp vs speed by using variable compression test rig. Knowledge of functions of 4 stroke and two stroke engines and Combustion System of IC Engines with Lubrication and Cooling system.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments: (I.C. ENGINES & GAS TURBINES LAB)

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp,fhp, vs speed (ii) volumetric efficiency & indicated specific specific fuel consumption vs speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
11. To draw the scavenging characteristic curves of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

Course Outcomes (COs): After studying this course, students will be able:

CO 1- Understand the how to prepare the graph between bhp, ihp, fhp vs speed by using variable compression test rig.

CO 2- Knowledge of functions of 4 stroke and two stroke engines.

CO 3- Learn Combustion System of IC Engines with Lubrication and Cooling system.

CO 4- Familiarization of the pollution control system.

NOTE:

2. At least ten experimentsare tobe performed in the Semester.

3. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as perthe scope of the syllabus.

Course code	**LC-ME-314G**				
Category	Engineering Science courses				
Course title	**HEAT TRANSFER LAB**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	0	0	2	1	
Objectives:	(1) The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation. (2) The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. Measurement of heat transfer rate in a channel flow using winglets.
4. To determine the thermal conductivity of a solid by the guarded hot plate method.
5. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
6. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
7. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
8. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
9. To measure the emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity with surface temperature.
10. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
11. To verify the Stefen-Boltzmann constant for thermal radiation.
12. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes.
13. To study the two phases heat transfer unit.
14. To determine the water side overall heat transfer coefficient on a cross-flow heat exchanger.
15. Design of Heat exchanger using CAD and verification using thermal analysis package eg. I-Deas etc.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understanding the conduction heat transfer coefficient.

CO 2- Design and analyze heat transfer system with practical demonstration.

CO 3- Selection of equipments and their practical demonstration in heat transfer design.

CO 4- Knowledge of development about mass transfer

Note:

1. At least ten experiments are to be performed in the semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

Course code	**LC-ME-316G**				
Category	Engineering Science courses				
Course title	**DYNAMICS OF MACHINE LAB**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Objectives:	1. To understand the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations. 2. Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
4. To study gyroscopic effects through models.
5. To determine gyroscopic couple on Motorized Gyroscope.
6. To perform the experiment for static balancing on static balancing machine.
7. To perform the experiment for dynamic balancing on dynamic balancing machine.
8. Determine the moment of inertial of connecting rod by compound pendulum method and tri-flair suspension pendulum.

Course Outcomes: At the end of the course, the student shall be able to:

CO 1- Understand the various practical demonstrations of forces in mechanism.

CO 2- Knowledge of various Design features of mechanism with practical demonstration.

CO 3- Learning the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine

CO 4- Prepare practical model using the various linkages.

Note :

1. Ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed & set by the concerned Institution as per the scope of the syllabus.

Course code	**PCC-ME -318 G**				
Category	Professional Core Courses				
Course title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Objectives:	1. To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.				
Practical Class mark	25 Marks				
Total	25Marks				
Duration of Exam	03 Hours				

Selecting of Seminar Topics by Teacher or concerned to teacher by students. A seminar topic given by students in semester.

Course code	**PEC-ME -320G**				
Category	Professional Elective Courses				
Course title	**INTERNAL COMBUSTION ENGINES & GAS TURBINES**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	1. To familiarize with the terminology associated with IC engines. 2. To understand the basics of IC engines. 3. To understand combustion, and various parameters and variables affecting it in various types of IC engines. 4. To learn about various systems used in IC engines and the type of IC engine required for various applications				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems.

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

UNIT-II

Combustion in I.C. Engines: S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

UNIT-III

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems.

Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.

UNIT-IV

Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytropic efficincy, surging, choking and stalling, performance characteristics, Problems.

Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with intercooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the Air Standard Cycles with their applications.
CO 2- Analyze carburetion, injection and ignition systems with new technologies.
CO 3- Conceptualize Combustion System of IC Engines.
CO 4- Knowledge of Lubrication and Cooling systems and fuel cells.
CO 5- Analyses the gas turbines.

Text Books:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India

References:

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York
3. Fundamentals of Internal Combustion Engines-H.N. Gupta, PHI, New Delhi

Course code	**PEC-ME -322G**				
Category	Professional Elective Courses				
Course title	**WELDING TECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	1.To study essential concepts for welding processes. 2.To study various techniques for weld testing. 3. To study the concept special welding processes and welding automation.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Oxy-Acetylene Welding: Introduction: Welding processes and their principles, Industrial Applications, Principles of Oxy- Acetylene Welding, Procedure, Types of flames, Poping, Flash Back and Fire. Equipment and Accessories: Torches, Regulators, Pressure Gauges, Gas Cylinders, Filler Rods and Welding Fluxes. Welded Joints and their Defects: Types of Joints and Welding Positions, Common Welding Defects and their control.

Automation in Welding: Introduction, Manual Welding, Semi-Automatic Welding, Automatic Welding, Welding Mechanization, Flexible Automated Welding, Robotic Welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system.

UNIT-II

Electric Arc Welding: Principle of Electric Arc Welding: Principle, Welding Procedure, Arc Length, Arc Force and Arc Blow. Equipment and Accessories: Welding Machines, A.C. and D.C. Transformers, Motor Generators, Rectifiers, Use of Tong Tester for measuring welding currents, Types of Electrodes and Indian system of classification and coding of covered Electrodes for Mild Steels.

UNIT-III

Special and Allied Welding Processes: Resistance Welding: Principle, Types and Applications, Equipment and Machinery required. Metal Inert Gas Arc Welding (MIG): Principle, Advantage of Gas Shielded Arc Welding, Types of Metal Transfer, Welding Equipment and Shielding Gases, MIG Welding and its components.CO_2 Welding: Difference from MIG Welding, Principle of operation, Welding Equipments, Welding Parameters, Joint Design, Welding Procedure, Advantages, Disadvantages and Applications. Tungsten Inert Gas Arc Welding: Welding Equipment-Electrodes, Inert gases and Torches, Inert gas shielded, Spot welding Processes. Submerged Arc Welding: Principle of the Process and its Applications, Fluxes and Welding Rods. Soldering and Brazing: Soft and Hard Solders, Fluxes, Soldering Iron, Soldering procedure, principle of Brazing and different methods of Brazing, Comparison between Brazing and Soldering.

UNIT-IV

Destructive Testing of Welds: Destructive tests: their advantage and Types such as Tensile Test, Bend Test, Impact Test, Hardness Test, Fatigue Tests, Equipment required and the test piece Geometry. Computer systems for Welding Engineering: Introduction, computer systems, software for welding engineers, magdata, weld cost, weld vol, distortcalc, cut best, weld best, ferrite predictor and weld selector.

Non Destructive Testing of Welds: Non Destructive Tests: their Advantages and Limitations, Comparison with Destructive Tests, Visual Examination, Dye Penetrant Inspection, Magnetic Particle Inspection, X-Rays and Gamma Rays Inspection and Ultrasonic Inspection of Welds. Standards/ codes for welding.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Lay down Principles and applications of oxyacetylene and electric arc welding.

CO 2- Understand various types of weld testing.

CO 3- Have Knowledge of techniques of welding automation.

CO 4- Describe methods of advanced and special welding processes. Course Contents:

Text Books: 1. Welding and Welding Technology by R. Little- Tata McGraw Hill Publication.

2. Welding Processes and Technology by R. S. Parmar- Khanna Publication.

References:

1. Welding Technology by Koeingsberger, J. R. Adair- Macmillan.

2. Welding Technology by Rossi- Mc Graw Hill Publications.

3. Welding Handbook, Eighth Edition, Vol. 1 & 2- American Welding Society.

4. Welding, Hoffman, Pearson Indian Education Services, Pvt. Ltd. India

Course code	**PEC-ME -324G**				
Category	Professional Elective Courses				
Course title	**AIRCRAFT TECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	To understand the principles of operation of aircrafts, aerodynamics, general familiarization of aircraft engine systems, maintenance procedures and standard practices.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Principles of Flight: History of flights, Aircraft configurations, Flight control systems; Mechanical control, Powered control, Fly-By-Wire and digital Fly-By-Wire control systems, flying limits, Airframe & engine manufacturers.

Aircraft Thermodynamics: First law of thermodynamics, Second law of thermodynamics, Air standard cycles, Brayton cycle & its variants.

UNIT-II

Aircraft Propulsion: Thrust, Thrust equation, Propulsive efficiency, Factors effecting thrust, Fundamentals of gas turbine engines, Aircraft engine construction, Classification of compressors; centrifugal and axial compressor, Effect of pressure, velocity & temperature change through the compressor, classification of combustion chambers and performance, classification of gas turbines & operation, convergent/divergent nozzles, Type of aircraft engines; turbo jet, turbo-prop & turbo fan engines.

UNIT-III

Aerodynamics of Airplanes: Basics of aerodynamics, Wing airfoil profile and effects, Thrust, drag, lift & gravity, Control surfaces; aileron, elevator, rudder, slat, flap & spoiler, servo tab etc. Thrust reversers.

Engine Systems, Inspection& Maintenance: Fuel system, Lubrication system, Compressor air flow control system, Turbine vanes and blade cooling, Full authority digital electronic engine control, Engine starting and ignition, Fire protection system, Engine Inlet cowling anti icing, environmental control system, engine indicating system, Standard practices of aero engine maintenance, engine overhauling, Bore scope inspection.

UNIT-IV

Miscellaneous Aviation: Concepts and flight of Helicopter, Drone, Air taxi, Rocket etc. History & overview of air war fare, Difference between civil & fighter craft aerodynamics & engines,

Development &types of fighter crafts, fighter craft weapons & firing, Safety, maintenance & emergency features. Maritime fighters.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Explore principles of flight and the basic thermodynamics involved.

CO 2- Have knowledge of Propulsion fundamentals and application of gas turbine system in aircraft.

CO 3- Understand aerodynamics, different aircraft systems, inspection and maintenance.

CO 4- Explore different aviation systems along with fighter crafts.

References:

1. Kermode, A.C. Flight without formulae, Pearson Education; latest edition

2. Anderson, J.D. Introduction to flights, McGraw-Hill latest edition

3. Engineering Thermodynamics- P K Nag, Tata McGraw Hill

4. Thermodynamics: An Engineering Approach- Cengel and Boles, McGraw Hill Company

5. Hill P.G & Peterson, C.R. "Mechanics & Thermodynamics of propulsion" Pearson education latest edition

6. United Technologies' Pratt & Whitney, "The Aircraft Gas Turbine Engine and its Operation

7. Kroes & Wild, "Aircraft Power Plants", 7th Edition- McGraw Hill, New York, latest edition

8. Mekinley, J.L and R.D. Bent, Aircraft Power Plants, McGraw Hill latest edition

9. Teager, S, "Aircraft Gas Turbine Technology, McGraw Hill latest edition

10. Aviation Maintenance Technician Hand Book- Power Plant Volume -2 FAA-H-8083-32.

Course code	**PEC-ME -326G**				
Category	Professional Elective Courses				
Course title	**RELIABILITY, AVAILABILITY & MAINTAINABILITY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	The objective of the course is to provide the students with the fundamental concepts, the necessary knowledge and the basic skills related to systems reliability, availability and maintainability.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Reliability Availability and Maintainability (RAM), Development of RAM Engineering, Reliability Availability and Maintainability utilization factors, down time consequences. Failure data analysis, MTBF, MTBR, MTTR, Reliability improvement and apportionment;

UNIT-II

Concept of terro-technology; Statistical distribution associated with reliability engineering.; Quantitative measures of reliability, Bath tub curve; Quantitative; Fault tree analysis (FTA),Failure mode and effect analysis (FMEA), Failure mode, effect and criticality analysis (FMECA).

UNIT-III

Reliability engineering fundamentals and applications, Historical perspectives, Definition of Reliability, Role of Reliability evaluation, Reliability assessment, relationship between Different Reliability functions, typical Hazard functions, Mean time to failure, Cumulative Hazard function and average failure rate.

Application of Probability distribution function in Reliability evaluation combinational Aspects of Reliability, Markov models optimization of system Reliability, Heuristic Methods applied to optimal system Reliability.

UNIT-IV

Maintainability : Definition and application of Maintainability Engineering, Factors affecting Maintainability. Maintainability design criteria, operating and down time categories, Mean time to activity restore equipment, Mean Maintenance man hours, Mean time for corrective and Preventive Maintenance, measures of maintainability and measures to assure maintainability.

Availability, types of Availability, Steady state availability, approaches to increase equipment Availability, Markov analysis of availability.

Course Outcomes: At the end of his course, the students will be able to:

CO 1 Evaluate the reliability of a system and its subcomponents

CO 2 Gain the necessary knowledge about failure distributions and apply failure maintenance techniques.

CO 3 Perform reliability analysis of a system and designing the same CO 4 Estimate systems availability and maintainability,

CO 4 Develop the Markov model for the mechanical systems.

References:

1. Reliability Engineering Fundamentals R. Ramakumar

2 Maintainability, Availability and Dimitri Kececelogu

3. Reliability Engineering Govil

4. Reliability Engineering Balguruswamy

5. Elsayed A. Elsayed, Reliability is Engineering, Addison Wesley, latest edition

6.Cher Ming Tan, “Reliability Assessment of Integrated Circuits and its misconception”, Nova Science Publisher, Inc, latest edition

Course code	**HSMC-02G**				
Category	**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)**				
Course title	**ORGANIZATIONAL BEHAVIOUR**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT-II

Introduction of organization:-Meaning and process of Organization, Management v/s Organization; Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.

Individual Processes and Behavior-Personality- Concept, determinants and applications; Perception- Concept, process and applications, Learning- Concept ,theories ; Motivation- Concept, techniques and importance.

UNIT-III

Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, Conflict- Concept, sources, types, management of conflict; Leadership: Concept, function, styles & qualities of leadership.

Communication – Meaning, process, channels of communication, importance, barriers and overcome of communication.

UNIT-IV

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; Organizational culture - Elements, types and factors affecting organizational culture. Organizational change: Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes :On completion of this course, the students will be able

CO1: Students will be able to apply the managerial concepts in practical life.

CO2: The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
CO3: Students will be able to understand the behavioral dynamics in organizations.
CO4: Students will be able to understand the organizational culture and change.

References:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

Course code	**HSMC-04G**				
Category	**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)**				
Course title	**HUMAN RESOURCE MANAGEMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	1. To acquaint the students with the concept and function of human resource management 2. To learn the various human resource systems and programme in an organization to achieve higher productivity 3. To acquaint the students with knowledge of career planning and development, occupational safety, health and wellbeing and union management relationship.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Human Resource Management: concept and scope; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals; Human Resource Planning & Forecasting: significance and process.

UNIT-II

HR Sourcing: Recruitment, Selection and Induction. Job Analysis: job Description and job Specification; Job Design: concept and methods; Job Evaluation-concept &methods; Performance appraisal and counselling.

UNIT-III

Training: training process and methods; Career planning and Development; Succession planning; Employee Compensation: basic concepts & determinants;

UNIT-IV

Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM. HR Audit &Accounting, ethics & corporate social responsibility.

Course Outcomes :On completion of this course, the students will be able

CO1: To develop the understanding of the concept of human resource management and to understand its relevance in organizations.

CO2: To develop necessary skill set for application of various HR issues.

CO3: To analyse the strategic issues and strategies required to select and develop manpower resources.

CO4: To integrate the knowledge of HR concepts to take correct business decisions.

Suggested Readings: 1. K. Aswathapa Human resource Management: Text and cases, 6th edition, Tata McGraw Hill, New Delhi,2012

2. Uday Kumar Haldar &Juthika Sarkar(2012) Human resource Management New Delhi, Oxford University Press.

3. De Cenvo, Da & Robbins S.P.(2010) Fundamentals of Human Resource Management, 9th edition, New York, John Wiley & Sons.

4. Gary Dessler (2008) Human Resource Management, 11th edition New Delhi: Pearson Prentice Hall.

5. Tanuja Agarwala, Strategic Human resource Management, Oxford University Press 2007.

References:

1.Handbook of Industrial and Organizational Psychology: Personnel Psychology(Vol. 1). New Delhi: Sage Publications, New Delhi. Armstrong, M. latest edition

2.A Handbook of Human Resource Management Practice (9th ed.). New Delhi : Kogan Page India, Aswathappa, K. latest edition

3.Managing Human Resources. India: Thomson Asi Private Limited. Bratton, J. & Gold, J. latest edition

4.Human Resource Management Theory and Practice (4th ed.), New York, NY: Palgrave Macmillan. Cascio, W.F &Aguinis, H. latest edition

Course code	**HSMC-06G**				
Category	**OPEN ELECTIVE COURSES(OEC)**				
Course title	**INDUSTRIAL PSYCHOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	1. To acquaint students with the applications of psychometric tools and inventories in organizations 2. To acquaint the students with the tools of behavioral and organizational interventions & develop the skills to analyze behavioral issues in organizations. 3. To gain an understanding of the functioning of an organizations through organized field visit. 4. To gain firsthand experience through focused group discussions.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Structured Experience Students need to learn to plan, design and conduct the structured exercises in any of the following areas under supervisor supervision: self-awareness, team building, interpersonal skills, leadership skills, perception, decision-making and problem solving, creativity, power and politics, communication skills, conflict, stress management, motivation and goal setting, or any recent developments.

UNIT-II

HRD Instruments: (any five: administered, scored, interpreted and discussed) Role efficacy, role stress, coping styles, HRD climate, TOBI, SPRIO, MAOB, emotional intelligence, ENNEAGRAM, conflict management styles, OCTAPACE, leadership, trust, life and goal planning or any recent developments.

Field Visit: Students will get firsthand experience of the organization. Can take up any project given by the organization and write a report. A student can undertake specific or overall activity of the organizations in consultation with the supervisor. The student can choose any organization and write a report: education sector, government sector, health sector, banking sector, service industry, NGO, or any recent developments.

UNIT-III

Force-field Analysis and Appreciative Inquiry Students will conduct with the help of supervisor all the steps of force field analysis (identifying the problem and identifying the desired state; identifying the forces involved, and determining the strengths of each force. Action plans for increasing driving forces and reducing restraining forces and appreciative inquiry (4 D approach: discovery, dreaming, designing and destiny) as an OD intervention. After conducting the same students will write the report of the same.

UNIT-IV

Focused Group Discussion Either students conduct a focus group based on need diagnostic or problem focused group study in any area of consumer behavior (customers of sales, retail, banking, insurance, aviation etc) or industrial / organizational psychology/human resource and submit a report. a) Select the team b) Select the participants c) Decide on time and location d) Prepare for and conduct focus group discussion e) Submit a report .

Course Learning Outcomes (CLOs) By the end of this course, students will be able to demonstrate the following:

1. Describe major topics and subspecialties including critical theory and research finding that have defined the field of I/O psychology
2. Describe the complicated systems of individual and group psychological processes involved in the world of work
3. Connect the basic principles of I/O psychology to personnel and human resources management within the organization
4. Describe the ways in which individual career choices and work-lefe success can be improved through the benefits of I/O psychology
5. Use APA style writing and to enhance psychological writing

References:

1. Barbour, R. (2007). Doing Focus Groups. Los Angeles: Sage Publications. Clark, A.W. latest edition
2. Experimenting with organizational life: The action research approach. New York: Plenum Press. Cooperrider, D.L., Whitney, D. &Stavros, J.M. latest edition
3. Appreciative Inquiry Handbook: For Leaders of Change (2nd ed.). San Francisco, USA: Berrett – Koehler Publishers Inc. French, W.L., Cecil, H.B., & Vohra, V. latest edition
4. Organizational Development: Behavioral Science Interventions for Organization Improvement (latest ed.). New Delhi: Prentice Hall. Krueger, R.A., Casey, M.A. latest edition
5. Focus Groups: A practical guide for Applied Research (latest ed.). Los Angeles: Sage Publications, Los Angeles. Litosselitti, L. latest edition
6. Using Focus Groups in Research. New York, NY:Continuum. Pareek, U. & Purhoit, S. latest edition
7. Training Instruments in HRD and OD (3rd ed.). New Delhi: Tata McGraw Hill. Pfeiffer, J.W. &Jones, J.E. latest edition
8. A Handbook of structured Experiences for Human Relations Training. San Diego, CA: University Associates Inc. Sayeed, O.B & Pareek, U. latest edition
9. Actualizing Managerial Roles: Studies in Role Efficacy. New Delhi: Tata McGraw – Hill Publishing Company Limited. Watkins, J.M., Bernard, J., Kelly, M.R. latest edition
10. Appreciative Inquiry: Change at the Speed of Imagination (2nd ed.). USA: John Wiley and Sons Inc.

Course code	**HSMC-08G**				
Category	**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)**				
Course title	**FUNDAMENTALS OF MANAGEMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	Students will be able to understand the how evolution of Management and contribution of Management thinkers. The importance of staffing and training ;the concept of material management and inventory control; the components of marketing and advertising ;various sources of finance and capital structure.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Meaning of management, Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts. Principles of Management. The Management Functions, Inter-relationship of Managerial functions. Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

UNIT-II

Production Management : Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and various methods.

UNIT-III

Marketing Management - Definition of marketing, marketing concept, objectives & Functions of marketing. Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

UNIT-IV

Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

Course outcomes:

Students will be able to understand

CO1 - Evolution of Management and

contribution of Management thinkers. CO2 -

importance of staffing and training

CO3 - the concept of material

management and inventory control

CO4 - the components of marketing

and advertising

CO5 - various sources of finance and capital structure

TEXT BOOKS: 1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S. Bhalla.(Kalyani Publishers)

2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)

REFERENCES:

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)

2. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).

3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).

4. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)

5. Management - James A.F. Stoner & R.Edward Freeman, PHI.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Mechanical Engineering)

SEMESTER 7th AND 8th

Scheme effective from 2021-22

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
OEC	Open Elective Courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical
PROJ	Project

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Studies and Examination B.TECH (Mechanical Engineering) – 7th Semester

w.e.f. 2021-22 (Scheme-G)

Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
		L	T	P			Internal Assessment	External Examination Theory	Practical	Total	
PEC	Professional Elective Courses(PEC): Refer List-II	3	0	0	3	3	25	75		100	3
PCC-ME-401G	Design of Machine Element-II	3	0	0	3	3	25	75		100	3
PCC-ME-403G	Entrepreneurship Development	3	0	0	3	3	25	75		100	3
PEC	Professional Elective Courses(PEC): Refer List-III	3	0	0	3	3	25	75		100	3
LC-ME-403G	Workshop Lab-III	0	0	2	2	1	25		25	50	3
PCC-ME-405G	Seminar	0	0	2	2	1	25		25	50	3
PROJ-ME-407G	Project-I	0	0	9	9	4.5	25		25	50	3
PT-ME-409G	Practical Training-II	0	0	2	2	Refer Note:1 (Grading)					
MC-317G	Constitution of India	2	0	0	2	Refer Note:2 (Grading)					
TOTAL CREDIT						**18.5**	**175**	**300**	**75**	**550**	**3**

Note: 1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat .

Practical Training. Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Note: 2 The students will be awarded grades A, B, C & F in Evaluation of Constitution of India. A student who is awarded 'F' grade is required to repeat.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

3.Choose any one subject from Professional Elective Courses(PEC) (Semester-VII) LIST-II and LIST-III

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester-VII) LIST-II

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-401G	Refrigeration & Air Conditioning	3	3
2.	PEC-ME-403G	Project Management	3	3
3.	PEC-ME-405G	Numeric Control of Machine Tools and Robotics	3	3
4.	PEC-ME-407G	Finite Element Analysis	3	3

Note: Students will have to select any one out of the list.

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester-VII) LIST-III

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-409G	Noise and Vibrations	3	3
2.	PEC-ME-411G	Solar Energy Engineering	3	3
3.	PEC-ME-413G	Tribology	3	3
4.	PEC-ME-415G	Composite Materials	3	3

Note: Students will have to select any one out of the list.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Studies and Examination B.TECH (Mechanical Engineering) – 8th Semester

w.e.f. 2021-22(Scheme-G)

Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
		L	T	P			Internal Assessment	External ExaminationTheory	Practical	Total	
PCC-ME-402G	Industrial Automation	3	0	0	3	3	25	75		100	3
PEC	Professional Elective Courses(PEC): Refer List-IV	3	0	0	3	3	25	75		100	3
PEC	Professional Elective Courses(PEC): Refer List-V	3	0	0	3	3	25	75		100	3
PEC-	Professional Elective Courses(PEC): Refer List-VI	3	0	0	3	3	25	75		100	3
OEC/HSMC-III	Refer OEC List-III	3	0	0	3	3	25	75		100	3
LC- ME-404G	Workshop Lab-IV	0	0	2	2	1	25		25	50	3
PCC-ME-406G	Seminar	0	0	2	2	1	25		25	50	3
PROJ-ME-408G	Project-II	0	0	10	10	5	25		25	50	3
TOTAL CREDIT						**22**	**200**	**375**	**75**	**650**	

1.Choose any one subject from Professional Elective Courses(PEC) (Semester-VIII) LIST-IV

2.Choose any one subject from Professional Elective Courses(PEC) (Semester-VIII LIST-V

3.Choose any one subject from Professional Elective Courses(PEC) (Semester-VIII LIST-VI.

4.Choose any one subject from Open Elective Courses(OEC)/ Humanities and Social Sciences Including Management Courses (HSMC)- (Semester VIII)-LIST-III

PROFESSIONAL E ELECTIVE COURSES(PEC) (Semester-VIII) LIST-IV

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-402G	Tool Design	3	3
2.	PEC-ME-404G	Plant Maintenance Engg.	3	3
3.	PEC-ME-406G	Design and Optimization of Thermal Energy Systems	3	3
4.	PEC-ME-408G	Gas Dynamics and Jet Propulsion	3	3

Note: Students will have to select any one out of the list.

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester- VIII) LIST-V

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-412G	Power Plant Engineering	3	3
2.	PEC-ME-414G	Product Design and Development	3	3
3.	PEC-ME-416G	Non Conventional Energy Resources Utilization	3	3
4.	PEC-ME-418G	Introduction to Nanoscience and Nanotechnology	3	3

Note: Students will have to select any one out of the list.

PROFESSIONAL ELECTIVE COURSES(PEC) (Semester-VIII) LIST-VI

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-420G	Automobile Engineering	3	3
2.	PEC-ME-422G	Design of Transmission Systems	3	3
3.	PEC-ME-424G	Alternate Fuels and Energy Systems	3	3
4.	PEC-ME-426G	Optimisation for Engineering Design	3	3

Note: Students will have to select any one out of the list.

OPEN ELECTIVE COURSES(OEC)/ HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)-LIST-III

Students have to select any one Open Elective Course-I from the list of courses.

List-III (Semester VIII)

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	OEC –ME-402G	Operation Research	3	3
2.	OEC –ME-410G	Quality Engineering	3	3
3.	OEC –EE-412G	Electrical Power Generation	3	3
4.	OEC-CSE-430G	Computer Communication	3	3
5.	OEC-CE- 448G	Traffic Engineering and Road Safety	3	3
6.	OEC-CE- 450G	Disaster Management	3	3
7.	OEC –ECE-453G	Microprocessor Application in Automobiles Sector	3	3
8.	HSMC-10G	Management Information Systems	3	3

Note: Students will have to select any one out of the list.

Course code	**PCC-ME-401G**				
Category	Professional Core Courses				
Course title	**Design of Machine Element-II**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	To understand the Design for Production and for variable loading. Impart in depth knowledge of designing of screws and different types of fasteners. How to design bearings, selection of bearings for different aspects & lubricants with their properties. Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication. Learn in depth knowledge of flywheels and their design.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Design for Production ; Erogonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining.

Variable Loading : Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

UNIT-II

Shafts: Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.

Springs: Types of Springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem.

UNIT-III

Bearings : design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

UNIT-IV

Gears : Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth -Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Expose the students to the Design for Production and for variable loading.

CO 2- Impart in depth knowledge of designing of screws and different types of fasteners.

CO 3- Design bearings, selection of bearings for different aspects & lubricants with their properties.

CO 4- Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication.

CO 5- Learn in depth knowledge of flywheels and their design.

Note:

1. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:
   (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
   (ii) Design Data Book PSG College of Technology Coimbatore

Text Books:

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

Reference Books :

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman 8. Machine Design : S.G. Kulkarni , TMH , New Delhi.

Course code	**PCC-ME-403G**				
Category	Professional Core Courses				
Course title	**Entrepreneurship Development**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	To familiarize the students with the basics of Entrepreneurship Development.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Entrepreneurship : Concept and Definitions; Entrepreneurship and Economic Development; Types of Entrepreneurs; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Manager Vs. Entrepreneur, types of entrepreneurships, Entrepreneurial myths.

UNIT-II

Opportunity Identification and Product Selection: Entrepreneurial Opportunity Search & Identification;Criteria to Select a Product; Conducting Feasibility Studies; Sources of business ideas, launching a new product; export marketing, Methods of Project Appraisal, Project Report Preparation; Project Planning and Scheduling. Sources of finance for entrepreneurs.

UNIT-III

Small Enterprises and Enterprise Launching Formalities : Definition of Small Scale; Rationale; Objective;Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection , Role of SSI in Economic Development of India; major problem faced by SSI,MSMEs

– Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes.

UNIT-IV

Role of Support Institutions and Management of Small Business : Director of Industries; DIC; SIDO;SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Venture Capital : Concept, venture capital financing schemes offered by various financial institutions in India, Legal issues – Forming business entity, considerations and criteria, requirements for formation of a Private/Public Limited Company,

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Students will be able understand who the entrepreneurs are and what competences needed

CO2 - Students will be able to understand insights into the management, opportunity search, identification of a product, market flexibility studies, project finalization etc. required for small business enterprise.

CO3- Students will be able to write a report and do oral presentation on the topics such as product identification, business ideas, export marketing etc.

CO4 - Students will be able to know the different financial and other assistance available for establishing small industrial units.

Text Books & Reference Books :

1. "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
2. Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
3. "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
4. "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
5. Enterpreneurship Development- S.Chand&Co.,Delhi- S.S.Khanka 1999
6. Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
7. Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.
8. Entrepreneurship Ideas in Action- L. Greene, Thomson Asia Pvt. Ltd., Singapore, 2004.

Course code	**PEC-ME-401G**				
Category	Professional Elective Courses (PEC)) **(Semester-VII) LIST-II**				
Course title	**REFRIGERATION & AIR CONDITIONING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	1. To familiarize with the terminology associated with refrigeration systems and air conditioning 2. To understand basic refrigeration processes 3. To understand the basics of psychrometry and practice of applied psychrometrics . 4. To acquire the skills required to model, analyse and design different refrigeration as well as air conditioning processes and components				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Definition of refrigeration & air conditioning; Necessity; Methods of refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants-Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants; Introduction to Cryogenics.

Air Refrigeration System: Carnot refrigeration cycle. Temperature. Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air

craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems, problems.

UNIT-II

Vapour Compression (VC) Refrigeration Systems: (A) Simple Vapour Compression (VC) Refrigeration systems-Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

Multistage Ref. Systems- Necessity of compound compression, Compound VC cycle , Inter-cooling with liquid sub –cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers.

Other Refrigeration Systems: (A) Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems. Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.

UNIT-III

Psychrometry of Air & Air Conditioning Processes: Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychrometric processes in air washer, Problems.

Air- Conditioning Load Calculations: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart, Problems.

UNIT-IV

Air Conditioning Systems with Controls & Accessories: Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories; Problems.

Refrigeration and Air Conditioning Equipments: Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the air refrigeration, vapour compression refrigeration, vapour absorption, steam jet refrigeration systems and different type of refrigerants.

CO 2- Expedite the working of single stage, multistage and cascade refrigeration.

CO 3- Knowledge of psychrometry and different psychrometric processes. Understand and evaluate cooling and heating load and design of HVAC system.

CO 4- Develop and design RAC systems and evaluate different expansion and control devices.

Text Books :

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India. .
2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

Reference Books:

1. A course in Refrigeration & Air Conditioning – Arora & Domkundwar, Dhanpat Rai & Sons.
2. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
3. Refrigeration & Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.

Course code	**PEC-ME-403G**				
Category	Professional Elective Courses (PEC)) **(Semester-VII) LIST-II**				
Course title	**PROJECT MANAGEMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the concepts of Project Management, how it work.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Project Management :Project Management Concepts, Project Planning, Resource Scheduling, Critical Chain Scheduling, Project Quality Management, Project performance Measurement and Control, Project Closure/ Termination, Managing Project Teams, IT in Projects, International Projects: Issues in managing international projects, Selection and training of employees, cross cultural considerations.

UNIT-II

Theory & Background : Definitions, hard & soft projects, multi project management, program management , project phases, project control project groups. Go/no go decisions.

Idea Phase : Idea selction, development of project contract, determination of project organization, development of project order.

UNIT-III

Defintion Phase : Phase steps : Project description, project results, work breakdown structure, Input management, Project leader ship.

Planning Phase : Development of responsibility matrix, detail project planning, risk & change analysis, arranging input.

UNIT-IV

Implementation Phase : Project monitoring & control, project adjustment, dealing with people.

Implementation & After Care : Evaluation and closure of a project.

Course Outcomes (COs): At the end of the course, the student shall be able to: They properly understand the concepts of Project Management, how it work.

Reference Books:

1. Project Management handbook, Cleland , D.I. and W.R. King, USA.
2. Project Management Body of Knoweldge (PMBOK), Project.
3. Handbook for project oriented organization, Rath S. Hoogland, R. and Turner, J.R.
4. Clifford F Gray, Erik W Larson, "Project Management-The Managerial Process", Tata Mcgraw-Hill Publishing Co Ltd
5. Jack Meredith, Samuel J. Mantel Jr. "Project Management- A Managerial Approach", John Wiley and Sons
6. John M Nicholas "Project Management For Business And Technology" Prentice Hall of India Pvt Ltd
7. James P Lewis "Project Planning, Scheduling And Control" Tata Mcgraw-Hill Publishing Co Ltd.

Course code	**PEC-ME-405G**				
Category	Professional Elective Courses (PEC)) **(Semester-VII) LIST-II**				
Course title	**NUMERIC CONTROL OF MACHINE TOOLS AND ROBOTICS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the basic knowledge of machine tools and robotics and also automation concepts.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fundamentals of Numerical Control: Introduction to numerical control, Classification of NC/CNC machines and axis nomenclature, PTP and Continuous Contouring, Absolute and Incremental Programming, Difference between NC and CNC, Different types of software's in CNC.

Control system fundamentals: feedback, transfer function, system stability. Open Loop and Closed Loop control: Servo Mechanism, Position and Velocity feedback.

Engineering Analysis of NC/CNC systems: Computations of total number of pulses and pulse frequency in Open Loop and Closed Loop control, Precision in NC/CNC: Resolution, Accuracy and Repeatability.

Interpolation in NC and CNC: Linear and Circular, Tolerance Analysis: Inward, Outward and Secantial. System components: Machine Control Unit (MCU), Transducers, Actuators.

UNIT-II

Design considerations of NC/CNC machine tools: Re-circulating ball screw, lost motions in NC systems, Turning Centers and Machining Centers.

Part Programming: Manual programming: Different G codes and M codes, Stock Removal Cycle, Canned Cycles. Computer assisted Part Programming. Tool path generation from CAD models, CNC Toolings.

Process optimization: Online condition monitoring in CNC,

Adaptive control: ACC, ACO & GA. DNC: Direct and Distributed Numerical Control, Merits of DNC, Concept of BTR, Data Multiplexing.

UNIT-III

Automation & Robotics; Spatial Descriptions & Transformations, Manipulator Kinematics – Forward and Inverse; Jacobians: Velocities & Static Forces. Robot Arm Dynamics: Lagrange-Euler formulation of manipulator dynamics. Trajectory Planning: Joint-interpolated trajectories, Geometric problems with Cartesian paths, Collision-free path planning. Robot Control Systems: Feedback and Closed-loop control, Transfer Functions, Control of Second-order systems, Non-linear & time varying systems, Adaptive.

UNIT-IV

Robotic Prehension**:** Dexterous manipulation; ANN approach in prehension, Sensors in Robotics: Machine vision, Force & Torque sensors. Robot programming: simulators and languages, Tele-robotics and virtual interfaces for task specification and programming, Concept of nanorobotics, Performance analysis of industrial robots and their manufacturing applications, Economics of robotics, Social issues & future of robotics.

Course Outcomes (COs): At the end of the course, the student shall be able to: They properly understand the concepts of basic knowledge of machine tools and robotics and also automation concepts.

Text Book:

1. Robotics for Engineers by Y. Koren, McGraw Hill New York

2. Robotics Technology and Flexible Automation by S.R.Deb, TMH.

2. Numerical Control and Computer Aided manufacturing by R. S. Pressman & J. E. Williams, John Wiley & Sons

3. Computational Geometry for Design and Manufacture, by I. D. Faux and M. J. Pratt, Ellis Horwood, Chichester, 1979.

4. Numerical Control in Manufacturing by F. W. Wilson, McGraw-Hill Book Company New York.

5. Mittal R. K. &Nagrath I. J., "Robotics and Control", TMH, 2003 (Reprint 2007 or later).

6. Groover, M. P., et al., "Industrial Robotics", MGHISE, 1986

7. Computer Control of Manufacturing Systems by Y. Koren, McGraw-Hill

8. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawHill

9. Robotics: Control, Sensing, Vision and Intelligence by Fu, Lee and Gonzalez, McGraw Hill New York.

Course code	**PEC-ME-407G**				
Category	Professional Elective Courses (PEC) **(Semester-VII) LIST-II**				
Course title	**FINITE ELEMENT ANALYSIS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	1. To illustrate the principle of mathematical modeling of engineering problems 2. To introduce the basics and application of Finite Element Method.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.

UNIT-II

One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics and heat transfer, longitudinal vibration and mode shapes, fourth order beam equation, transverse deflections and natural frequencies.

UNIT-III

Two dimensional equations, variational formulation, finite element formulation, triangular elements- shape functions, elemental matrices and RHS vectors; application to thermal problems, torsion of non-circular shafts, quadrilateral and higher order elements. Plane stresses and plane strain problems, body forces and thermal loads, plate and shell elements.

UNIT-IV

Natural coordinate systems, isoparametric elements and shape functions, numerical integration and application to plane stress problems, matrix solution techniques, solution of dynamic problems, introduction to FE software.

Course Outcomes: Upon completion of the course, students will understand the FEM formulation and its application to simple structural and thermal problems

Text Books:

1. Reddy J.N., An Introduction to Finite Element Method, 3rd ed., Tata McGraw Hill, 2005.

2. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi, 2007.

3. Rao S.S., The Finite Element Method in Engineering, 3rd ed., Butterworth Heinemann, 2004.

4. Chandraputla&Belegundu, Introduction to Finite Elements in Engineering, 3rd ed., Prentice Hall, 1990.

Course code	**PEC-ME-409G**				
Category	**PROFESSIONAL ELECTIVE COURSES(PEC)** (Semester-VII) LIST-III				
Course title	**NOISE AND VIBRATIONS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	CO1 - Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom CO2 - To introduce the basics concept of two degree of vibration and vibration isolation and transmissibility CO3 - Analyse experimental methods for vibration analysis. CO4 –To learn the influence and stiffness coefficients. CO5 - Analyse the concept of the non-linearity in vibrations and also concept of noise.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fundamentals : Importance of Study of Vibrations, Classifications of Vibrations, Free and Forced, Undamped and Damped, Linear and Non-linear, Deterministic and Random, Harmonic Motion, Vector and Complex Number Representations, Definitions and Terminology, Periodic Functions, Harmonic Analysis, Fourier Series Expansion.

Free and Damped Vibrations : Single Degree of Freedom system, D'Alemberts Principal, Energy Methods, Rayleighs Method, Application of these Methods, Damped Free Vibrations, Logarithmic Decrement, Under Damping, Critical and Over Damping, Coulomb Damping.

UNIT-II

Harmonically Excited Vibrations : Forced Damped Harmonic Vibration of Single Degree of Freedom Systems, Rotating Unbalance, Rotor Unbalance, Critical Speeds and Whirling of Rotating Shafts, Support Motion, Vibration Isolation, Energy Dissipated by Damping, Equivalent, Viscous Camping, Structural Damping Sharpness of Resonance, Vibration Measuring Instruments.

Transient Vibrations : Impulse Excitation, Arbitrary Excitation, Response to Step Excitions, Base Excitation Solution by Laplace Transforms, Response Spectrum, Runge-Kutta Method.

UNIT-III

Two Degrees of Freedom Systems : Introduction to Multi-Degree of Freedom Systems, Normal Mode Vibrations, Coordinate Coupling, Principal Coordinates, Free Vibrations in Terms of Initial Conditions, Forced Harmonic Vibrations, Vibration Absorber, Centrifugal Vibration Absorber, Vibration Damper.

Multi degrees of Freedom Systems and Numerical Methods Introduction, Influence Coefficients, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, Orthogonality of Normal Modes, Dunkerley's Equation, Method of Matrix Iteration, The Holzer Type Problem, Geared and Branched Systems, Beams.

UNIT-IV

Normal Mode Vibration of Continuous System: Vibrating String, Longitudinal Vibrations of Rod, Torsional Vibrations of Rod, Lateral Vibrations of Beam.

Noise**:** Noise characteristics, Sources of noise, noise level measurement techniques, vehicular noise level, engine noise, transmission noise, brake squeal, structural noise, noise in auxiliaries, wind noises etc.

Noise Testing & Noise Control:Mechanization of noise generation, noise control methodologies, noise control measures, environmental noise management. Road vehicle noise standards .

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom

CO2 - To understand the concept of two degree of vibration and vibration isolation and transmissibility

CO3 - Analyse experimental methods for vibration analysis.

CO4 - Understanding the influence and stiffness coefficients.

CO5 - Analyse the concept of the non-linearity in vibrations and also concept of noise.

Text Books :

1. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India.
2. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons
3. Noise, Pollution & Control – S. P. Singal, Narosa Publishing House, New Delhi

Reference Books :

1. Theory and Practice of Mechanical Vibrations J.S. Rao and K. Gupta, Wiley Eastern Ltd.
2. Mechanical Vibrations S.S. Rao, Addison – Wesely Publishing Company.

Course code	**PEC-ME-411G**				
Category	**Professional Elective Courses** (Semester-VII) (List-III)				
Course title	**SOLAR ENERGY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	To provide an overview of solar system and the associated energy conversion issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Solar Radiation: Introduction, solar system – sun, earth and earth-sun angles, time, derived solar angles, estimation of solar radiation (direct and diffuse), measurement systems – phyrheliometers and other devices. Effect of Solar radiation upon structures: Steady state heat transmission, solar radiation properties of surfaces, shading of surfaces, periodic heat transfer through walls and roofs.

UNIT-II

Solar Collectors: Flat plate and concentrating – comparative study, design and materials, efficiency, selective coatings, heliostats. Heating Applications of Solar Energy: Air and Water heating systems, thermal storages, solar bonds, solar pumps, solar lighting systems, solar cookers, solar drying of grains.

UNIT-III

Cooling Applications of Solar Systems: Continuous and Intermittent vapour absorption systems for cooling applications, absorbent – refrigerant combination, passive cooling systems.

UNIT-IV

Solar Electric Conversion Systems: Photovoltaics, solar cells, satellite solar power systems. Effects on Environment, economic scenario, ozone layer depletion, green house effect, global warming, Remedial measures by international bodies.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the concept and principles of solar system.

CO2 - Utility and applications of solar system and the associated with energy conversion issues.

Text Books:

1. Solar Energy – S P Sukhatme, Tata McGraw Hill

2. Solar Energy Process – Duffie and Bechman, John Wiley

References Books:

1. Applied Solar Energy – Maniel and Maniel, Addison Wiley

2. Solar Energy: Fundamentals and Applications – R P Garg and Jai Prakash, TMH.

Course code	**PEC-ME-413G**				
Category	**PROFESSIONAL ELECTIVE COURSES(PEC)** (Semester-VII) LIST-III				
Course title	**TRIBOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the basic concept of tribology and use of engine, wear, friction .				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

.3

UNIT-I

Introduction: Introduction of Tribology – General tribological considerations in the design of bearings, gears, cams, reciprocating components, etc.

Engine tribology basics - tribology / aspects of engine components such as bearings, piston assembly, valve train and drive train components etc.

UNIT-II

Friction: Natural of metal surfaces – Surface properties – Surface parameters and measurements. Friction – Sliding friction – Rolling friction characteristics of common metals and non-metals – friction under environments. Engine friction – Losses and engine design parameters.

Wear: Economic role of wear – type of wear- wear mechanism, factors affecting wear, selection of materials for different wear situations, measurement of wear, tribometers and tribometry. Engine wear, mechanisms, wear resistance material and coatings and failure mode analysis.

Bearings and Lubrication: Lubricants, type of lubricants, properties and testing, service classification of lubricants, lubrication of tribological components, lubrication system, lubricant monitoring, SOAP, ferrography and other rapid testing methods for lubricants contamination.

UNIT-III

Hydrodynamic Lubrication: Theory of hydrodynamic lubrication, generalized Reynolds equation, slider bearings, fixed & pivoted shoe bearings, hydrodynamic journals bearings, short and finite bearings, thrust bearings, sintered bearing, non-circular bearings and multi side surface bearings.

Externally (Externally – pressurized) lubrication: Hydrostatic bearing, basic concepts, bearing pads, coefficients, restrictors, capillary, orifice and flow control valve, bearing characteristics number and performance coefficients, flat, conical and spherical pad thrust bearing, multi-recess journal and thrust bearings, air and gas lubricated bearings.

UNIT-IV

Elasto – hydrodynamic lubrication: Ball and roller element bearings, classification, selection and life estimation, fatigue, monitoring of ball / roller bearings, diagnostics.

Rheodynamics (Static) lubrication: Non-Newtonian fluids, characteristics, general recommendations of lubricants, SAE & other cloud numbers, thixotopic, materials and Bingham solids, grease lubrication and care stability, tribology components in extreme environments like vacuum, pressure, temperature, tribology matching and selection, tribolo-testing and standards.

Course Outcomes (CO'S): Students would be able : CO1 - To understand about the basic concept of tribology and use of engine, wear, friction .

Reference Books:

1. Friction and Lubrication, Bowden F.P. & Tabor D., Heinemann Edu. Books Ltd. 1974
2. Friction & Wear of Material, Ernest Rabinowiez
3. Tribology – Handbook, Neal M.J., Butterworth, 1973
4. Standard hand Book of Lubrication Engg., O'Connor J.J. & Boyd J., McGraw Hill, 1968.
5. Theory of Hydro-dynamic Lubrication, Pinkus O, & Sternlincht B., McGraw Hill, 1961.

6. Theory & Practice of Lubrication of Bearing, Fuller D.D., McGraw Hill, 1947. 7. Analysis & Lubrication of Bearings, Shaw M. C., Macks F., McGraw Hill, 1947.

Course code	**PEC-ME-415G**				
Category	**PROFESSIONAL ELECTIVE COURSES(PEC)** (Semester-VII) LIST-III				
Course title	**COMPOSITE MATERIALS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	3	0	0	3	
Objectives:	1. To understand the mechanical behaviour of composite materials 2. To get an overview of the methods of manufacturing composite materials and their fabrication methods and testing.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke;s law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes .

UNIT-II

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic

materials, generalized Hill's criterion for anisotropic materials, TsaiHill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies

UNIT-III

Fabrication methods: Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin-transplant method, pltrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films

UNIT-IV

Testing of Composites: Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.

Course Outcomes (CO'S): Upon completion of this course, the students will have an overview of the mechanical behaviour and application of composite materials and their fabrication methods and testing.

Text Books:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998
3. Materials characterization, Vol. 10, ASM hand book
4. Mechanical Metallurgy by G. Dieter Mc-Graw Hill
5. Thermal Analysis of Materials by R.F. Speyer, Marcel Decker
6. Engineering Materials: Polymers, Ceramics and Composites A.K Bhargava Prentice Hall India

Course code	**LC- ME-403G**				
Category	Professional Core Courses				
Course title	**Workshop Lab-III**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	0	0	2	1	
Objectives:	Understand the vapour compression refrigeration system and vapour absorption system. Application of different compressors used in refrigeration system. Understand functioning of various control devices Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system. Knowledge of how the loading condition changes the COP of the system.				
Internal Practical Class Marks	25 Marks				
External Practical Class Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments : (Refrigeration & Air Conditioning Lab)

1) To study the vapour compression Refrigeration System and determine its C.O.P. and draw P-H and T-S diagrams.
2) To Study the Mechanical heat pump and find its C.O.P.
3) To study the Air and Water heat pump and find its C.O.P.
4) To study the cut- sectional models of Reciprocating and Rotary Refrigerant compressor.
5) To study the various controls used in Refrigerating & Air Conditioning systems.
6) To study the Ice- plant, its working cycle and determine its C.O.P and capacity.

7) To study the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.
8) To determine the By-pass factor of Heating & Cooling coils and plot them on Psychrometric charts on different inlet conditions.
9) To determine sensible heat factor of Air on re-circulated air-conditioning set up.
10) To study the chilling plant and its working cycle.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the vapour compression refrigeration system and vapour absorption system.

CO 2- Application of different compressors used in refrigeration system.

CO 3- Understand functioning of various control devices

CO 4- Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system.

CO 5- Knowledge of how the loading condition changes the COP of the system.

Note :

1) At least six experiments are to be performed in the semester.
2) At least seven experiments should be performed form the above list. Remaining two experiments may either be performed from the above list or as designed & set by the concerned institute as per the scope of the syllabus.

<table>
<tr><td>Course code</td><td colspan="5">PCC- ME-405G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">SEMINAR</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VII</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Objectives:</td><td colspan="5">To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.</td></tr>
<tr><td>Internal Class Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>External Class Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Selecting of Seminar Topics by Teacher or concerned to teacher by students. A seminar topic given by students in semester.

<table>
<tr><td>Course code</td><td colspan="5">PROJ-ME-407G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">PROJECT-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VII</td></tr>
<tr><td>0</td><td>0</td><td>9</td><td>4.5</td></tr>
<tr><td>Objectives:</td><td colspan="5">This course is aimed to provide more weightage for project work. The project work could be done in the form of a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.</td></tr>
<tr><td>Internal Project Marks</td><td colspan="5">25</td></tr>
<tr><td>External Project Marks</td><td colspan="5">25</td></tr>
<tr><td>Total</td><td colspan="5">50</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than four –six students in a group(If any large/big projects occurs then strength of students increases ap per guide supervision). Viva- voce must be based on the preliminary report submitted by students related to the project.

<table>
<tr><td>Course code</td><td colspan="5">PT-ME-409G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Courses</td></tr>
<tr><td>Course title</td><td colspan="5">PRACTICAL TRAINING-II</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VII</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>Objectives:</td><td colspan="5">• Achieving the objectives of the University and its colleges and departments in practical training.
• Providing students with practical skills, which match the requirements of the job market and allow them to directly enter the work community in a serious and constructive manner.
• Providing students with experience to help them take decisions pertaining to their future career objectives.
• Providing college students the full opportunity to apply theoretical knowledge (gained during their studies) in a real work environment at a later stage of their studies.
• Developing the student's understanding of the needs of the job market and reaching this understanding successfully</td></tr>
<tr><td>Internal Practical Training Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>External Practical Training Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

PRACTICAL TRAINING VIVA-VOCE:

1) Assessment of Practical Training-I, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry/ Professional organization/ Research Laboratory with the prior approval of the Director-Principal/ Mechanical Software /Automobile Workshop. **According to performance letter grades A, B, C, F are to be awarded: Excellent : A ; Good : B ; Satisfactory : C ; Not**

satisfactory : F. A student who has been awarded ‘F’ grade will be required to repeat the practical training.

2) **Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the VII semester.**

Course code	**MC-317G**				
Category	Mandatory Course				
Course title	**Constitution of India**				
Scheme and Credits	L	T	P	**Credits**	Semester-VII
	2	0	0	0	

MC-317G is mandatory non-credit course in which the students will be awarded grades.

Note: 2 The students will be awarded grades A, B, C & F in Evaluation of Constitution of India. A student who is awarded 'F' grade is required to repeat.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT-II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT-III

Organs of Governance: President – Qualification and Powers of the President, GovernorQualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT-IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956. The examination of the regular students will be conducted by the concerned college/Institute internally.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course code	**PCC-ME-402G**				
Category	Professional Core Courses				
Course title	INDUSTRIAL **AUTOMATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	It has been at the forefront of creating new platforms that impact the nation's competitiveness in manufacturing and infrastructure. Automation Industry has been propelling economies internationally by enabling manufacturing and infrastructure to meet the growing needs across the globe. This cross disciplinary segment is the key to enhanced productivity, reliability and quality in multiple domains.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity.

Material handling systems: Overview of Material Handling Systems-Rotary feeders, oscillating force feeder, Vibratory feeder, elevator type and Centrifugal type feeders, Principles and Design Consideration, Material Transport Systems, Storage Systems.

UNIT-II

Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and

Implementation, Flow lines & Transfer Mechanisms, Fundamentals and Analysis of Transfer Lines, product design for automatic assembly.

Control Technologies in Automation: Industrial Control Systems ,Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete Control, Computer Process and its Forms. Sensors, Actuators and other Control System Components.

UNIT-III

Evaluation of automatic production: product manufacturabiiity, orientation devices-active and passive devices, parts orientation and escapement.

Pneumatic and hydraulic components and circuits: Boolean algebra, pneumatic sensors and amplifiers, jet destruction devices, logic devices, schimit triggering devices, developing pneumatic circuits for automatic die casting machine.

UNIT-IV

Modeling and Simulation for manufacturing Plant Automation: Introduction/need for system Modeling, Building Mathematical Model of a manufacturing Plant, Modern Tools Artificial neural networks in manufacturing automation, A Iin manufacturing, Fuzzy decision and control, robots and application of robots for automation.

Course Outcomes (COs): At the end of the course, the student shall be able to get practical exposure of Automation Industry has been propelling economies internationally by enabling manufacturing and infrastructure to meet the growing needs across the globe. This cross disciplinary segment is the key to enhanced productivity, reliability and quality in multiple domains.

Reference Books:

1) Hand book of design, manufacturing and Automation: R.C. Dorf, John Wiley and Sons.
2) Automation, Production Systems and Computer Integrated Manufacturing, M. P. Groover, Pearson Education.
3) Industrial Automation: W.P. David, John Wiley and Sons.
4) Computer Based Industrial Control, Krishna Kant, EEE-PHI
5) An Introduction to Automated Process Planning Systems, Tiess Chiu Chang & Richard A.Wysk

6) ManufacturingassemblyHandbook:-Bruno Lotter
7) Anatomy of Automation ,Amber G.H&P.S. Amber, Prentice Hall.
8) PerformanceModelingofAutomatedManufacturingSystems,Viswanandham,PHI.
9) Automatic process control system and Hardware-R.P. Hunter, Prentice Hall.

Course code	PEC-ME-402G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-IV)				
Course title	**TOOL DESIGN**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main objective of tool design is to increase production while maintaining quality and lowering costs.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Tool design Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non metallic tool materials Designing with relation to heat treatment .

Design of cutting Tools Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters .

UNIT-II

Design of Jigs and Fixtures Introduction – Fixed Gages – Gage Tolerances –selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General

considerations in the design of drill jigs – Drill bushings – Methods of construction –Thrust and Turning Moments in drilling - Drill jigs and modern manufacturing- Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Modular Fixtures – Cutting Force Calculations.

UNIT-III

Design of Forming Tools Types of Sheet Metal Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing dies-Design and drafting. Design of Bulk forming dies and moulds for metals and plastics.

UNIT-IV

Tool Design for CNC machine tools Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine .

Course Outcomes (CO'S): At the end of the course, the student shall be able to: understand tool design concept and how to increase production while maintaining quality and lowering costs.

Books:

1) Cyrll Donaldson, George H.LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd., 2000.
2) E.G.Hoffman," Jig and Fixture Design", Thomson Asia Pvt Ltd, Singapore, 2004
3) Venkataraman K., "Design of Jigs, Fixtures and Presstools", TMH, 2005
4) Haslehurst M., "Manufacturing Technology", The ELBS, 1978.

Course code	PEC-ME-404G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-IV)				
Course title	**PLANT MAINTENANCE ENGG**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	• To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities. • To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements. • To illustrate some of the simple instruments used for condition monitoring in industry.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Principles and Practices of Maintenance:-Awareness on maintenance and plant engineering maintenance, objectives o maintenance and plant engineering, state of plant, functions and responsibilities; Installation, commissioning, spare part management function, utility and service function, maintenance planning function, physical assets management, Basic Principles of maintenance planning – Planning function in maintenance, maintenance organization, systems of plant engineering and management, decentralization in plant engineering, advantages and

drawbacks of decentralization, staffing in plant engineering, Directing, plant engineering and management as integrating function.

UNIT-II

Maintenance Strategies: Introduction, failure based maintenance, contractual maintenance, reliability centered maintenance, Time based maintenance, Condition based maintenance, maintenance strategy, hurdles in formulating maintenance strategy. Maintenance procedure and their selection, characteristics of maintenance strategy.

UNIT-III

Facility Planning and Plant Layout: Introduction, objectives of good facility planning, principles o facility layout, facility location study, facilities governing selection of location, steps in facility location study, plant layout, flow patterns to facilities assembly lines

UNIT-IV

Spare Parts Management: Introduction, features/characteristics of spare parts, functions of spare parts management, classification of spare parts- ABC analysis, SDE Analysis, VED Analysis, CIN Analysis, HML analysis, XYZ analysis, maintenance system optimization, codification, standardization, levels of standards, advantages of standardization, barriers to standardization

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

1) To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2) To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
3) To illustrate some of the simple instruments used for condition monitoring in industry.

Text Books:

1) Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
2) Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995

References Books:

1. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
2. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.

3. Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1988.
4. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
5. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.
6. “Advances in Plant Engineering and Management”, Seminar Proceedings - IIPE, 1996.

Course code	PEC-ME-406G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-IV)				
Course title	**Design And Optimization Of Thermal Energy Systems**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To learn basic principles underlying piping, pumping, heat exchangers; modeling and optimization in design of thermal systems. To develop representational modes of real processes and systems. To optimization concerning design of thermal systems.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

DESIGN CONCEPTS:-Design Principles, Workable Systems, Optimal Systems, Matching of System Components, Economic Analysis, Depreciation, Gradient Present Worth factor, modelling overview – levels and steps in model development - Examples of models – curve fitting and regression analysis .

UNIT-II

MODELLING AND SYSTEMS SIMULATION :-Modelling of thermal energy systems – heat exchanger - solar collectors – distillation - rectification turbo machinery components - refrigeration systems - information flow diagram - solution of set of nonlinear lgebraic equations - successive substitution - Newton Raphson method- examples of thermal systems simulation

UNIT-III

OPTIMIZATION :-constraints, problem formulation - unconstrained problems - necessary and sufficiency conditions. Constrained optimization - Lagrange multipliers, constrained variations, Linear Programming - Simplex tableau, pivoting, sensitivity analysis - New generation optimization techniques – examples

UNIT-IV

DYNAMIC BEHAVIOUR :- Steady state Simulation, Laplace Transformation, Feedback Control Loops, Stability Analysis, Non-Linearities

APPLICATIONS AND CASE STUDIES :- Case studies of optimization in thermal systems problems- Dealing with uncertainty- probabilistic techniques – Trade-offs between capital and energy using Pinch analysis

Course Outcomes (CO'S): At the end of the course, the student shall be able to: understand modeling and optimization of Thermal systems.

REFERENCES Books:-

1. B.K.Hodge, Analysis and Design of Thermal Systems, Prentice Hall Inc., 1990.
2. Bejan A., George Tsatsaronis , Michael J. Moran , Thermal Design and Optimization, Wiley , 1996.
3. D.J. Wide, Globally Optimal Design, Wiley- Interscience, 1978.
4. Kapur J. N., Mathematical Modelling , Wiley Eastern Ltd , New York , 1989.
5. Rao S. S., Engineering Optimization Theory and Practice, New Age Publishers, 2000.
6. Stoecker W. F., Design of Thermal Systems, McGraw Hill Edition, 1989.
7. YogeshJaluria , Design and Optimization of Thermal Systems , CRC Press , 2007.

Course code	PEC-ME-408G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-IV)				
Course title	**GAS DYNAMICS AND JET PROPULSION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	1. To understand the features of compressible isentropic flows and irreversibilities like shocks. 2. To provide a basic knowledge of jet and rocket propulsion technologies.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Compressible flow, definition, Mach waves and Mach cone, stagnation states, Mass, momentum and energy equations of one-dimensional flow, Isentropic flow through variable area ducts, nozzle s and diffusers, subsonic and supersonic flow I variable area ducts, choked flow, Area-Mach number relations for isentropic flow .

UNIT-II

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables.

UNIT-III

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines.

UNIT-IV

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights

Course Outcomes: Upon completion of this course, the students will be able to apply gas dynamics principles to jet and space propulsion systems

Text Books:

1. Ahmed F. El-Sayed, Aircraft Prpoulsion and Gas Turbine Engines, CRC Press, 2008.
2. H.S. Mukunda, "Understanding Aerospace Chemical Propulsion", Interline Publishing, 2004.
3. Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992.
4. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975.
5. Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986.

Course code	PEC-ME-412G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-V)				
Course title	**POWER PLANT ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To provide an overview of power plants and the associated energy conversion issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

UNIT-II

Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal,

using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles. Problems.

UNIT-III

Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

Power Plant Economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants-incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.

UNIT-IV

Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:

CO1 - Understand the principles of steam power plants and gas power plants.

CO2 - Utility and applications of nuclear power plant.

CO3 - Installation and commissioning of hydro-electric power plants.

CO4 - Understand various factors affecting non-conventional power plant.

CO5 - understand the principles of operation for different power plants and their economics.

Text Books :

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Campany Ltd., New Delhi
2. Power Plant Engineering : P.K. Nag Tata McGraw Hill second Edition 2001.

Reference Books :

1. Power Plant Engg. : M.M. El-Wakil McGraw Hill 1985.

<table>
<tr><td>Course code</td><td colspan="5">PEC-ME-414G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses (PEC) (Semester-VIII) (List-V)</td></tr>
<tr><td>Course title</td><td colspan="5">PRODUCT DESIGN AND DEVELOPMENT</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VIII</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">The objective of product development is to cultivate, maintain and increase a company's market share by satisfying a consumer demand. Not every product will appeal to every customer or client base, so defining the target market for a product is a critical component that must take place early in the product development process. Quantitative market research should be conducted at all phases of the design process, including before the product or service is conceived, while the product is being designed and after the product has been launched.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

DESIGN PROCESS – The design process - Morphology of Design - Design drawings - Computer Aided Engineering - Designing of standards - Concurrent Engineering - Product life cycle - Technological Forecasting - Market Identification - Competition Bench marking - Systems Engineering - Life Cycle Engineering - Human Factors in Design - Industrial Design.

UNIT-II

DESIGN METHODS – Creativity and Problem Solving - Product Design Specifications - Conceptual design - Decision theory - Embodiment Design - Detail Design - Mathematical Modeling - Simulation - Geometric Modeling - Finite Element Modeling - Optimization - Search Methods - Geometric Programming - Structural and Shape Optimization.

UNIT-III

INTRODUCTION TO SOLID MECHANICS: Stress, Strain in 2-d and 3-d, relation between stress and strain, theories of failure.

MATERIAL SELECTION PROCESSING AND DESIGN – Material selection Process - Economics - Cost Vs Performance - Weighted property Index - Value Analysis - Role of Processing and Design - Classification of Manufacturing Process - Design for Manufacture - Design for Assembly - Design for castings, Forging, Metal Forming, Machining and Welding - Residual stresses - Fatigue, Fracture and Failure.

UNIT-IV

ENGINEERING STATISTICS AND RELIABILITY – Probability - Distributions - Test of Hypothesis - Design of Experiments - Reliability Theory - Design of Reliability - Reliability centered Maintenance.

QUALITY ENGINEERING – Total Quality Concept - Quality Assurance - Statistics Process Control - Taguchi Methods - Robust Design - Failure Model Effect Analysis.

Course Outcomes (CO'S): At the end of the course, the student shall be able to: to understand how product development is to cultivate, maintain and increase a company's market share by satisfying a consumer demand. They know, how quantitative market research should be conducted at all phases of the design process, including before the product or service is conceived, while the product is being designed and after the product has been launched.

Text Books:

1. Dieter George E., "Engineering Design – A Materials and Processing Approach", McGraw Hill, International Edition Mechanical Engg ., Series ,1991.

2. Karl t. Ulrich and Steven d Eppinger "Product Design and Developement " ,McGraw Hill,Edition 2000.

3. Palh .G. and Beitz .W., " Engineering Design ", Springer - Verlag , NY. 1985. 4. Ray .M.S., " Elements of Engg. Design ", Prentice Hall Inc . 1985.

5. Suh .N.P. , " The Principle of Design ", Oxford University Press , NY. 1990.

Course code	**PEC-ME-416G**				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-V)				
Course title	**NON CONVENTIONAL ENERGY RESOURCES UTILIZATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main purpose of fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Principles Of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

Solar Energy Collection:Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

UNIT-III

Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermoelectric generators, seebeck, peltier and joul Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faradays laws, thermodynamic aspects, selection of fuels and operating conditions.

UNIT-IV

Bio-Mass:Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects..

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Course Outcomes (COs): At the end of the course, the student shall be able to: understanding of fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.

Reference Book:

1) Renewable energy resources/ Tiwari and Ghosal/Narosa.
2) Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
3) Non-Conventional Energy Systems / K Mittal/Wheeler

Text books:

1) Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2) John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3) M.V.R. Koteswara Rao, “Energy Resources: Conventional & Non-Conventional” BSP Publications,2006.
4) D.S. Chauhan,”Non-conventional Energy Resources” New Age International.

5) C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.
6) Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7) Godfrey Boyle,“ Renewable Energy Power For A Sustainable Future”, Oxford University Press.

Course code	PEC-ME-418G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-V)				
Course title	**INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To introduce nanotechnology and nanostructures . To introduce fabrication and characterization techniques used in nanotechnology.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Background to Nanoscience: Defination of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challengs of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

UNIT-II

Types of nanostructure and properties of nanomaterials: One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

UNIT-III

Application of Nanomaterial: Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

UNIT-IV

Nanomachines: covalent and non covalent approaches, Molecular motors and machines, molecular devices, single molecular devices, practical problems with molecular deviceNanofluids: nanoparticles, preparation of nanofluids, thermophysical properties of nanofluids in comparison with base fluid. Nanoswitches - nano computers- nanofilters

Course Outcomes : At the end of the course, the student shall be able to:

- ❖ Understand properties of materials at nanoscale
- ❖ Know the fabrication and characterization methods used in nanotechnology
- ❖ Acquaint with the various applications of nanotechnology.

Text books:

1. A.K. Bandyopdhyay, Nanomaterials, , New age international publishers,2008
2. Bharat Bhushan, Springer Handbook of Nanotechnology, 2010 Charles P Poole, Frank J Owens, Introduction to Nanotechnology, John Wiley and Sons, 2003
3. Jeremy Ramsden,Nanotechnology, William Andrew, Elsevier, 2011
4. T Pradeep, Nano: The essentials, McGraw – Hill education,2 007
5. V.S.Muralidharan, A Subramnya,Nano science and Technology, Ane books Pvt Ltd

Reference books:

1. Gregory Timp, Nanotechnology, Springer-Verlag, 2009
2. John Mongillo, Nano Technology, Greenwood Press, 2007
3. Kelsall Robert. W, Ian Hamley, MarkGeoghegan, Nanoscale Science and Technology, Wiley Eastern,2005
4. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.
5. Nanoparticles: From theory to applications – G. Schmidt, Wiley Weinheim 2004.

6. Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005), 11: 830- 831, Cambridge University Press.
7. Processing & properties of structural naonmaterials - Leon L. Shaw, Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK 2005.

Course code	PEC-ME-420G				
Category	Professional Elective Courses(PEC) (Semester-VIII) (List-VI)				
Course title	**AUTOMOBILE ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To understand the construction and working principle of various parts of an automobile.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch; Clutch Linkages.

UNIT-II

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases.

Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

UNIT-III

Suspension Systems : Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

Steering System : Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toein/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering.

UNIT-IV

Automotive Brakes, Tyres & Wheels : Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes.

Emission Control System & Automotive Electrical : Sources of Atmospheric Pollution from the automobile, Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation (PVC) Systems, Evaporative Emission Control, Heated Air Intake System, Exhaust Gas Recirculation (ECR) Systems, Air Injection System and Catalytic Converters; Purpose construction & operation of lead acid Battery, Capacity Rating & Maintenance of Batteries; Purpose and Operation of Charging Systems, Purpose and Operations of the Starting System; Vehicle Lighting System.

Course Outcomes : At the end of the course, the student shall be able to:

CO1 - Identify the different parts of the automobile

CO2 - Explain the working of various parts like engine, transmission, clutch, brakes.

CO3 - Describe how the steering and the suspension systems operate.

CO4 - Understand the environmental implications of automobile emissions.

CO5 - Understand the function of each automobile component and also have a clear idea about the overall vehicle performance.

CO6 - Develop a strong base for understanding future developments in the

Text Books:

1) Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2) Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

Reference Books:

1) Automotive Mechanics – Crouse / Anglin, TMH.
2) Automotive Technology – H.M. Sethi, TMH, New Delhi.
3) Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
4) Automotive Mechanics – Joseph Heitner, EWP.
5) Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
6) The Motor Vehicle – Newton steeds Garrett, Butter Worths.

Course code	PEC-ME-422G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-VI)				
Course title	**DESIGN OF TRANSMISSION SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To learn about the design procedures for mechanical power transmission components Contents: Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection of hoisting wire ropes and pulleys, design of chains and sprockets				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, factor safety, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.

UNIT-II

Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of a pair of straight bevel gears; Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.

UNIT-III

Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box- Design of multi-seed gear box for machine tool applications; constant mesh gear box, speed reducer unit; Variable speed gear box; Fluid couplings, Torque converters for automotive applications.

UNIT-IV

Cam design, types: pressure angle and undercutting base circle determination, forces and surface stresses; Design of plate clutches, axial clutches, cone clutches, internal expanding rim clutches; Electromagnetic clutches; Band and Block brakes, external shoe brakes, internal expanding shoe brake.

Course Outcomes: Upon completing this course the students will be able to design transmission systems for engines and machines.

Text Books:

1. Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata McGraw Hill, 2010.

2. Jindal U.C., Machine Design: Design of Transmission System, Dorling Kindersley, 2010.

3. Maitra G. and Prasad L., Handbook of Mechanical Design, 2nd ed., Tata McGraw Hill, 2001

Course code	PEC-ME-424G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-VI)				
Course title	**ALTERNATE FUELS AND ENERGY SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main purpose of fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. Almost all fuels are chemical fuels. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Estimation of petroleum reserve-Need for alternate fuel-Availability and properties of alternate fuels-general use of alcohols- LPG-Hydrogen-Ammonia, CNG, and LNG-Vegetable oils and Biogas-Merits and demerits of various alternate fuels.

UNIT-II

Alcohols: Properties as engine fuels, alchohols and gasoline blends-Combustion characteristics in engines-emission characteristics. Vegetable Oils: Various vegetable oils for engines Esterification-Performance in engines-Performance and emission characteristics

UNIT-III

Natural Gas, LPG, Hydrogen and Biogas: Availability of CNG, properties modification required to use in engines-performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG-Hydrogen-Storage and handling, performance and safety aspects.

UNIT-IV

Electrical and Solar Powered Vehicles: Layout of an electric vehicle-Advantage and limitations Specifications-System component, Electronic control system-High energy and power density batteries-Hybrid vehicle-Solar powered vehicles.

Course Outcomes (COs): At the end of the course, the student shall be able to: understand how the fuel is to store energy, which should be in a stable form and can be easily transported to the place of use. Almost all fuels are chemical fuels. The user employs this fuel to generate heat or perform mechanical work, such as powering an engine. It may also be used to generate electricity, which is then used for heating, lighting, or other purposes.

Reference Books :

1) Maheswar Dayal, Energy today & tomorrow, I & B Horishr India,1982
2) Nagpal, Power Plant Engineering, Khanna Publishers,1991.
3) Alchohols and Motor fuels progress in technology, Series No.19,SAEPublicartion USA 1980.
4) SAE paper Nos.840367, 841156,841333,841334.
5) The properties and performance of modern alternate fuels SAE paper No 841210.
6) Bechtold.R.L. Alternative Fuels Guide Book, SAE, 1997.

Course code	PEC-ME-426G				
Category	Professional Elective Courses (PEC) (Semester-VIII) (List-VI)				
Course title	**OPTIMISATION FOR ENGINEERING DESIGN**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The main aim of to understanding while engineering design problems can often be conveniently formulated as multiobjective optimization problems, these often comprise a relatively large number of objectives. Such problems pose new challenges for algorithm design, visualisation and implementation.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Single Variable Optimization for engineering design: Introduction-Engineering optimization problems-Optimality criteria-Bracketing methods-Region elimination methods-Point estimation methods-Gradient based methods-Root finding using optimization techniques- Computer programmes.

UNIT-II

Multi Variable Optimization Algorithm: Optimality criteria-Unidirectional search-Direct search methods-gradient based methods- Computer programmes.

Constrained Optimization Algorithms: Kuhn – Tucker conditions –Transformation methods – sensitivity analysis.

UNIT-III

Direct search for constrained minimization-Unearized search techniques – feasible direct method-generalised reduction gradient method-Gradient projection method- Computer programmes.

Specialized Algorithms : Integer programming – Geometric programming.

UNIT-IV

Non-Traditional Optimization Algorithms: Genetic algorithms – Simulated annealing – Global optimization – Computer programmes.

Course Outcomes (COs): At the end of the course, the student shall be able to: understanding while engineering design problems can often be conveniently formulated as multiobjective optimization problems, these often comprise a relatively large number of objectives. Such problems pose new challenges for algorithm design, visualisation and implementation..

Reference Books :

1. Kalyanmay Deb, Optimization for Engineering Design, Prentice Hall of India, New Delhi.
2. Taha. M.A., Operations Research, Macmillan, New York, 1989
3. Rao.S.S., Optimisation Theory and Application, Wiley Eastern, New Delhi, 1990
4. Muirthy, Linear Programming, Wiley, New York, 1987.
5. Rekiaaitis. G.V. Ravindran.A. And Regedell K.M., Engineering optimization methods and applications, Wiley, New York, 1986.
6. Conley. W., Computer Optimization Techniques, Pntrecelli Book, 1980.

Course code	OEC –ME-402G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**OPERATIONS RESEARCH**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The aims of operation research include: solving operational questions, solving questions related to resources' operations, and solving decision-making questions. Operational research has a relation with different areas of study and it has several applications. Operation research is considered as a tool of productivity. In comparison to traditional approaches, operation research provides more extensive, quantitative, and detailed information about different issues and managers can implement their decisions based on quantitative analyses. Operation research will be a good assistance for managers in different areas.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex GaussJordan reduction process in simplex methods, BIG-M methods computational, problems.

UNIT-II

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepperg stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic Of LP: Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT-III

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources leveling in project, problems.

UNIT-IV

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.

Decision Theory: Decision process, SIMON model types of decision making environment-certainty, risk, uncertainty, decision making with utilities, problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Discuss the role of operations research in decision-making, and its applications in industry and should be able to formulate and design real-world problems through models & experiments.

CO 2- Knowledge of various types of deterministic models like linear programming, transportation model etc.

CO 3- Explore various types of stochastic models like waiting line model, project line model, simulation etc.

CO 4- Deduce the relationship between a linear program and its dual and perform sensitivity analysis.

CO 5- Describe different decision making environments and apply decision making process in the real world situations

Text Books:

1) Operation Research – TAHA, PHI, New Delhi.
2) Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

Reference Books :

1) Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2) Quantitative Techniques- Vohra, TMH, New Delhi 8. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
3) Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
4) Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

Course code	OEC-ME-410G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**QUALITY ENGINEERING**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	To understand the concept of Quality Engineering which emphasizes growth, creativity, and analytical thinking.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Section A

Basic Concepts of Quality: Definitions of Quality and its importance in industry, Quality function, Quality Characteristics, Quality process, Quality Traits, Applications of Quality Concept, Introduction to quality control, Computer aided quality control, Total quality control(TQC) and its implementation, Elements of TQC, Quality Circle, Objectives of quality circle, Role of management in quality circle, Quality in service organizations, characteristics of a service organization, Important service dimensions, Design of service quality.

Section B

Basic Statistical Concepts: The Concept of variation, Distinction between variables and attributes data, The frequency distribution, graphical representation of frequency distribution, Quantitative description of distribution, the normal curve, concept of probability, laws of probability, probability distributions, hyper geometric distribution, binomial distribution, The Poisson distribution.

Section C

Quality systems: Quality systems, Need for quality System, Need for standardization, History of ISO:9000 series standards and its features, steps to registration, India and ISO:9000, Automated inspection systems technologies, Different forms of Inspection, Industrial inspection,

Section D

Total Quality Management: Introduction o TQM, Concepts, Characteristics of TQM, Relevance of TQM, Approaches to TQM Implementation, TQM philosophies, Taguchi Philosphy, JIT, Kaizen, Six Sigma approach, 5-S approach

Course Outcomes: Upon completion of this course the student will be able to:

CO1 - Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability

CO2 - Use control charts to analyze for improving the process quality.

CO3 - Describe different sampling plans

CO4 - Acquire basic knowledge of total quality management

CO5 - Understand the modern quality management techniques

Text Books:

1. Quality planning and Analysis, Juran and Gryna, TMH, New Delhi
2. Quality Management, Kanishka Bed, Oxford University Press, New Delhi
3. Introduction to SQC, Montgomery DC, 3e, Wiley, New Delhi
4. Fundamentals of quality control and improvement, A Mitra, Mcmillan pub. Company, NY

Reference Books:

1. Fundamentals of Applied Statistics, Gupta and Kapoor, Sultan Chand and Sons, New Delhi.

Course code	OEC –EE-412G				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**ELECTRICAL POWER GENERATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	The aims of Electrical power generation include: The aim of subject is to get knowledge about power generation and its related issues.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 2.5 marks from all units and remaining eight questions of 12.5 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

INTRODUCTION: Energy sources, their availability, recent trends in Power Generation, Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations, Hydro Electric Plant, Nuclear Power Plant and Diesel Power Stations.

Section-D

ELECTRIC ENERGY CONSERVATION & MANAGEMENT: Energy management, Energy Audit, Energy Efficient Motors, Co-generation.

Course Outcomes: Upon completion of this course the student will be able to:

The knowledge about power generation and its related issues.

TEXT BOOKS:

1. Electric Power Generation, B.R.Gupta
2. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,1984.

REF. BOOKS:

1. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons
2. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi
3. Power Plant Engg: G.D. Rai
4. Electric Power: S.L. Uppal (Khanna Publishing)

Course code	OEC-CSE-430G				
Category	Open Elective Courses(OEC) (Semester VIII) List-III				
Course title	**COMPUTER COMMUNICATION**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	1. To Build an understanding of the fundamental concepts of computer networking and familiarizing the student with the basic taxonomy and terminology of the computer networking and data communication. 2. To outline various models, topologies and devices of Computer Networks. 3. To explain the functions of various layers in Network Reference Model. 4. To apply different network concepts in various network communication protocols.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Data Communication: Need, components, Data representations communication model, Characteristics of an effective Communication system, Transmission modes: Simplex, Half Duplex and Full Duplex. Serial and parallel transmission. Unicasting, Multicasting, Broadcasting, Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM), Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying,

MULTIPLEXING: FDM, WDM, TDM, packet switching and circuit switching.**Transmission Media**: Copper cable, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable. Introduction to Computer Network: applications, benefits and problems, Types of Networks: PAN, LAN, MAN and WAN.

UNIT-II

Network Topologies: Introduction to Computer Network Topologies: Mesh Topology, Bus Topology, Star Topology, Ring Topology, Tree Topology, Hybrid Topology, Irregular – Topology.

OSI and TCP/IP Model: Layering architecture of networks, OSI model, Functions of each layer, Services and Protocols of each layer.

UNIT-III

Media Access Control, Random Access: ALOHA, CSMA and CSMA/CD. Controlled Access: Reservation, Polling and Token Passing. Channelization: FDMA, TDMA and CDMA

Ethernet: Features and types of LANs, Types of Ethernets- Thicknet, Thinnet, Fast Ethernet and Gigabit and 10G Ethernet etc. Concept of Carrier Sense Multiple Access (CSMA)/CD in Ethernet.

Network addressing: Physical addressing, logical addressing and port addressing, MAC addressing in Ethernet, IP V4 addressing: concept of subnet, network and host address, IP address Classes- A, B, C, D and E classes. Introduction to classless addressing.

UNIT-IV

LAN interconnecting devices: Repeater, Hubs, Switches, Bridges, Routers, Gateways.

Internet and E-mail: Concept of Internet, Advantages of Internet, Security issues in using internet. Application of Internet in various fields: Scientific, Business, Research, Sports, Medicine & Health Care, Engineering, Teaching. HTTP and FTP

Email :concept, Protocols: SMTP, POP, IMAP.

Learning Outcomes: By the end of the course the students will be able to:

1. Independently understand basic computer network technology.

2. Understand and explain Data Communications System and its components.

3. Identify the different types of network topologies and protocols.

4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.

5. Identify the different types of network devices and their functions within a network

Text Book:

1.Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson publications, 2010.

2. Forouzan, Data Communication and networking ,5th Edition, Tata McGrawHill, 2012.

3. William Stalling, Data & Computer Communication 6th edition, LPE Pearson Education, 2013.

Reference Books:

Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred, 2000, Addison Wesley, Low Price Edition.

Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2 Edition

Computer Networking – ED Tittel , 2002, T.M.H.

Course code	**OEC-CE- 448G**				
Category	Open Elective Courses(OEC) (Semester VIII) List-III				
Course title	**Traffic Engineering and Road Safety**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

- Acquaint the students to basic concepts of Traffic and their significance.
- To stimulate the students to think systematically and objectively about various traffic problems

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module-1: Traffic Characteristics: Importance of traffic characteristics. Road user characteristics. Vehicular characteristics. Max dimensions and weights of vehicles allowed in India.

Module-2: Traffic Studies: Traffic volume study, speed study and origin and destination study. Speed and delay study.

Unit-II

Module-3: Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures.Capacity and Level of Service.

Module-4: Relationship between speed, volume and density,PCU, Design service volume, Capacity of non-urban roads. IRC recommendations, Brief review of capacity of urban roads.

Unit-III

Module-5: Traffic Control Devices: Signs, Signals, markings and islands. Types of signs, Types of signals,Design of Signal, Intersections at grade and grade separated intersections. Types of grades separatedintersections, Parking surveys: On street parking, off street parking.

Unit-IV

Module-6 Road safety audit, RSA team, RSA Report, Elements of RSA,Vehicular air pollution and Situation in India, Motor vehicle act, Vehicular emission norms in India and abroad, Alternate fuels, Factors affecting fuel consumption.

COURSE OUTCOMES:

After completing this course, students should be able:

- To realize the significance of traffic engineering in today life.
- To understand the processes involved in traffic studies.
- To appreciate the role of Traffic regulations.

RECOMMENDED BOOKS:

- Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
- Highway Engg by S.K.Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
- Traffic Engg and Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
- Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.

Course code	**OEC-CE- 450G**				
Category	Open Elective Courses(OEC) (Semester VIII) List-III				
Course title	**Disaster Management**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester 8th**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

- To provide basic conceptual understanding of disasters and its relationships with development.
- Provide an understanding of the social nature of natural hazards and disasters
- Increase awareness of hazards and disasters around the world and the unequal social consequences stemming from disaster events.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Introduction: Terminology,Global and Indian scenario, role of engineer, importance of study in human life, long term effects of disaster. Geological Mass Movement and land disasters, Atmospheric disasters, Disaster Mitigation

Unit-II

Natural Disaster: Nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion

Man-made Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit -III

Case Studies: Damage profile analysis- Uttarkashi/Bhuj/Latur earthquakes, Kerala floods, cyclone Fani and Amphan, Bihar floods, Covid 19.

Unit IV

Disaster Management: Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India.Applications of GIS, Remote sensing and GPS in this regard.

COURSE OUTCOMES:

After completing this course, students should be able:

1. To know natural as well as manmade disaster and their extent and possible effects on the economy.
2. To Plan national importance structures based upon the previous history.
3. To acquaint with government policies, acts and various organizational structures associated with an emergency.
4. To know the simple dos and don'ts in such extreme events and act accordingly.

REFERENCE BOOKS:

1. Singhal J.P. Disaster Management, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011

Course code	**OEC –ECE-453G**				
Category	Open Elective Courses (OEC) (Semester-VIII) List-III				
Course title	**MICROPROCESSOR APPLICATION IN AUTOMOBILES SECTOR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	This course deals with the systematic study of the Architecture and programming issues of 8085-microprocessor family and interfacing with other peripheral ICs and coprocessor. The aim of this course is to give the students basic knowledge of the microprocessors needed to develop the systems using it.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Architecture: General 8 bit microprocessor and its architecture 8085,Z-80 and MC 6800 MPU and its pin functions-Architecture-Functions of different sections.

UNIT-II

Instruction Set: Instruction format-addressing modes-instruction set of 8085 MPU-T-STATE Machine cycle and instruction cycles-Timing diagrams-Different machine cycles-Fetch and execute operations-estimation of execution times.

UNIT-III

Assembly Language Programming: Construct of the language programming-Assembly format of 8085-Assembly Directive-Multiple precision addition and subtraction-BCD to Binary and Binary

to BCD Multiplication, Division, Code conversion using look up tables-stack and subroutines. Data Transfer Schemes: Interrupt structure-Programmed I/O, DMA-Serial I/O.

UNIT-IV

Interfacing Devices: Types of interfacing devices-Input/Output ports 8212, 8255,8251,8279. Octal latches and tristate buffers-A/D and D/A converters-Switches, LED's ROM and RAM interfacing. Applications: Data acquisitions-Temperature control-Stepper motor control Automotive applications engine control, Suspension system control, Driver information systems, Development of a high speed, high precision learning control system for the engine control.

Course Outcomes (COs): At the end of the course, a student will be able to: Explain the architecture, pin configuration of various microprocessors and Interfacing devices **.**

Reference Books :

1. Ramesh, Goankar.S., Microprocessor Archietecture Programming and Applications, Wiley Eastern Ltd.,New Delhi,1986.

2. Aditya .P. Mathur, Introduction to Microprocessors, III Edition Tata McGraw Hill Publishuing Co Ltd New Delhi,1989.

3. Ahson. S. I., Microprocessors with Applications in Process Control,Tata McGraw Hill New Delhi,1986.

4. SAE Transactions,1986 Sec 3.

5. Jabez Dhinagfar .S., Microprocessor Applications in Automobiles.

6. L. Bianco and A. Labella., Automotive Micro Electronics, Elsevier science Publishers,1986.

Course code	HSMC-10G				
Category	Humanities And Social Sciences Including Management Courses (HSMC)-(Semester-VIII) List-III				
Course title	**MANAGEMENT INFORMATION SYSTEMS**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	3	0	0	3	
Objectives:	Its main goals are to help an organization's executives make decisions that improve the organization's agenda and incorporate the company's organizational structure and dynamics to better leverage the organization for a competitive advantage.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

UNIT-I Foundation of Information Systems: Introduction to information system in business, 8 fundamentals of information systems, Solving business problems with information systems, Types of information systems, Effectiveness and efficiency criteria in information system.

UNIT-II

An overview of Management Information Systems: Definition of a management 8 information system, MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS,Structure of a Management information system.

UNIT-III

Concepts of planning: Concept of organizational planning, The Planning Process, 8 Computational support for planning. Business applications of information technology: Internet & electronic commerce

and its applications Enterprise Solutions, Information System for Business Operations(SDLC),Information System for Strategic Advantage, Decision Support Systems and its benefits and characteristics.

UNIT-IV

Managing Information Technology: Enterprise & global management, Security & 8 Ethical challenges, Planning & Implementing changes. Advanced Concepts in Information Systems: Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management, and Procurement Management.

Course Outcomes (COs): Upon successful completion of this course, students will be able to CO1. Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making. CO2. Analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives. CO3. Effectively communicate strategic alternatives to facilitate decision making.

Text Book:

1. O Brian, "Management Information System", TMH
2. Gordon B. Davis & Margrethe H. Olson, "Management Information System", TMH
3. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.

Refrence Books:-

1. O Brian, "Introduction to Information System", MCGRAW HILL.
2. Murdick, "Information System for Modern Management", PHI.
3. Jawadekar, " Management Information System", TMH.
4. Jain Sarika, "Information System", PPM
5. Davis, "Information System", Palgrave Macmillan

Course code	**LC-ME -402G**				
Category	Professional Core Courses				
Course title	**WORKSHOP LAB-IV**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	0	0	2	1	
Objectives:	To understand the construction and working principle of various parts of an automobile.				
Internal Practical Marks	25 Marks				
External Practical Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments :

1. To study and prepare report on the constructional details, working principles and operation of the following Automotive Engine Systems & Sub Systems.
   (a) Multi-cylinder : Diesel and Petrol Engines.
   (b) Engine cooling & lubricating Systems.
   (c) Engine starting Systems.
   (d) Contact Point & Electronic Ignition Systems.
2. To study and prepare report on the constructional details, working principles and operation of the following Fuels supply systems:
   (a) Carburetors
   (b) Diesel Fuel Injection Systems
   (c) Gasoline Fuel Injection Systems.
3. To study and prepare report on the constructional details, working principles and operation of the following Automotive Clutches.
   (a) Coil-Spring Clutch
   (b) Diaphragm – Spring Clutch.
   (c) Double Disk Clutch.

4. To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems.
    (a) Synchromesh – Four speed Range.
    (b) Transaxle with Dual Speed Range.
    (c) Four Wheel Drive and Transfer Case.
    (d) Steering Column and Floor – Shift levers.
5. To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials.
    (a) Rear Wheel Drive Line.
    (b) Front Wheel Drive Line.
    (c) Differentials, Drive Axles and Four Wheel Drive Line.
6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
    (a) Front Suspension System.
    (b) Rear Suspension System.
7. To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems.
    (a) Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
    (b) Power steering Systems, e.g. Rack and Pinion Power Steering System.
    (c) Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns.
8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
    (a) Various Types of Bias & Radial Tyres.
    (b) Various Types of wheels.
9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
    (a) Hydraulic & Pneumatic Brake systems.
    (b) Drum Brake System.
    (c) Disk Brake System.
    (d) Antilock Brake System.

(e) System Packing & Other Brakes.

10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.
11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)
12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

Course Outcomes (COs): At the end of the course, the student shall be able to get practical exposure of:

CO 1- Principle of automobiles drive and advances in automobiles.

CO 2- Various types of clutch.

CO 3- Various types of steering system along with merits and demerits.

CO 4- Various type of hybrid vehicles.

CO 5- Hydrogen based technology for pollution control

Note :

1. At least ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or as designed & set by the concerned institution as per the scope of the syllabus.

Course code	**PCC- ME-406G**				
Category	Professional Core Courses				
Course title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VIII
	0	0	2	1	
Objectives:	To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.				
Internal Practical Marks	25 Marks				
External Practical Marks	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Selecting of Seminar Topics by Teacher or concerned to teacher by students. A seminar topic given by students in semester.

<table>
<tr><td>Course code</td><td colspan="6">PROJ-ME-408G</td></tr>
<tr><td>Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">PROJECT-II</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VIII</td></tr>
<tr><td>0</td><td>0</td><td>10</td><td>5</td></tr>
<tr><td>Objectives:</td><td colspan="5">This course is aimed to provide more weightage for project work. The project work could be done in the form of a major practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.</td></tr>
<tr><td>Internal Project Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>External Project Marks</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

The students expected to take up a project under the guidance of teacher from the college. The project must be based on mechanical engineering problems, which can be extended up to the full semester. The students may be asked to work individually or in a group normally not more than four –six students in a group(If any large/big projects occurs then strength of students increases ap per guide supervision). Viva- voce must be based on the preliminary report submitted by students related to the project.