Study & Evaluation Scheme

of

Bachelor of Technology (Mechanical Engineering)

[Applicable for Academic Session 2014-15]

[With revision approved by VC date January 11, 2017 & January 16, 2018]

TEERTHANKER MAHAVEER UNIVERSITY

N.H.-24, Delhi Road, Moradabad, Uttar Pradesh-244001

Website: www.tmu.ac.in

TEERTHANKER MAHAVEER UNIVERSITY

(Established under Govt. of U. P. Act No. 30, 2008)
Delhi Road, Bagarpur, Moradabad (U.P)

Study & Evaluation Scheme
Bachelor of Technology
SUMMARY

Programme : B.Tech. (Mechanical Engineering)
Duration : Four year full time (Eight Semesters)
Medium : English
Minimum Required Attendance : 75 %
Credit :
Maximum Credit : 194
Minimum credit required for the degree : 190

Assessment :

Internal	External	Total
30*/40**	70*/60**	100

Internal Evaluation (Theory Papers)

Class Test I	Class Test II	Class Test III	Assignment(s)	Other Activity (including attendance)	Total
Best two out of three					
10 Marks	10 Marks	10 Marks	5*/10** Marks	5*/10** Marks	30*/40** Marks

Project Phase-I :

Internal	External	Total
100	-	100

Evaluation of Practical/Industrial Training/ Project Phase-II :

Internal	External	Total
50	50	100

Duration of Examination :

External	Internal
3 hrs.	$1\frac{1}{2}$ hrs

To qualify the course a student is required to secure a minimum of 40*/45**% marks in aggregate including the semester end examination and teacher's continuous evaluation (i.e. both internal and external).

A candidate who secures less than 40*/45**% of marks in a course shall be deemed to have failed in that course. The student should have at least 50*/45**% marks in aggregate to clear the semester. In case a student has secured more than 40*/45**% in each course, but less than 50*/45**% overall in a semester, he/she shall re-appear in courses where the marks are less than 40*/45**% to achieve the required aggregate percentage in the semester.

Question Paper Structure

1. *The question paper shall consist of eight questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weightage 4 marks each).*
2. *Out of the remaining seven questions, student shall be required to attempt any five questions. There will be minimum one and maximum two questions from each unit of the syllabus. The weightage of Question No. 2 to 8 shall be 10 marks each.*
3. *Usually each question in the examination should be designed to have a numerical component.*

*upto academic session 2015-16 and **from academic session 2016-17 onwards

Study & Evaluation Scheme
Programme: B. Tech. (Mechanical Engineering)
Semester I

S. No	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	EAS101	Engineering Mathematics-I	3	1	-	4	30	70	100
2	EAS102/202	Physics - I	3	-	-	3	30	70	100
	EAS103/203	Chemistry							
3	EME101/201	Engineering Mechanics	3	-	-	3	30	70	100
	EME102/202	Manufacturing Science							
4	ECS101/201	Computer Basics & C Programming	3	-	-	3	30	70	100
	EAS 104/204	Environmental Science							
5	EEE101/201	Basic Electrical Engineering	3	-	-	3	30	70	100
	EEC101/201	Basic Electronics Engineering							
6	EHM101	Foundation English-I	2	-	2	3	30	70	100
7	*EAS151/251*	Physics (Lab)	-	-	3	1.5	50	50	100
	EAS152/252	Chemistry (Lab)							
8	EME151/251	Engineering Mechanics (Lab)	-	-	3	1.5	50	50	100
	ECS151/251	Computer Basics & C Programming (Lab)							
9	EME152/252	Engineering Drawing (Lab)	-	-	4	2	50	50	100
	EME153/253	Workshop Practice (Lab)							
10	EEE151/251	Basic Electrical Engineering (Lab)	-	-	3	1.5	50	50	100
	EEC151/251	Basic Electronics Engineering (Lab)							
		Total	**17**	**1**	**15**	**25.5**	**380**	**620**	**1000**

Semester II

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	EAS201	Engineering Mathematics-II	3	1	-	4	30	70	100
2	EAS102/202	Physics - I	3	-	-	3	30	70	100
	EAS103/203	Chemistry							
3	EME101/201	Engineering Mechanics	3	-	-	3	30	70	100
	EME102/202	Manufacturing Science							
4	ECS101/201	Computer Basics & C Programming	3	-	-	3	30	70	100
	EAS 104/204	Environmental Science							
5	EEE101/201	Basic Electrical Engineering	3	-	-	3	30	70	100
	EEC101/201	Basic Electronics Engineering							
6	EHM201	Foundation English-II	2	-	2	3	30	70	100
7	EAS151/251	Physics (Lab)	-	-	3	1.5	50	50	100
	EAS152/252	Chemistry (Lab)							
8	EME151/251	Engineering Mechanics (Lab)	-	-	3	1.5	50	50	100
	ECS151/251	Computer Basics & C Programming (Lab)							
9	EME152/252	Engineering Drawing (Lab)	-	-	4	2	50	50	100
	EME153/253	Workshop Practice (Lab)							
10	EEE151/251	Basic Electrical Engineering (Lab)	-	-	3	1.5	50	50	100
	EEC151/251	Basic Electronics Engineering (Lab)							
		Total	**17**	**1**	**15**	**25.5**	**380**	**620**	**1000**

Semester III

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	EAS301	Mathematics III	3	1	-	4	30	70	100
	EAS302	Physics II							
2	EME 301	Strength of Material	3	1	-	4	30	70	100
3	EME 302	Engineering Thermodynamics	3	-	-	3	30	70	100
4	EME 303	Machine Drawing	3	-	-	3	30	70	100
5	EME 304	Material Science	3	-	-	3	30	70	100
6	EME 305	Industrial Engineering	3	-	-	3	30	70	100
7	EME 351	Machine Drawing Lab	-	-	3	1.5	50	50	100
8	EME 352	Material Science Lab	-	-	3	1.5	50	50	100
9	EME 353	Thermodynamics Lab	-	-	3	1.5	50	50	100
		Total	**18**	**02**	**9**	**24.5**	**330**	**570**	**900**

Additional Courses for Lateral Entry Students with B.Sc background, to be taken in III and IV semester and all should pass with minimum of 40% marks: credits will not be added.

1	EME152/252	Engineering Drawing Lab	-	-	3	1.5	50	50	100
2	EME101/201 EME102/202	Engineering Mechanics Manufacturing Science	3	-	-	3	30	70	100
3	EME153/253 EME151/251	Workshop Practice (Lab) Engineering Mechanics (Lab)	-	-	3	1.5	50	50	100

Semester IV

S. No.	Course Code	Subject		Periods		Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	EAS401	Mathematics III	3	1	-	4	30	70	100
	EAS402	Physics II							
2	EME401	Production Technology – I	3	-	-	3	30	70	100
3	EME402	Measurement, Metrology& Control	3	-	-	3	30	70	100
4	EHM403	Operation Research	3	1	-	4	30	70	100
5	EME404	Numerical Techniques	3	-	-	3	30	70	100
6	EME405	Fluid Mechanics	3	-	-	3	30	70	100
7	EME451	Production Technology-I Lab	-	-	4	2	50	50	100
8	EME452	Measurement, Metrology & Control Lab	-	-	3	1.5	50	50	100
9	EME453	Fluid Mechanics Lab	-	-	3	1.5	50	50	100
		Total	**18**	**02**	**10**	**25**	**330**	**570**	**900**

Semester V

Sl. No.	*Course Code*	*Subject*	*Periods*			*Credit*	*Evaluation Scheme*		
			L	*T*	*P*		*Internal*	*External*	*Total*
1	EME 501	Production Technology –II	3	-	-	3	40	60	100
2	EME 503	Theory of Machines	3	-	-	3	40	60	100
3	EME 504	Design of Machine Elements	3	1	-	4	40	60	100
4	EME 505	Heat & Mass Transfer	3		-	3	40	60	100
5	EHM 501	Technical Writing	2	-	2	3	40	60	100
6	EHM 502	Industrial Psychology	3	-	-	3	40	60	100
7	EME 552	Production Technology II Lab	-	-	4	2	50	50	100
8	EME 553	Heat & Mass Transfer Lab	-	-	3	1.5	50	50	100
9	EME 591	Industrial Training (4 Weeks) & Presentation	-	-	-	2	50	50	100
		Total	**17**	**01**	**09**	**24.5**	**390**	**510**	**900**

Semester VI

S. N	**Subject Code**	**Subject**	**Periods**			**Credits**	**Evaluation Scheme**		
			L	**T**	**P**		**Internal**	**External**	**Total**
1	EME 601	Refrigeration & Air Conditioning	3	0	0	3	40	60	100
2	EME 603	Mechanical Vibrations	3	1	0	4	40	60	100
3	EME 604	Dynamics of Machine	3	0	0	3	40	60	100
4	EME 605	Metallurgy	3	0	0	3	40	60	100
5	EHM 602	Operations Management	3	0	0	3	40	60	100
6	EHM603	Engineering and Managerial Economics	3	0	0	3	40	60	100
7	EME 651	Refrigeration & Air Conditioning Lab	0	0	3	1.5	50	50	100
8	EME 652	Mechanical Vibrations Lab	0	0	3	1.5	50	50	100
	EME 654	**Solid Works Lab**							
9	EME 653	Dynamics of Machine Lab	0	0	3	1.5	50	50	100
		Total	**18**	**1**	**9**	**23.5**	**390**	**510**	**900**

Semester VII

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	**EME701**	**Computer Aided Design (CAD)**	3		-	3	40	60	100
2	EME 707	Hydraulics Machines	3		-	3	40	60	100
3	EME703	Power Plant Engineering	3		-	3	40	60	100
4	EME704	IC Engines	3	-	-	3	40	60	100
5	EME706	Engineering Materials	3	-	-	3	40	60	100
	EME702	Auto Mobile Engineering							
	EME708	**Environmental Protection and Management**							
6	**EME751**	**CAD Lab**	-	-	3	1.5	50	50	100
	EME753	**CAD Lab**	-	-	3	1.5	50	50	100
7	EME752	IC Engines Lab	-	-	3	1.5	50	50	100
8	EME791	Industrial Training (6 Weeks) & Presentation	-		-	3	50	50	100
9	EME799	Project Work Phase-1 (Synopsis, Literature Survey & Presentation)	-		6	3	100	-	100
		Total	**15**	**-**	**12**	**24**	**450**	**450**	**900**

Semester VIII

S. No.	Course Code	Subject	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
1	EHM 801	Total Quality Management	3	-	-	3	40	60	100
	EHM 803	**Total Quality Management**							
2	EME802	Computer Aided Manufacturing (CAM)	3	-	-	3	40	60	100
3	EME803	Unconventional Manufacturing Process	3	-	3	3	40	60	100
	EME804	Non Destructive Testing							
	EME 801	Mechatronics							
4	EME 853	Computer Aided Manufacturing (CAM) Lab	-	-	4	2	50	50	100
5	EME 852	Unconventional Manufacturing Process Lab	-	-	3	1.5	50	50	100
	EME 855	Non Destructive Testing Lab							
	EME 851	Mechatronics (Lab)							
6	EME899	Project Work Phase-2 (Report, Analysis, Experimentation / Simulation and Presentation)	-	-	18	9	50	50	100
		Total	**9**	**-**	**28**	**21.5**	**270**	**330**	**600**

Semester I

ENGINEERING MATHEMATICS-I

Course Code: EAS101	L	T	P	C
	3	1	0	4

Objective:

- To familiarize the basics of matrices, differential calculus, multiple integrals and vector calculus.
- To solve all problems related to matrices, calculus and vectors.

Course Contents

Unit I **(Lectures 08)**

Matrices: Elementary row and column transformation; Rank of matrix; Linear dependence; Consistency of linear system of equations; Characteristic equation; Cayley-Hamilton Theorem; Eigen values and Eigen vectors; Diagonalization; Complex and unitary matrices.

Unit II **(Lectures 08)**

Differential Calculus-I: Successive differentiation; Leibnitz theorem; Partial differentiation; Euler's theorem; Curve tracing; Change of variables; Expansion of function of several variables

Unit III **(Lectures 08)**

Differential Calculus–II: Jacobian; Approximation of errors; Extrema of functions of several variables; Lagrange's method of multipliers (Simple applications).

Unit IV **(Lectures 08)**

Multiple Integrals: Double and triple integral; Change of order & Change of variables; Beta and Gamma functions; Applications to area, volume; Dirichlet integral and applications.

Unit V **(Lectures 08)**

Vector Calculus: Point functions; Gradient, Divergence and Curl of a vector and their physical interpretations; Line, Surface and Volume integrals; Green's & Stokes' theorem; Gauss' divergence theorem.

Text Books

1. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers.
2. Prasad C., *Engineering Mathematics for Engineers*, Prasad Mudralaya.
3. Dass H.K., Engineering Mathematics Vol-I, S. Chand.

Reference Books

1. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern.
2. Piskunov N, *Differential & Integral Calculus*, Moscow Peace Publishers.
3. Narayan Shanti, *A Text book of Matrices*, S. Chand.

Semester I/II
PHYSICS-I

Course Code: EAS102/EAS 202	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:

- To understand the fundamentals of physics like interference, diffraction, lasers etc.

Course Contents

Unit I **(Lectures 08)**

Semiconductor Physics: Distinction among metal, insulator & semiconductor on the basis of band theory; Intrinsic and Extrinsic semiconductors; Basic concepts of Fermi level; Electron and hole mobilities; Electrical conductivity and Hall effect; Basics of p-n Junction.

Unit II **(Lectures 08)**

Interference: Basics of interference of light; coherent Sources, Conditions of Interference; Interference by division of wave front and amplitude (Fresnel's bi-prism, Newton's Rings).

Diffraction: Single and multiple slit Diffraction; Diffraction Grating; Rayleigh's criterion of resolution; Resolving Power of Telescope, Microscope and Grating.

Unit III **(Lectures 08)**

Polarization: Phenomenon of double refraction; Ordinary and extra-ordinary rays; Nicol Prism; Production and analysis of Plane, Circularly and Elliptically Polarized Light; Optical Activity; Specific Rotation, Polarimeter.

Laser: Principle of Laser action; Einstein's Coefficients; Construction and working of He-Ne and Ruby Laser.

Unit IV **(Lectures 08)**

Fiber Optics and Holography: Fundamentals of fiber optics; Types of fibers; Acceptance angle ; Numerical aperture; Attenuation, signal loss in optical fiber and dispersion; Propagation mechanism and communication in optical fiber.

Basic principle of holography; Construction of a hologram and wave reconstruction; Applications of holography.

Unit V **(Lectures 08)**

Electromagnetics: Ampère's law and displacement current; Maxwell's equations in Integral and Differential Forms; Equation of continuity; Electromagnetic Wave Propagation in Free Space and Conducting Media; Poynting Theorem.

Text Books

1. Malik K. H., *Engineering Physics*, Tata McGraw Hill.
2. Subramanyam N, *Optics*, Tata McGraw Hill.

Reference Book

1. Yadav V. S., *Engineering Physics*, Tata McGraw Hill.
2. Mehta Neeraj, *Engineering Physics Vol. I & II*, Prentice Hall of India Pvt. Ltd.

Semester I/II
CHEMISTRY

Course Code: EAS103/EAS203	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:

- To understand the fundamentals of chemistry like Bonding, Pollution, Polymers, Water Chemistry, etc.

Course Contents

Unit I **(Lectures 08)**

Chemical bonding & Solid State Chemistry:

Molecular theory of diatomic hetero-molecules; Band theory of bonding in metals; Hydrogen bonding; Radius Ratio Rule; Space lattice (only cubes); Type of unit cell, Bragg's Law, Calculation of Density of unit cell; One & Two Dimensional solids; graphite as two dimensional solid and its conducting properties; Fullerene & its applications.

Unit II **(Lectures 08)**

Polymers , Reaction Kinetics, Phase rule & Electrochemistry:

Structures of the following polymers, viz, Natural and synthetic rubbers, Polyamide and Polyester fibres, polymethylmethacrylate, poly acrylonitrile and polystyrene; A brief account of conducting polymers (polypyrrole & polytriphene) & their applications.

Order & Molecularity of reactions; First & Second order reactions; Energy of activation.

Phase Rule: Its application to one component system (Water). Equilibrium Potential, Introduction of electrochemical cells & Types: Galvanic & Concentration cells, Electrochemical theory of corrosion & protection of corrosion.

Unit III **(Lectures 08)**

Water Chemistry & Fuels:

Hardness of water; water softening by Lime Soda Process, Calgon process, Zeolites and ion-exchange resins; Reverse osmosis;

Classification of fuels, Coal, Biomass & Biogas; Determination of gross and net calorific values using Bomb Calorimeter.

Unit IV **(Lectures 08)**

Glass & Ceramics:

Concept of glass & its constituents; Classification & uses of different glasses; Elementary idea of manufacturing process of glass; Introduction to Ceramics materials & its constituents, Industrial application of glass & ceramics.

Unit V **(Lectures 08)**

Lubricants:

Introduction to lubricants; Mechanism of lubrication; Classification of lubricants; Flash and fire points, Selection of lubricants.

Text Books

1. Agarwal R. K., Engineering Chemistry, Krishna Prakashan.
2. Morrison & Boyd, *Organic Chemistry*, Prentice Hall
3. Chawla Shashi, Engineering Chemistry, Dhanpat Rai Publication.

Reference Books

1. Barrow Gordon M., *Physical Chemistry*, McGraw-Hill.
2. Manahan Stanley E., *Environmental Chemistry*, CRC Press.

Semester I/II
ENGINEERING MECHANICS

Course Code: EME101/EME201	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:
To study about mechanics, force system, torsion, beams, trusses, frames etc.

Course Contents

Unit I **(Lectures 08)**

Force systems and analysis: Basic concept; Newton's laws of motion; Transfer of force to a parallel position; Determination of resultant of planer force system; Free body diagrams; Equilibrium of forces and its equations.

Friction: Introduction; Coulomb's law of friction; Equilibrium of bodies involving dry fiction; Belt Friction.

Unit II **(Lectures 08)**

Structural Analysis: Beams; Introduction; Shear force and Bending Moment; shear force and Bending Moment Diagram for statically determinate beams.

Trusses: Introduction; Simple Trusses; Determination of Forces in simple trusses members; methods of joints and method of section.

Unit III **(Lectures 08)**

Centroid and Moment of Inertia: Centroid of plane; curve, area, volume and composite bodies; Moment of inertia of plane area; Parallel Axes Theorem; Perpendicular axes theorems; Principal Moment Inertia; Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their axis of symmetry

Unit IV **(Lectures 08)**

Simple stress and strain: Introduction; Normal shear stresses; stress-strain diagrams for ductile and brittle materials; Elastic constants; one dimensional loading of members of varying cross sections.

Unit V **(Lectures 08)**

Pure Bending of Beams: Introduction; Simple bending theory; Stress in Beams of different cross sections.

Torsion: Introduction; Torsion of shafts of circular section; Torque and Twist; Shear stress due to Torque.

Text Books

1. Bansal R. K., *Engineering Mechanics,* Laxmi Publications.
2. Kumar D. S., *Engineering Mechanic,* S. K. Kataria & Sons.
3. Kumar K. L., Kumar V., *Engineering Mechanics,* Tata McGraw Hill Publication.
4. Khurmi R. S., *Engineering Mechanics,* S. Chand Publications.

Reference Books

1. Shames, *Engineering Mechanics,* Prentice Hall of India Pvt. Ltd.
2. Ryder G. H., *Strength of Materials,* Macmillan Publishers India Ltd.
3. Ramamruthams, *Strength of materials,* Dhanpat Rai Publications.

Semester I/II
MANUFACTURING SCIENCE

Course Code: EME102/EME202	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective: To expose the students about basics of manufacturing processes as applicable in Mechanical Engineering.

Course Contents

Unit I **(Lectures 08)**

Basic Metals & Alloys: Properties and Applications; Properties of Materials: Strength, elasticity, stiffness, malleability, ductility, brittleness, toughness, and hardness; Elementary ideas of fracture fatigue & creep.

Unit II **(Lectures 10)**

Metal Forming: Basic metal forming operations & uses of such as: Forgoing, Rolling, Wire drawing/making and Extrusion, and its products/application; Press-work; die & punch assembly, cutting and forming, its application; Hot-working versus cold-working; Introduction to Plastics: Types, Machines: Injection Moulding.

Casting: Pattern & allowance; Molding sands its desirable properties; Mould making with the use of core; Gating system, Casting defects & remedies; Cupola Furnace, Die-casting and its uses.

Unit III **(Lectures 10)**

Machining: Basic principles of Lathe-machine and operations performed on it; basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

Welding: Importance & basic concepts of welding; Classification of welding processes: Gas-welding, types of flames and principle; Electric-Arc welding; Resistance welding; Soldering, & Brazing and its uses.

Unit IV **(Lectures 8)**

Unconventional Manufacturing Process: Limitations of conventional manufacturing process; need of unconventional manufacturing processes; Basic Principles and working of unconventional manufacturing process and their applications; Electro-Discharge machining; Electro-chemical machining; Ultrasonic machining; Abrasive jet machining; Water jet machining;, Laser cutting and Laser beam welding.

Unit V **(Lectures 04)**

Super Finishing Processes: Introduction; Lapping; Honing; Buffing; Burnishing; Powder coating; Polishing

Text Books

1. Hajra & Bose, *Workshop Technology, Vol 1 & 2*, Roy Media Promoters.
2. Pandey & Singh, *Production Engineering Science*, Standard Publishers.
3. R.K. Jain, *Production technology*, Khanna publishers.

Reference Books

1. Raghuvanshi, B.S., *Workshop Technology, Vol 1 & 2*, Dhanpat Rai & Sons.
2. Laxmi Narayan & Vaish W, *A Text Book of Practical Geometrical Drawing,* Pearson Education.

Semester I/II
COMPUTER BASICS & C PROGRAMMING

Course Code: ECS101/ECS201	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:

- To learn the basics of computers & C programming language.

Course Contents:

Unit I **(Lectures 08)**

Concepts in Computer Application: Definition of Electronic Computer; History; Generations; Characteristics and Application of Computers; Classification of Computers; Functional Component of Computer: CPU, I/O devices, Type of Memory & Memory Hierarchy, Firmware and Human ware.

Data and data types: Definitions, data, data types: Integer, Character, Float, String, etc.; Constants and Variable Declaration; Token; Keyboard; Identifier.

Unit II **(Lectures 08)**

Programming Language Classification & Computer Languages: Generation of Languages; Introduction to 4GLs; Translators; Assemblers; Compilers; Interpreters.

Number System: Decimal, Octal, Binary and Hexadecimal & their Conversions; Various Code: BCD, ASCII and EBCDIC and Gray Code.

Operators and Expressions: Numeric and relation operators; logical operator; bit operator; operator precedence and associativity.

Unit III **(Lectures 08)**

Internet and Web Technologies: Hypertext Markup Language; WWW; Gopher; FTP; Telnet; Web Browsers; Search Engines; Email.

Control Structure: while statement, if, else, Nested if else statement. Nested logic: for loop, do- while loop, loop inside a loop structure, Switch Statement. Break and default with switch.

Unit IV **(Lectures 08)**

Concepts in Operating Systems: Elementary Concepts in Operating Systems; Textual Vs GUI Interface.

Arrays: Notation and representation; Manipulation of array elements; Multidimensional arrays.

Unit V **(Lectures 08)**

Functions & Strings: Definition; Declaration; Call by Value; Call by Reference; Returns values and their types; Function calls

Text Books

1. Sinha P. K., *Computer Fundamentals,* BPB Publications.
2. Yadav, DS*, Foundations of IT*, New Age.
3. Curtin, *Information Technology: Breaking News*, Tata McGraw Hill.
4. Rajaraman,R, *Introduction to Computers*, Prentice Hall of India.

Reference Books

1. Peter Nortans, *Introduction to Computers*, Tata McGraw Hill.
2. Leon & Leon, *Fundamental of Information Technology*, Vikas Publishing.
3. Kanter, *Managing Information System*, Prentice-Hall.
4. CISTems*, Internet: An Introduction*, Tata McGraw Hill.

Semester I/II
ENVIRONMENTAL SCIENCE

Course Code: EAS104/EAS204	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective: To create awareness among students about environment protection.

Unit I **(Lectures 08)**

Introduction: Definition, Scope, Segments of Environment and its Multidisciplinary Nature; Some Major Environmental Problems; Definition and Scope of Ecology.

Unit II **(Lectures 08)**

Ecology And Environment: Concept of an Ecosystem- its components and functions; Trophic Levels- Producer; Consumer and Decomposer; Energy Flow in an Ecosystem; Biogeochemical Cycles; Food Chain; Food Web and Ecological Pyramid.

Unit III **(Lectures 08)**

Air & water pollution: Various segments of Atmosphere and their Significance; Sources and Effects of Air Pollution; Sources of Air Pollution: Photochemical Smog, Acid Rain, Global Warming, Ozone Layer - Its Depletion and Control Measures; Sources of Water Pollution; Treatment of Water Pollution; Eutrophication.

Unit IV **(Lectures 08)**

Soil & Thermal pollution: Soil pollution: Sources and Consequences; Solid Wastes – Pollution; Treatment & Disposal.

Thermal - sources and consequences; Sustainable Development; Dams and Reservoirs- Their Benefits and Problems**.**

Unit V **(Lectures 08)**

Biodiversity & its conservation

Bio-Diversity Hot-spots of Biodiversity in India and World; Conservation; Importance and Factors Responsible for Loss of Biodiversity; Deforestation- causes and effects; Biogeographical Classification of India; Environment Conservation Movement in India (Chipko Movement, Appiko Movement), Bioremediation; Biological Magnification.

Text Books

1. De A.K., *Environmental Chemistry*, New Age Publishers Pvt. Ltd.
2. Masters, G.M., *Introduction to Environmental Engineering and Science*, Prentice Hall India Pvt. Ltd.
3. Odum, E.P., *Fundamentals of Ecology*, W. B. Sannders Co.

Reference Books

1. Bryant,P.J., *Biodiversity and Conservation*, Hypertext Book.
2. Tewari, Khulbe & Tewari, *Textbook of Environment Studies*, I.K. Publication.
3. Trivedi, R.K., *Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II*, Environment Media.

Semester I/II
BASIC ELECTRICAL ENGINEERING

Course Code: EEE101/EEE201	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective

- To understand the fundamental concept of Electrical Engineering like DC Network, AC Network, Measuring Instruments, Energy Conversion Devices etc.

Course Contents

Unit I **(Lectures 08)**

D.C. Network Theory: Circuit theory concepts-Mesh and node analysis; Network Theorems-Superposition theorem, Thevenin's theorem, Norton's theorem and Maximum Power Transfer theorem; Star Delta transformation.

Unit II **(Lectures 08)**

Steady State Analysis of A.C. Circuits: Sinusoidal and phasor representation of voltage and current; Single phase A.C. circuit behaviour of resistance, inductance and capacitance and their combination in series & parallel; Power factor; Series and parallel resonance; Band width and quality factor; magnetic circuit.

Unit III **(Lectures 08)**

Measuring Instruments: Construction and principles of operation of voltage and current measuring instruments; introduction to power and energy meters.
Three Phase A.C. Circuits: Star-Delta connections; Line and phase voltage/current relations; Three phase power and its measurement.

Unit IV **(Lectures 08)**

Transformer: Principle of operation; Types of construction; Phasor diagram; Equivalent circuit; Efficiency and voltage regulation of single phase transformer; Open and short circuit tests.
D.C. Machines: Principles of electromechanical energy conversion; Types of D.C. machines; E.M.F. equation; Magnetization and load characteristics; Losses and efficiency; Starter and speed control of D.C. Motors; Motor applications.

Unit V **(Lectures 08)**

Three phase induction Motor: Principle of operation; Types and methods of starting; slip-torque characteristics; Applications.
Synchronous Machines: Principle of Operation of Alternator and synchronous motor
Single phase Motors: Principle of operation and methods of starting of induction motor,

Text Books

1. V. Del Toro, *Principles of Electrical Engineering*, Prentice-Hall International.
2. W.H. Hayt & J.E. Kemmerly, *Engineering Circuit Analysis*, McGraw Hill.

Reference Books

1. Nagrath I.J., *Basic Electrical Engineering*, Tata McGraw Hill.
2. Fitzgerald A.E & Higginbotham ., D.E., Basic Electrical Engineering, McGraw Hill.
3. A Grabel, *Basic Electrical Engineering*, McGraw Hill.
4. Cotton H., *Advanced Electrical Technology*, Wheeler Publishing.

Semester I/II
BASIC ELECTRONICS ENGINEERING

Course Code: EEC101/EEC201	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective

- To understand the basic concept of Electronics Engineering like p-n Junction, Bipolar Junction Transistor, Field Effect Transistor, Operational Amplifier etc.

Course Contents

Unit I **(Lectures 08)**

p-n Junction: Properties of Elements; Crystal Structure; Energy band diagram; Introduction to PN-Junction; Depletion layer; V-I characteristics Diode Ratings (average current, peak-inverse voltage); p-n junction as rectifiers (half wave and full wave) & filter; calculation of ripple factor and load regulation; clipping and clamping circuits; Zener diode and its application as shunt regulator.

Unit II **(Lectures 08)**

Bipolar Junction Transistor (BJT): Basic construction; transistor action; CB, CE and CC configurations; input/output characteristics; Biasing of transistors: Fixed bias, emitter bias, potential divider bias; Graphical analysis of CE amplifier; concept of Voltage gain current gain; λ-parameter model (low frequency); Computation of A_i, A_v, R_i & R_o of single transistor CE amplifier configuration.

Unit III **(Lectures 08)**

Field Effect Transistor (FET): Basic construction of JFET; Principle of working; concept of pinch-off maximum drain saturation current; input and transfer characteristics; Characteristics equation; CG, CS and CD Configuration; fixed and self biasing of JFET amplifier Introduction of MOSFET; Depletion and Enhancement type MOSFET- Construction; Operation and Characteristics.

Unit IV **(Lectures 08)**

Operational Amplifier (Op-Amp): Concept of ideal operational amplifier; ideal and practical Op-Amp parameters; inverting, non-inverting and unity gain configurations; Applications of Op-Amp as adders, difference amplifiers, integrators and differentiator.

Unit V **(Lectures 08)**

Switching Theory: Number system; conversion of bases (decimal, binary, octal and hexadecimal numbers); Adder & Subtraction; BCD numbers; Seven Segment Display; Boolean Algebra; Logic gates; Concept of universal gates; Canonical forms; minimization using K-Map

Text Books

1. Robert Boylestad & Louis Nashelsky, *Electronic Circuit and Devices*, Pearson India.
2. Millman & Halkias, *Integrated Electronics*, McGraw Hill.
3. Millman & Halkias, *Electronics Devices and Circuits*, McGraw Hill.
4. Morris Mano M., *Digital Design,* Prentice Hall.

Reference Books

1. Sedra and Smith, *Microelectronic Circuits,* Oxford University Press .
2. Gayakwad, R A, *Operational Amplifiers and Linear Integrated circuits*, Prentice Hall of India Pvt. Ltd.
3. Chattopadhyay D and P C Rakshit, *Electronics Fundamentals and Applications*, New Age International.

Semester-I
FOUNDATION ENGLISH - I

Course code: EHM101	**L**	**T**	**P**	**C**
	2	**0**	**2**	**3**

(Common with BPH105/BED105/BAL101/AR107/BHM101/BFS106/BCA106/BBA106/ BCH106/ BFA103)

Course Contents:

Unit I **(Lectures 10)**

Functional Grammar: Patterns & Parts of speech Subject, Predicate, Noun, Pronoun, Adjective, Adverb, Verb, Verb phrases, Conjunction, Interjection.

Unit II **(Lectures 10)**

Vocabulary: Word formation, Prefix, Suffix, Compound words, Conversion, Synonyms, Antonyms, Homophones and Homonyms, How to look up a dictionary.

Unit III **(Lectures 10)**

Communication: Meaning & importance of communication, Barriers to effective communication, Channels of communication, Language as a tool of communication

Unit IV **(Lectures 10)**

Requisites of Sentence writing: Fragmented sentences, A good sentence, expletives, Garbled sentences, Rambling sentences, Loaded sentences, Parallel Comparison, Squinting construction, Loose & periodic sentences.

Text Books:

1. Martin & Wren - *High School English Grammar & Composition,* S.Chand & Co.
2. Lewis Norman - *Word Power made easy,* W.R.Goyal Publication & Distributors.
3. Better Your English: A Workbook for 1st year Students, Macmillan India.

Reference Books:

1. Raman Meenakshi & Sharma Sangeeta, *Technical Communication: Principles & Practices,* Oxford University Press, New Delhi.
2. Mohan Krishna & Banerji Meera, *Developing Communication Skills,* Macmillan India Ltd.
3. Rosen Blum M., *How to Build Better Vocabulary*, Bloomsbury Publication. London.

NOTE:

This syllabus has been designed to improve the oral and written communication skills of students. The faculty members should put emphasis on practical (oral) activities for generating students' interest in language learning.

Semester I/II
PHYSICS (LAB)

Course Code: EAS151/EAS251	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To determine the wavelength of Sodium light by Newton's rings.
2. To determine the wavelength of Sodium light by Fresnel's Biprism.
3. To determine the Specific Rotation of the Cane sugar solution with the help of Polari meter.
4. To determine the wavelength of the sodium light by Michelson's interferometer.
5. To study the PN junction characteristics.
6. To determine the high resistance by Leakage method.
7. To study the energy band gap by four probe method.
8. To study the variation of magnetic field using Stewart and Gee's apparatus.
9. To determine the frequency of A.C. mains by means of a Sonometer.
10. To study the Hall Effect.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)</td><td rowspan="2">ATTENDANCE (5 MARKS)</td><td rowspan="2">QUIZ (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
<tr><td>EXPERIMENT (10 MARKS)</td><td>FILE WORK (10 MARKS)</td><td>VIVA (10 MARKS)</td></tr>
</table>

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II
CHEMISTRY (LAB)

Course Code: EAS152/EAS252	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To determine total alkalinity in the given water sample.
2. To determine the temporary and permanent hardness in water sample using EDTA as standard solution.
3. To determine the available chlorine in bleaching powder solution.
4. To determine the chloride content in the given water sample by Mohr's method.
5. To determine the pH of the given solution using pH meter and pH-metric titration.
6. To determine the Equivalent weight of Iron by the chemical displacement method.
7. To determine the Viscosity of an addition polymer like polyester by Viscometer.
8. To determine the dissolved oxygen present in a water sample.
9. To prepare the Bakelite resin polymer.
10. To determine the viscosity of a given sample of a lubricating oil using Redwood Viscometer.
11. To determine the carbon dioxide content in polluted water sample.
12. To find chemical oxygen demand of waste water sample by potassium dichromate.
13. To determine the total hardness in water sample using complexometric method.
14. To determine the iron content in the given sample using external indicator.
15. To determine the strength of given HCL solution by titrating against N/10 Standard Sodium hydroxide solution.

Note: Minimum of 10 experiments has to be completed for completion of curriculum.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II
ENGINEERING MECHANICS (LAB)

Course Code: EME151/EME251	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

(Any 10 experiments of the following or such experiments suitably designed)

LIST OF EXPERIMENTS

1. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a steel specimen.
2. To conduct the compression test and determine the ultimate compressive strength for a specimen.
3. To conduct the Impact test on Impact-testing machine to find the toughness by Charpy impact test.
4. To conduct the Impact-test on Impact-testing machine to find the toughness by Izod impact Test.
5. To determine the hardness of the given specimen using Rockwell hardness testing machine.
6. To determine the hardness of the given specimen using Brinell hardness testing machine.
7. To determine gear ratio of simple and compound gear train.
8. To determine the mechanical advantage of worm and worm wheel for load lifting.
9. To find the coefficient of friction on inclined plane.
10. To perform torsion test for rod on torsion testing machine.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II
COMPUTER BASICS & C PROGRAMMING (LAB)

Course Code: ECS 151/ 251	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Course Contents

1. To write a program to calculate Sum & average of N numbers.
2. To write a program to convert integer arithmetic to a given number of day and month.
3. To write a program to find maximum and minimum out of 3 numbers a, b & c.
4. To write a program to find factorial of positive integer.
5. To write a program to find sum of series up to n number, 2+5+8+……+n.
6. To write a program to print all the number between 1 to 100 which are dividing by 7.
7. To write a program to generate Fibonacci series up to n.
8. To write a program to implement a function to calculate area of a circle.
9. To write a program to implement a recursive function to calculate factorial of given number.
10. To write a program to find whether number is prime or not.
11. To write a program to find that the enter character is a letter or digit.
12. To write a program to find addition of two matrix of n*n order.
13. To write a program to find multiplication of two matrix of n*n order.
14. To write a program to add 6 digit numbers in even case & multiple 6 digit number in odd case.
15. To write a program to find even or odd up to a given limit n.
16. To write a program to find whether a given no is palindrome or not.
17. To write a program to joining & Comparing the 2 string.

Evaluation of Practical Examination:

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)</td><td rowspan="2">ATTENDANCE (5 MARKS)</td><td rowspan="2">QUIZ (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
<tr><td>EXPERIMENT (10 MARKS)</td><td>FILE WORK (10 MARKS)</td><td>VIVA (10 MARKS)</td></tr>
</table>

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II
ENGINEERING DRAWING (LAB)

Course Code: EME152/EME252

L	T	P	C
0	0	4	2

1. To write all Numbers (0 to 9) and alphabetical Letters (A to Z) as per the standard dimensions.
2. To draw the types of lines and conventions of different materials.
3. To draw and study dimensioning and Tolerance.
4. To construction geometrical figures of Pentagon and Hexagon
5. To draw the projection of points and lines
6. To draw the Orthographic Projection of given object in First Angle
7. To draw the Orthographic Projection of given object in Third Angle
8. To draw the sectional view of a given object
9. To draw the development of the lateral surface of given object
10. To draw the isometric projection of the given orthographic projection.

Reference Books

1. Bhatt. N.D., *Elementary Engineering Drawing*, Charothar Publishing.
2. Narayana K.L. & Vaish W., *A Text Book of Practical Geometry on Geometrical Drawing,* Pearson Education.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each sheet prepared would be evaluated by the faculty concerned on the date of preparing the sheet on a 5 point scale which would include the sheet drawn by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II

WORKSHOP PRACTICE (LAB)

Course Code: EME153/EME253	**L**	**T**	**P**	**C**
	0	**0**	**4**	**2**

List of Experiments

Perform any ten experiments selecting at least one from each shop.

Carpentry Shop:

1. To prepare half-lap corner joint.
2. To prepare mortise & tenon joint.
3. To prepare a cylindrical pattern on woodworking lathe.

Fitting Bench Working Shop:

1. To prepare a V-joint fitting
2. To prepare a U-joint fitting
3. To prepare a internal thread in a plate with the help of tapping process

Black Smithy Shop:

1. To prepare a square rod from given circular rod
2. To prepare a square U- shape from given circular rod

Welding Shop:

1. To prepare a butt and Lap welded joints using arc welding machine.
2. To prepare a Lap welded joint Gas welding equipment.
3. To prepare a Lap welded joint using spot welding machine.

Sheet-metal Shop:

1. To make round duct of GI sheet using 'soldering' process.
2. To prepare a tray of GI by fabrication

Machine Shop:

1. To prepare a bolt on the lathe machine as per given. diagram
2. To prepare a job on the lathe machine as per given diagram.

Foundry Shop:

1. To prepare core as per given size.
2. To prepare a mould for given casting.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II
BASIC ELECTRICAL ENGINEERING (LAB)

Course Code: EEE151/EEE251	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To verify the Kirchhoff's current and voltage laws.
2. To verify the Superposition theorem.
3. To verify the Thevenin's theorem.
4. To verify the Norton's theorem.
5. To verify the maximum power transfer theorem.
6. To determine the efficiency of single-phase transformer by load test.
7. To determine the external characteristics of DC Shunt generator.
8. To measure current and speed for speed control of D.C. Shunt Motor.
9. To measure the power in a 3-phase system by two-wattmeter method
10. To measure the power factor in an RLC by varying the capacitance.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)</td><td rowspan="2">ATTENDANCE (5 MARKS)</td><td rowspan="2">QUIZ (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
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</table>

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester I/II
BASICS ELECTRONICS ENGINEERING (LAB)

Course Code: EEC151/EEC251	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To study the V-I characteristics of p-n junction diode.
2. To study the diode as clipper and clamper.
3. To study the half-wave & full-wave rectifier using silicon diode.
4. To study transistor in Common Base configuration & plot its input/output characteristics.
5. To study transistor in Common Emitter configuration & plot its input/output characteristics. .
6. To study the operational amplifier in inverting & non inverting modes using IC 741.
7. To study the operational amplifier as differentiator & integrator.
8. To study the Zener diode as a shunt regulator.
9. To study various logic gates & verify their truth tables.
10. To study half adder/full adder & verify their truth tables.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)</td><td rowspan="2">ATTENDANCE (5 MARKS)</td><td rowspan="2">QUIZ (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
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</table>

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II
ENGINEERING MATHEMATICS- II

Course Code: EAS201	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Objective: To familiarize the basic concept of Differential Equations, Laplace Transform, Fourier series and Partial Differential Equations etc.

Course Contents

Unit I **(Lectures 08)**

Differential Equations: Ordinary differential equations of first order; Exact differential equations; Linear differential equations of first order, Linear differential equations of nth order with constant coefficients; Complementary functions and particular integrals; Simultaneous linear differential equations; Solutions of second order differential equations by changing dependent and independent variables; Method of variation of parameters; Applications to engineering problems (without derivation).

Unit II **(Lectures 08)**

Series Solutions and Special Functions: Series solutions of ODE of 2nd order with variable coefficients with special emphasis to differential equations of Legendre and Bessel; Legendre polynomials; Bessel's functions and their properties.

Unit III **(Lectures 10)**

Partial Differential Equations and applications: Introduction of partial differential equations; Linear partial differential equations with constant coefficients of 2nd order and their classifications – parabolic; elliptic and hyperbolic with illustrative examples.

Method of separation of variables for solving partial differential equations; Wave equation up to two dimensions; Laplace equation in two-dimensions; Heat conduction equations up to two-dimensions; Equations of transmission Lines.

Unit IV **(Lectures 06)**

Fourier Series: Periodic functions, Trigonometric series; Fourier series; Euler's formulae; Even and odd functions, Half range sine and cosine series.

Unit V **(Lectures 08)**

Laplace Transform: Laplace transform; Existence theorem; Laplace transform of derivatives and integrals; Inverse Laplace transform; Unit step function; Diracth delta function; Laplace transform of periodic functions; Convolution theorem; Application to solve simple linear and simultaneous differential equations.

Text Books

1. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers.
2. Prasad C., *Engineering Mathematics for Engineers*, Prasad Mudralaya.
3. Das H.K., *Engineering Mathematics Vol-II*, S. Chand.

Reference Books

1. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern.
2. Piskunov N, *Differential & Integral Calculus*, Moscow Peace Publishers.
3. Narayan Shanti, *A Text book of Matrices*, S. Chand
4. Bali N.P., *Engineering Mathematics-II,* Laxmi Publications.

Semester II/I
PHYSICS-I

Course Code: EAS202/EAS102	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:

- To understand the fundamentals of physics like interference, diffraction, lasers etc.

Course Contents

Unit I **(Lectures 08)**

Semiconductor Physics: Distinction among metal, insulator & semiconductor on the basis of band theory; Intrinsic and Extrinsic semiconductors; Basic concepts of Fermi level; Electron and hole mobilities; Electrical conductivity and Hall effect; Basics of p-n Junction.

Unit II **(Lectures 08)**

Interference: Basics of interference of light; coherent Sources, Conditions of Interference; Interference by division of wave front and amplitude (Fresnel's bi-prism, Newton's Rings).

Diffraction: Single and multiple slit Diffraction; Diffraction Grating; Rayleigh's criterion of resolution; Resolving Power of Telescope, Microscope and Grating.

Unit III **(Lectures 08)**

Polarization: Phenomenon of double refraction; Ordinary and extra-ordinary rays; Nicol Prism; Production and analysis of Plane, Circularly and Elliptically Polarized Light; Optical Activity; Specific Rotation, Polarimeter.

Laser: Principle of Laser action; Einstein's Coefficients; Construction and working of He-Ne and Ruby Laser.

Unit IV **(Lectures 08)**

Fiber Optics and Holography: Fundamentals of fiber optics; Types of fibers; Acceptance angle ; Numerical aperture; Attenuation, signal loss in optical fiber and dispersion; Propagation mechanism and communication in optical fiber.

Basic principle of holography; Construction of a hologram and wave reconstruction; Applications of holography.

Unit V **(Lectures 08)**

Electromagnetics: Ampère's law and displacement current; Maxwell's equations in Integral and Differential Forms; Equation of continuity; Electromagnetic Wave Propagation in Free Space and Conducting Media; Poynting Theorem.

Text Books

1. Malik K. H., *Engineering Physics*, Tata McGraw Hill.
2. Subramanyam N, *Optics*, Tata McGraw Hill.

Reference Book

1. Yadav V. S., *Engineering Physics*, Tata McGraw Hill.
2. Mehta Neeraj, *Engineering Physics Vol. I & II*, Prentice Hall of India Pvt. Ltd.

Semester II/I
CHEMISTRY

Course Code: EAS203/EAS103

L	T	P	C
3	0	0	3

Objective:

- To understand the fundamentals of chemistry like Bonding, Pollution, Polymers, Water Chemistry, etc.

Course Contents

Unit I **(Lectures 08)**

Chemical bonding & Solid State Chemistry:

Molecular theory of diatomic hetero-molecules; Band theory of bonding in metals; Hydrogen bonding; Radius Ratio Rule; Space lattice (only cubes); Type of unit cell, Bragg's Law, Calculation of Density of unit cell; One & Two Dimensional solids; graphite as two dimensional solid and its conducting properties; Fullerene & its applications.

Unit II **(Lectures 08)**

Polymers , Reaction Kinetics, Phase rule & Electrochemistry:

Structures of the following polymers, viz, Natural and synthetic rubbers, Polyamide and Polyester fibres, polymethylmethacrylate, poly acrylonitrile and polystyrene; A brief account of conducting polymers (polypyrrole & polytriphene) & their applications.

Order & Molecularity of reactions; First & Second order reactions; Energy of activation.

Phase Rule: Its application to one component system (Water). Equilibrium Potential, Introduction of electrochemical cells & Types: Galvanic & Concentration cells, Electrochemical theory of corrosion & protection of corrosion.

Unit III **(Lectures 08)**

Water Chemistry & Fuels:

Hardness of water; water softening by Lime Soda Process, Calgon process, Zeolites and ion-exchange resins; Reverse osmosis;

Classification of fuels, Coal, Biomass & Biogas; Determination of gross and net calorific values using Bomb Calorimeter.

Unit IV **(Lectures 08)**

Glass & Ceramics:

Concept of glass & its constituents; Classification & uses of different glasses; Elementary idea of manufacturing process of glass; Introduction to Ceramics materials & its constituents, Industrial application of glass & ceramics.

Unit V **(Lectures 08)**

Lubricants:

Introduction to lubricants; Mechanism of lubrication; Classification of lubricants; Flash and fire points, Selection of lubricants.

Text Books

1. Agarwal R. K., Engineering Chemistry, Krishna Prakashan.
2. Morrison & Boyd, *Organic Chemistry*, Prentice Hall
3. Chawla Shashi, Engineering Chemistry, Dhanpat Rai Publication.

Reference Books

1. Barrow Gordon M., *Physical Chemistry*, McGraw-Hill.
2. Manahan Stanley E., *Environmental Chemistry*, CRC Press.

Semester II/I
ENGINEERING MECHANICS

Course Code: EME201/EME101	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:
To study about mechanics, force system, torsion, beams, trusses, frames etc.

Course Contents

Unit I **(Lectures 08)**

Force systems and analysis: Basic concept; Newton's laws of motion; Transfer of force to a parallel position; Determination of resultant of planer force system; Free body diagrams; Equilibrium of forces and its equations.

Friction: Introduction; Coulomb's law of friction; Equilibrium of bodies involving dry fiction; Belt Friction.

Unit II **(Lectures 08)**

Structural Analysis: Beams; Introduction; Shear force and Bending Moment; shear force and Bending Moment Diagram for statically determinate beams.

Trusses: Introduction; Simple Trusses; Determination of Forces in simple trusses members; methods of joints and method of section.

Unit III **(Lectures 08)**

Centroid and Moment of Inertia: Centroid of plane; curve, area, volume and composite bodies; Moment of inertia of plane area; Parallel Axes Theorem; Perpendicular axes theorems; Principal Moment Inertia; Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their axis of symmetry

Unit IV **(Lectures 08)**

Simple stress and strain: Introduction; Normal shear stresses; stress-strain diagrams for ductile and brittle materials; Elastic constants; one dimensional loading of members of varying cross sections.

Unit V **(Lectures 08)**

Pure Bending of Beams: Introduction; Simple bending theory; Stress in Beams of different cross sections.

Torsion: Introduction; Torsion of shafts of circular section; Torque and Twist; Shear stress due to Torque.

Text Books

1. Bansal R. K., *Engineering Mechanics,* Laxmi Publications.
2. Kumar D. S., *Engineering Mechanic,* S. K. Kataria & Sons.
3. Kumar K. L., Kumar V., *Engineering Mechanics,* Tata McGraw Hill Publication.
4. Khurmi R. S., *Engineering Mechanics,* S. Chand Publications.

Reference Books

1. Shames, *Engineering Mechanics,* Prentice Hall of India Pvt. Ltd.
2. Ryder G. H., *Strength of Materials,* Macmillan Publishers India Ltd.
3. Ramamruthams, *Strength of materials,* Dhanpat Rai Publications.

Semester II/I
MANUFACTURING SCIENCE

Course Code: EME202/EME102	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective: To expose the students about basics of manufacturing processes as applicable in Mechanical Engineering.

Course Contents

Unit I **(Lectures 08)**

Basic Metals & Alloys: Properties and Applications; Properties of Materials: Strength, elasticity, stiffness, malleability, ductility, brittleness, toughness, and hardness; Elementary ideas of fracture fatigue & creep.

Unit II **(Lectures 10)**

Metal Forming: Basic metal forming operations & uses of such as: Forgoing, Rolling, Wire drawing/making and Extrusion, and its products/application; Press-work; die & punch assembly, cutting and forming, its application; Hot-working versus cold-working; Introduction to Plastics: Types, Machines: Injection Moulding.

Casting: Pattern & allowance; Molding sands its desirable properties; Mould making with the use of core; Gating system, Casting defects & remedies; Cupola Furnace, Die-casting and its uses.

Unit III **(Lectures 10)**

Machining: Basic principles of Lathe-machine and operations performed on it; basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

Welding: Importance & basic concepts of welding; Classification of welding processes: Gas-welding, types of flames and principle; Electric-Arc welding; Resistance welding; Soldering, & Brazing and its uses.

Unit IV **(Lectures 8)**

Unconventional Manufacturing Process: Limitations of conventional manufacturing process; need of unconventional manufacturing processes; Basic Principles and working of unconventional manufacturing process and their applications; Electro-Discharge machining; Electro-chemical machining; Ultrasonic machining; Abrasive jet machining; Water jet machining;, Laser cutting and Laser beam welding.

Unit V **(Lectures 04)**

Super Finishing Processes: Introduction; Lapping; Honing; Buffing; Burnishing; Powder coating; Polishing

Text Books

1. Hajra & Bose, *Workshop Technology, Vol 1 & 2*, Roy Media Promoters.
2. Pandey & Singh, *Production Engineering Science*, Standard Publishers.
3. R.K. Jain, *Production technology*, Khanna publishers.

Reference Books

1. Raghuvanshi, B.S., *Workshop Technology, Vol 1 & 2*, Dhanpat Rai & Sons.
2. Laxmi Narayan & Vaish W, *A Text Book of Practical Geometrical Drawing,* Pearson Education.

Semester II/I
COMPUTER BASICS & C PROGRAMMING

Course Code: ECS201/ECS101	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective:

- To learn the basics of computers & C programming language.

Course Contents:

Unit I **(Lectures 08)**

Concepts in Computer Application: Definition of Electronic Computer; History; Generations; Characteristics and Application of Computers; Classification of Computers; Functional Component of Computer: CPU, I/O devices, Type of Memory & Memory Hierarchy, Firmware and Human ware.

Data and data types: Definitions, data, data types: Integer, Character, Float, String, etc.; Constants and Variable Declaration; Token; Keyboard; Identifier.

Unit II **(Lectures 08)**

Programming Language Classification & Computer Languages: Generation of Languages; Introduction to 4GLs; Translators; Assemblers; Compilers; Interpreters.

Number System: Decimal, Octal, Binary and Hexadecimal & their Conversions; Various Code: BCD, ASCII and EBCDIC and Gray Code.

Operators and Expressions: Numeric and relation operators; logical operator; bit operator; operator precedence and associativity.

Unit III **(Lectures 08)**

Internet and Web Technologies: Hypertext Markup Language; WWW; Gopher; FTP; Telnet; Web Browsers; Search Engines; Email.

Control Structure: while statement, if, else, Nested if else statement. Nested logic: for loop, do- while loop, loop inside a loop structure, Switch Statement. Break and default with switch.

Unit IV **(Lectures 08)**

Concepts in Operating Systems: Elementary Concepts in Operating Systems; Textual Vs GUI Interface.

Arrays: Notation and representation; Manipulation of array elements; Multidimensional arrays.

Unit V **(Lectures 08)**

Functions & Strings: Definition; Declaration; Call by Value; Call by Reference; Returns values and their types; Function calls

Text Books

1. Sinha P. K., *Computer Fundamentals,* BPB Publications.
2. Yadav, DS*, Foundations of IT*, New Age.
3. Curtin, *Information Technology: Breaking News*, Tata McGraw Hill.
4. Rajaraman,R, *Introduction to Computers*, Prentice Hall of India.

Reference Books

1. Peter Nortans, *Introduction to Computers*, Tata McGraw Hill.
2. Leon & Leon, *Fundamental of Information Technology*, Vikas Publishing.
3. Kanter, *Managing Information System*, Prentice-Hall.
4. CISTems*, Internet: An Introduction*, Tata McGraw Hill.

Semester II/I
ENVIRONMENTAL SCIENCE

Course Code: EAS204/EAS104	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective: To create awareness among students about environment protection.

Unit I **(Lectures 08)**

Introduction: Definition, Scope, Segments of Environment and its Multidisciplinary Nature; Some Major Environmental Problems; Definition and Scope of Ecology.

Unit II **(Lectures 08)**

Ecology And Environment: Concept of an Ecosystem- its components and functions; Trophic Levels- Producer; Consumer and Decomposer; Energy Flow in an Ecosystem; Biogeochemical Cycles; Food Chain; Food Web and Ecological Pyramid.

Unit III **(Lectures 08)**

Air & water pollution: Various segments of Atmosphere and their Significance; Sources and Effects of Air Pollution; Sources of Air Pollution: Photochemical Smog, Acid Rain, Global Warming, Ozone Layer - Its Depletion and Control Measures; Sources of Water Pollution; Treatment of Water Pollution; Eutrophication.

Unit IV **(Lectures 08)**

Soil & Thermal pollution: Soil pollution: Sources and Consequences; Solid Wastes – Pollution; Treatment & Disposal.

Thermal - sources and consequences; Sustainable Development; Dams and Reservoirs- Their Benefits and Problems**.**

Unit V **(Lectures 08)**

Biodiversity & its conservation

Bio-Diversity Hot-spots of Biodiversity in India and World; Conservation; Importance and Factors Responsible for Loss of Biodiversity; Deforestation- causes and effects; Biogeographical Classification of India; Environment Conservation Movement in India (Chipko Movement, Appiko Movement), Bioremediation; Biological Magnification.

Text Books

1. De A.K., *Environmental Chemistry*, New Age Publishers Pvt. Ltd.
2. Masters, G.M., *Introduction to Environmental Engineering and Science*, Prentice Hall India Pvt. Ltd.
3. Odum, E.P., *Fundamentals of Ecology*, W. B. Sannders Co.

Reference Books

1. Bryant,P.J., *Biodiversity and Conservation*, Hypertext Book.
2. Tewari, Khulbe & Tewari, *Textbook of Environment Studies*, I.K. Publication.
3. Trivedi, R.K., *Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II*, Environment Media.

Semester II/I
BASIC ELECTRICAL ENGINEERING

Course Code: EEE201/EEE101	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective

- To understand the fundamental concept of Electrical Engineering like DC Network, AC Network, Measuring Instruments, Energy Conversion Devices etc.

Course Contents

Unit I **(Lectures 08)**

D.C. Network Theory: Circuit theory concepts-Mesh and node analysis; Network Theorems-Superposition theorem, Thevenin's theorem, Norton's theorem and Maximum Power Transfer theorem; Star Delta transformation.

Unit II **(Lectures 08)**

Steady State Analysis of A.C. Circuits: Sinusoidal and phasor representation of voltage and current; Single phase A.C. circuit behaviour of resistance, inductance and capacitance and their combination in series & parallel; Power factor; Series and parallel resonance; Band width and quality factor; magnetic circuit.

Unit III **(Lectures 08)**

Measuring Instruments: Construction and principles of operation of voltage and current measuring instruments; introduction to power and energy meters.
Three Phase A.C. Circuits: Star-Delta connections; Line and phase voltage/current relations; Three phase power and its measurement.

Unit IV **(Lectures 08)**

Transformer: Principle of operation; Types of construction; Phasor diagram; Equivalent circuit; Efficiency and voltage regulation of single phase transformer; Open and short circuit tests.
D.C. Machines: Principles of electromechanical energy conversion; Types of D.C. machines; E.M.F. equation; Magnetization and load characteristics; Losses and efficiency; Starter and speed control of D.C. Motors; Motor applications.

Unit V **(Lectures 08)**

Three phase induction Motor: Principle of operation; Types and methods of starting; slip-torque characteristics; Applications.
Synchronous Machines: Principle of Operation of Alternator and synchronous motor
Single phase Motors: Principle of operation and methods of starting of induction motor,

Text Books

1. V. Del Toro, *Principles of Electrical Engineering*, Prentice-Hall International.
2. W.H. Hayt & J.E. Kemmerly, *Engineering Circuit Analysis*, McGraw Hill.

Reference Books

1. Nagrath I.J., *Basic Electrical Engineering*, Tata McGraw Hill.
2. Fitzgerald A.E & Higginbotham ., D.E., Basic Electrical Engineering, McGraw Hill.
3. A Grabel, *Basic Electrical Engineering*, McGraw Hill.
4. Cotton H., *Advanced Electrical Technology*, Wheeler Publishing.

Semester II/I
BASIC ELECTRONICS ENGINEERING

Course Code: EEC201/EEC101	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective

- To understand the basic concept of Electronics Engineering like p-n Junction, Bipolar Junction Transistor, Field Effect Transistor, Operational Amplifier etc.

Course Contents

Unit I **(Lectures 08)**

p-n Junction: Properties of Elements; Crystal Structure; Energy band diagram; Introduction to PN-Junction; Depletion layer; V-I characteristics Diode Ratings (average current, peak-inverse voltage); p-n junction as rectifiers (half wave and full wave) & filter; calculation of ripple factor and load regulation; clipping and clamping circuits; Zener diode and its application as shunt regulator.

Unit II **(Lectures 08)**

Bipolar Junction Transistor (BJT): Basic construction; transistor action; CB, CE and CC configurations; input/output characteristics; Biasing of transistors: Fixed bias, emitter bias, potential divider bias; Graphical analysis of CE amplifier; concept of Voltage gain current gain; λ-parameter model (low frequency); Computation of A_i, A_v, R_i & R_o of single transistor CE amplifier configuration.

Unit III **(Lectures 08)**

Field Effect Transistor (FET): Basic construction of JFET; Principle of working; concept of pinch-off maximum drain saturation current; input and transfer characteristics; Characteristics equation; CG, CS and CD Configuration; fixed and self biasing of JFET amplifier Introduction of MOSFET; Depletion and Enhancement type MOSFET- Construction; Operation and Characteristics.

Unit IV **(Lectures 08)**

Operational Amplifier (Op-Amp): Concept of ideal operational amplifier; ideal and practical Op-Amp parameters; inverting, non-inverting and unity gain configurations; Applications of Op-Amp as adders, difference amplifiers, integrators and differentiator.

Unit V **(Lectures 08)**

Switching Theory: Number system; conversion of bases (decimal, binary, octal and hexadecimal numbers); Adder & Subtraction; BCD numbers; Seven Segment Display; Boolean Algebra; Logic gates; Concept of universal gates; Canonical forms; minimization using K-Map

Text Books

1. Robert Boylestad & Louis Nashelsky, *Electronic Circuit and Devices*, Pearson India.
2. Millman & Halkias, *Integrated Electronics*, McGraw Hill.
3. Millman & Halkias, *Electronics Devices and Circuits*, McGraw Hill.
4. Morris Mano M., *Digital Design,* Prentice Hall.

Reference Books

1. Sedra and Smith, *Microelectronic Circuits,* Oxford University Press .
2. Gayakwad, R A, *Operational Amplifiers and Linear Integrated circuits*, Prentice Hall of India Pvt. Ltd.
3. Chattopadhyay D and P C Rakshit, *Electronics Fundamentals and Applications*, New Age International.

Semester-II
FOUNDATION ENGLISH - II

Course code: EHM 201	**L**	**T**	**P**	**C**
	2	**0**	**2**	**3**

(Common with BPH206/BBA206/BCA206/BHM201/AR207/BCH206/BFA203)

Unit I **(Lectures 10)**

Functional Grammar: Articles, Preposition, Tenses: Functions, Synthesis, Transformation, Spotting errors and correction of sentences.

Unit II **(Lectures 10)**

Pre- Requisites of Technical written Communication: One word substitution, Spelling rules, Words often confused & misused, Phrases.

Unit III **(Lectures 10)**

The Structure of sentences/ clauses: Adverb clause, Adjective clause, Noun clause. Sentences: Simple, Double, Multiple and complex, Transformation of sentences: simple to complex & vice versa, simple to compound & vice-versa, Interrogative to assertive & negative & vice-versa.

Unit IV **(Lectures 10)**

Technical Communication: Nature, Origin and Development, Salient features, Scope & Significance, Forms of Technical Communication, Difference between Technical Communication & General writing, Objective Style vs. Literary Composition

Text-Books:

1. Wren & Martin, *High School English Grammar & Composition* – S. Chand & Co.
2. Raman Meenakshi & Sharma Sangeeta, *Technical Communication-Principles & Practice,* Oxford University Press, New Delhi, 2007.
3. Mitra Barum K., *Effective Technical Communication,* Oxford University Press, New Delhi.
4. Better Your English- A Workbook for 1st year Students- Macmillan India.

Reference Books:

1. Horn A.S., *Guide to Patterns & Usage in English,* Oxford University Press, New Delhi.

NOTE:

This syllabus has been designed to improve the oral and written communication skills of students. The faculty members should put emphasis on practical (oral) activities for generating students' interest in language learning.

Semester II/I
PHYSICS (LAB)

Course Code: EAS251/EAS151	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1) To determine the wavelength of Sodium light by Newton's rings.
2) To determine the wavelength of Sodium light by Fresnel's Biprism.
3) To determine the Specific Rotation of the Cane sugar solution with the help of Polari meter.
4) To determine the wavelength of the sodium light by Michelson's interferometer.
5) To study the PN junction characteristics.
6) To determine the high resistance by Leakage method.
7) To study the energy band gap by four probe method.
8) To study the variation of magnetic field using Stewart and Gee's apparatus.
9) To determine the frequency of A.C. mains by means of a Sonometer.
10) To study the Hall Effect.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I
CHEMISTRY (LAB)

Course Code: EAS252/EAS152	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To determine total alkalinity in the given water sample.
2. To determine the temporary and permanent hardness in water sample using EDTA as standard solution.
3. To determine the available chlorine in bleaching powder solution.
4. To determine the chloride content in the given water sample by Mohr's method.
5. To determine the pH of the given solution using pH meter and pH-metric titration.
6. To determine the Equivalent weight of Iron by the chemical displacement method.
7. To determine the Viscosity of an addition polymer like polyester by Viscometer.
8. To determine the dissolved oxygen present in a water sample.
9. To prepare the Bakelite resin polymer.
10. To determine the viscosity of a given sample of a lubricating oil using Redwood Viscometer.
11. To determine the carbon dioxide content in polluted water sample.
12. To find chemical oxygen demand of waste water sample by potassium dichromate.
13. To determine the total hardness in water sample using complexometric method.
14. To determine the iron content in the given sample using external indicator.
15. To determine the strength of given HCL solution by titrating against N/10 Standard Sodium hydroxide solution.

Note: Minimum of 10 experiments has to be completed for completion of curriculum.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I
ENGINEERING MECHANICS (LAB)

Course Code: EME251/EME151	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

(Any 10 experiments of the following or such experiments suitably designed)

LIST OF EXPERIMENTS

1. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a steel specimen.
2. To conduct the compression test and determine the ultimate compressive strength for a specimen.
3. To conduct the Impact test on Impact-testing machine to find the toughness by Charpy impact test.
4. To conduct the Impact-test on Impact-testing machine to find the toughness by Izod impact Test.
5. To determine the hardness of the given specimen using Rockwell hardness testing machine.
6. To determine the hardness of the given specimen using Brinell hardness testing machine.
7. To determine gear ratio of simple and compound gear train.
8. To determine the mechanical advantage of worm and worm wheel for load lifting.
9. To find the coefficient of friction on inclined plane.
10. To perform torsion test for rod on torsion testing machine.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I
COMPUTER BASICS & C PROGRAMMING (LAB)

Course Code: ECS 251/ 151

L	T	P	C
0	0	3	1.5

Course Contents

1. To write a program to calculate Sum & average of N numbers.
2. To write a program to convert integer arithmetic to a given number of day and month.
3. To write a program to find maximum and minimum out of 3 numbers a, b & c.
4. To write a program to find factorial of positive integer.
5. To write a program to find sum of series up to n number, 2+5+8+……+n.
6. To write a program to print all the number between 1 to 100 which are dividing by 7.
7. To write a program to generate Fibonacci series up to n.
8. To write a program to implement a function to calculate area of a circle.
9. To write a program to implement a recursive function to calculate factorial of given number.
10. To write a program to find whether number is prime or not.
11. To write a program to find that the enter character is a letter or digit.
12. To write a program to find addition of two matrix of n*n order.
13. To write a program to find multiplication of two matrix of n*n order.
14. To write a program to add 6 digit numbers in even case & multiple 6 digit number in odd case.
15. To write a program to find even or odd up to a given limit n.
16. To write a program to find whether a given no is palindrome or not.
17. To write a program to joining & Comparing the 2 string.

Evaluation of Practical Examination:

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I
ENGINEERING DRAWING (LAB)

Course Code: EME252/EME152

L	T	P	C
0	0	4	2

1. To write all Numbers (0 to 9) and alphabetical Letters (A to Z) as per the standard dimensions.
2. To draw the types of lines and conventions of different materials.
3. To draw and study dimensioning and Tolerance.
4. To construction geometrical figures of Pentagon and Hexagon
5. To draw the projection of points and lines
6. To draw the Orthographic Projection of given object in First Angle
7. To draw the Orthographic Projection of given object in Third Angle
8. To draw the sectional view of a given object
9. To draw the development of the lateral surface of given object
10. To draw the isometric projection of the given orthographic projection.

Reference Books

1. Bhatt. N.D., *Elementary Engineering Drawing*, Charothar Publishing.
2. Narayana K.L. & Vaish W., *A Text Book of Practical Geometry on Geometrical Drawing,* Pearson Education.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each sheet prepared would be evaluated by the faculty concerned on the date of preparing the sheet on a 5 point scale which would include the sheet drawn by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I

WORKSHOP PRACTICE (LAB)

Course Code: EME253/EME153	**L**	**T**	**P**	**C**
	0	**0**	**4**	**2**

List of Experiments

Perform any ten experiments selecting at least one from each shop.

Carpentry Shop:

4. To prepare half-lap corner joint.
5. To prepare mortise & tenon joint.
6. To prepare a cylindrical pattern on woodworking lathe.

Fitting Bench Working Shop:

4. To prepare a V-joint fitting
5. To prepare a U-joint fitting
6. To prepare a internal thread in a plate with the help of tapping process

Black Smithy Shop:

1. To prepare a square rod from given circular rod
2. To prepare a square U- shape from given circular rod

Welding Shop:

4. To prepare a butt and Lap welded joints using arc welding machine.
5. To prepare a Lap welded joint Gas welding equipment.
6. To prepare a Lap welded joint using spot welding machine.

Sheet-metal Shop:

3. To make round duct of GI sheet using 'soldering' process.
4. To prepare a tray of GI by fabrication

Machine Shop:

3. To prepare a bolt on the lathe machine as per given. diagram
4. To prepare a job on the lathe machine as per given diagram.

Foundry Shop:

3. To prepare core as per given size.
4. To prepare a mould for given casting.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)</td><td rowspan="2">ATTENDANCE (5 MARKS)</td><td rowspan="2">QUIZ (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
<tr><td>EXPERIMENT (10 MARKS)</td><td>FILE WORK (10 MARKS)</td><td>VIVA (10 MARKS)</td></tr>
</table>

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I
BASIC ELECTRICAL ENGINEERING (LAB)

Course Code: EEE251/EEE151	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To verify the Kirchhoff's current and voltage laws.
2. To verify the Superposition theorem.
3. To verify the Thevenin's theorem.
4. To verify the Norton's theorem.
5. To verify the maximum power transfer theorem.
6. To determine the efficiency of single-phase transformer by load test.
7. To determine the external characteristics of DC Shunt generator.
8. To measure current and speed for speed control of D.C. Shunt Motor.
9. To measure the power in a 3-phase system by two-wattmeter method
10. To measure the power factor in an RLC by varying the capacitance.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester II/I
BASICS ELECTRONICS ENGINEERING (LAB)

Course Code: EEC251/EEC151	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To study the V-I characteristics of p-n junction diode.
2. To study the diode as clipper and clamper.
3. To study the half-wave & full-wave rectifier using silicon diode.
4. To study transistor in Common Base configuration & plot its input/output characteristics.
5. To study transistor in Common Emitter configuration & plot its input/output characteristics. .
6. To study the operational amplifier in inverting & non inverting modes using IC 741.
7. To study the operational amplifier as differentiator & integrator.
8. To study the Zener diode as a shunt regulator.
9. To study various logic gates & verify their truth tables.
10. To study half adder/full adder & verify their truth tables.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester III/IV
MATHEMATICS-III

Course Code: EAS301/EAS 401	L	T	P	C
	3	1	0	4

Unit I **(Lectures 08)**

Integral Transforms: Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.

Z – Transform and its application to solve differential equations.

Unit II **(Lectures 08)**

Functions of a Complex Variable: Analytic functions; C-R equations and harmonic functions; Line integral in the complex plane; Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions; Liouvilles theorem.

Unit III **(Lectures 08)**

Functions of a Complex Variable II: Representation of a function by power series; Taylor's and Laurent's series; Singularities, zeroes and poles; Residue theorem, evaluation of real integrals; conformal mapping and bilinear transformations.

Unit IV **(Lectures 08)**

Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve Fitting and Solution of Equations: Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations, Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

Unit V **(Lectures 08)**

Numerical Technique: Bisection method, Regula – Falsi method, Newton - Raphson method.

Interpolation: Finite difference, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals; Numerical Differentiation, Numerical Integration; Trapezoidal, Simpson's 1/3 and 3/8 rule.

Text Books

1. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers.
2. Prasad C., *Engineering Mathematics for Engineers*, Prasad Mudralaya.
3. Das H.K., *Engineering Mathematics Vol-II*, S. Chand.

Reference Books

1. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern.
2. Piskunov N, *Differential & Integral Calculus*, Moscow Peace Publishers.
3. Narayan Shanti, *A Text book of Matrices*, S. Chand.
4. Bali N.P., *Engineering Mathematics-III,* Laxmi Publications.

Semester III/IV
PHYSICS II

Course Code: EAS302/EAS 402	L	T	P	C
	3	1	0	4

Objective: To understand modern physics like nanotechnology, cryogenics etc.

Course Contents

Unit I **(Lectures 08)**

Relativistic Mechanics: Inertial and Non- inertial Frames; Michelson-Morley Experiment; Postulates of Special Theory of Relativity; Galilean and Lorentz Transformation; Length Contraction and Time Dilation; Addition of Velocities; Mass Energy Equivalence and Variation of Mass with Velocity.

Unit II **(Lectures 08)**

Modern Physics: Bragg's Law; Compton Effect; Wave Particle Duality; De Broglie matter wave; Davisson and Germer's Experiment; Phase and Group velocities; Uncertainty Principle and application.

Unit III **(Lectures 08)**

Quantum Mechanics II : Physical Interpretation of Wave Function and its Normalization; Expectation Value; Schrodinger Equation in One Dimension; Solutions of Time-Independent Schrodinger Equation for Free Particle; Particle in an Infinite Square Well; Potential Barrier and Tunneling; Hydrogen atom (qualitative

Unit IV **(Lectures 08)**

Superconductivity: Temperature dependence of resistivity; Meissner effect; Penetration depth; Type I and Type II superconductors; Temperature dependence of critical filed; BCS theory of superconductors; applications of superconductors.

Introduction to Nanomaterial: Basic principles of Nano science and technology; creation and use of buckyballs; properties and use of carbon nanotubes; applications of nanomaterial.

Unit V **(Lectures 08)**

Vacuum Physics: Mean free path; rotary and diffusion pumps; Pirani and Penning Gauges.

Nuclear Physics: Nuclear Forces; Binding Energy; Liquid Drop Model; Fission; Nuclear Reactors; Fusion and Energy Processes in Stars, Controlled Thermonuclear Reactions.

Text Books:

1. Robert Resmick, *Introduction to Special Theory of Relativity*, Wiley India Pvt. Ltd.
2. A. Beiser, *Perspectives of Modern Physics*, McGraw Hill.
3. R. Booker and E. Boysen, *Nanotechnology*, Wiley India Pvt. Ltd.
4. G. G. Haselden, *Cryogenic Fundamentals*, Academic Press.

Semester III
STRENGTH OF MATERIALS

Course Code: EME301

L	T	P	C
3	1	0	4

Objective: The objective is to know about various stresses, structures, designs of springs and deflection of beams under load.

Course Contents

Unit I **(Lectures 08)**

Review: Review of simple and compound Stress, Mohr's Circle; Theory of failure; Castigliano's Theorem; Impact load; Three-dimensional state of stress & strain, Equilibrium equations; Generalized Hook's Law; Airy's stress function and its applications

Unit II **(Lectures 08)**

Stresses in Beams: Review of pure bending; Direct and shear stresses in beams due to transverse and axial loads; Composite beams

Deflection of Beams: Equation of elastic curve; Deflection of cantilever and simply supported Beams; Macaulay's method; Area moment method; Fixed and continuous beams.

Torsion: Review of Torsion; Combined bending & torsion of solid & hollow shafts

Unit III **(Lectures 08)**

Helical and Leaf Springs: Deflection of springs by energy method; Helical springs under axial load and axial twist, Axial load and twisting moment acting simultaneously on both open and closed coiled springs, laminated springs;

Columns and Struts: Combined bending and direct stress; Middle third and middle quarter rules; Struts with different end conditions; Euler's theory, Rankine Gordon Formula.

Unit IV **(Lectures 08)**

Thin cylinders & Spheres: Hoop and axial stresses and strains, Volumetric strain.

Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal and external pressures; Compound cylinders, Stress due to interference fits.

Unit V **(Lectures 08)**

Curved Beams: Bending of beams with large initial curvature, Position of neutral axis for beams of rectangular, trapezoidal and circular cross sections; Stress in crane hooks; Stress in circular rings subjected to tension and compression.

Unsymmetrical Bending: Properties of beam cross-section, Slope of neutral axis; Stress and deflection in unsymmetrical bending; Determination of shear centre and flexural axis for I-section and channel-section.

Text books

1. Ryder, *Strength of Materials*, MacMillan

2. Timoshenko and Timoshenko & Yóung, *Strength of Materials,* Krieger Publishing Company.

Reference Books

1. Bear Jhonson*, Mechanics of Materials,* Tata McGraw-Hill.

2. Rajput R.K*, Strength of Materials*, S Chand & Company Ltd.

3. Ramamrutham & Narain *"Strength of Materials,* Dhanpat Rai Publishing Co P Ltd.

4. Kazami, *Advanced Mechanics of Solids*, TMH

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Semester III
ENGINEERING THERMODYNAMICS

Course Code: EME302

L	T	P	C
3	0	0	3

Objective: To understand basic thermodynamics and its applications to industrial equipment's.

Course Contents

Unit I **(Lectures 8)**

Basic Concepts of Thermodynamics: Definitions, system, control volume, surrounding, boundaries, universe; Types of systems; Macroscopic and microscopic viewpoints; Thermodynamic equilibrium; State, property, process; Cycle - Reversibility - Quasi - static process; Irreversible process; Causes of irreversibility; Energy in state and in transition; Types of work and heat; Point and path function**.**

Unit II **(Lectures 8)**

Laws of Thermodynamics: First law of thermodynamics; Corollaries: First law applied to a Process, applied to a flow system; Steady flow energy equation; Limitations of the first law; Thermal reservoir; Heat engine; Heat pump; Parameters of performance; Second law of thermodynamics: Kelvin-Plank and Clausius statements and their corollaries; PMM; Carnot's principle; Carnot cycle and its specialties; Thermodynamic scale of temperature; Clausius Inequality; Entropy; Principle of entropy increase; Energy equation; Availability and irreversibility; Thermodynamic potentials, Gibbs and Helmholtz Functions; Maxwell relations**.**

Unit III **(Lectures 8)**

Properties of Steam and Boiler: Pure substances; P-V-T- surfaces; T-S and h-s diagrams; Phase transformations: Triple point at critical state properties during change of phase; Dryness Fraction; Clausius - Clapeyron Equation; Properties of steam; Use of steam table & mollier charts; Steam generators: Classifications, working of fire tube & water tube boiler, boiler mounting & accessories, drought & its calculation, air pre-heater, feed water heater, super heater, boiler efficiency, equivalent evaporation, boiler trail & heat balance.

Unit IV **(Lectures 8)**

Vapor Power Cycle & Steam Nozzles: Rankine & modified Rankine cycles; Working of steam engine; Indicator diagram; Effect of pressure & temperature on Rankine cycle; Reheat cycle; Regenerative cycle; Feed water heater; Classification of turbines; Comparison with steam engine; Velocity diagram of simple & compound turbines & related calculations: Multistage of turbines; Work done; Efficiencies of reaction & impulse turbines. Flow through nozzles variation of velocity, area & specific volume; Nozzles efficiency; Throat area & supersaturated flow.

Unit V **(Lectures 8)**

Gas Power Cycle & Jet Propulsion: Gas turbine classifications, Brayton cycle; Principles of gas turbine; Gas turbine cycles with inter-cooling, reheat & regeneration, stage efficiency, polytrophic efficiency; Deviation of actual cycles from ideal cycles; introduction to the principal of jet propulsion: Turbojet & turboprop engines & their processes; Introduction to rocket engine

Text books

1. Singh onkar, *Applied Thermodynamics,* New Age International (p) Publishers Ltd.
2. Ballaney P.L., *Thermal Engineering* , Khanna Publisher
3. Kearton W.J., *Theory of Stream Turbine,* I. Pitman.

References books

1. Rajput R.K. *Thermal Engineering*, Laxmi Publication
2. Yahya SM. *Turbine Compressor & Fans*, TMH
3. Ganeshan, *Gas Turbine*, TMH
4. Yadav R. *Heat Engines*, CPH Allahabad
5. Nag PK. *Engineering Thermodynamics,* TMH

Semester III
MACHINE DRAWING

Course Code: EME303

L	T	P	C
3	0	0	3

Objective: To study various Machine drawing components.

Course Contents

Unit I **(Lectures 8)**

Machine Drawing Conventions: Need for drawing conventions; Introduction to ISI conventions.

1. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
2. Types of sections; Selection of section planes; Drawing of sections and auxiliary sectional views; Parts not usually sectioned.
3. Methods of dimensioning; General rules for sizes and placement of dimensions for holes, centres, curved and tapered features.
4. Title boxes, their size, location and details; Common abbreviations and their liberal usage.
5. Types of Drawings; Working drawings for machine parts.
6. Limits, Tolerances and fits.

Unit II **(Lectures 8)**

Drawing of Machine Elements-I: Simple parts; Selection of Views; Additional views for the following machine elements and parts with every drawing proportion

1. Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys; cotter joints and knuckle joint.
3. Riveted joints for plates.

Unit III **(Lectures 8)**

Drawing of Machine Elements - II: Simple Parts; Selection of Views; Additional views for the following machine elements and parts with every drawing proportion

1. Shaft coupling-Spigot and socket pipe joint.
2. Journal, pivot and collar and foot step bearings.

Unit IV **(Lectures 8)**

Part Drawings: Drawings of the part for the following using conventions and easy drawing proportions; Engine parts – stuffing boxes; Cross heads; Eccentrics; Petrol Engine connecting rod; Piston assembly.

Unit V **(Lectures 8)**

Assembly Drawings

1. Machine parts – Screws jacks; Machine Vices; Plummer block; Tailstock; stuffing boxes; Cross heads; Eccentrics; Petrol Engine connecting rod; Piston assembly.
2. Valves: Steam stop valve, feed check valve and air cock.

Text Books

1. Dhawan, *Machine Drawing*, S. Chand Publications.
2. Narayana K.L., Kannaiah P Venkata Reddy K., *Machine Drawing*, New Age, Publishers.

Reference Books

1. Gill P.S., *Machine Drawing,* S.K. Kataria & Sons.
2. Luzzader, *Machine Drawing,* Prentice-Hall of India Pvt.

Semester III
MATERIAL SCIENCE

Course Code: EME304

L	T	P	C
3	0	0	3

Objective: To study the physical and mechanical properties of materials and their testing & applications.

Course Contents

Unit I **(Lectures 8)**

Introduction: Importance of materials; Review of atomic concepts in Physics and Chemistry; Atomic models; Periodic table; Chemical bonds.

Crystallography and Imperfections: Concept of unit cell, space lattice, Bravais lattices, common crystal structures; Atomic packing factor and density; Miller indices; X-ray crystallography techniques; Imperfections, Defects & Dislocations in solids.

Unit II **(Lectures 8)**

Mechanical properties and Testing: Stress-strain diagram; Ductile & brittle materials; Stress vs. strength; Toughness, Hardness, Fracture, Fatigue and Creep; Testing: Strength testing, Hardness testing, Impact testing, Fatigue testing, Creep testing, Non-destructive testing (NDT).

Micro-structural Examination: Microscope principle and methods; Preparation of samples and Microstructure examination and grain size determination; Comparative study of microstructure of various metals & alloys such as Mild Steel, GI, Brass.

Phase Diagram and Equilibrium Diagram: Unary and Binary diagrams, Phase rules; Types of equilibrium diagrams: Solid solution type, Eutectic type and combination type; Iron-carbon equilibrium diagram.

Unit III **(Lectures 8)**

Ferrous Materials: Iron and steel manufacture, furnaces; Carbon steels, alloy steels and cast irons, and their properties and uses.

Heat Treatment: Heat treatment such as Annealing, Normalizing, Quenching, Tempering and Case hardening; Time Temperature Transformation (TTT) diagrams.

Non-Ferrous Metals and Alloys: Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications; Various type brass, bronze, bearing materials, its properties and uses; Aluminium alloys such a Duralumin.

Unit IV **(Lectures 8)**

Magnetic Properties: Concept of magnetism; Dia-, para-, ferro- magnetism; Hysteresis; Soft and hard magnetic materials; Magnetic storages.

Electric Properties: Energy band concept of conductor, insulator and semi-conductor; Intrinsic & extrinsic semi-conductors; P-n junction and transistors; Basic devices and their applications; Super-conductivity and its applications; Meissner effect; Type I & II superconductors.

Unit V **(Lectures 8)**

Ceramics: Structure, Properties, Applications; Mechanical /Electrical behaviour and processing of Ceramics.

Plastics: Types of polymers/plastics and their applications; Mechanical behaviours and processing of plastics; Future of plastics.

Other Materials: Description of material such as optical and thermal materials, Concrete, Composite materials and their uses.

Performance of materials in service: Theoretical consideration of Fracture, Fatigue and Corrosion and their control.

Text Books

1. Callister W.D., *Material Science & Engineering Addition*, Wesly Publishing Co.
2. Van Vlash, *Elements of Material Science & Engineering*, John Wiley & Sons.
3. Dr.K.M.Gupta, *Material Science in Engineering*, UmeshPublications.

Reference Books

1. Raghvan, *Material Science*, Prentice Hall of India
2. Narula, *Material Science*, TMH
3. Srivastava, Srinivasan, *Science of Materials Engineering*, New age.

Semester III
INDUSTRIAL ENGINEERING

Course Code: EME305

L	T	P	C
3	0	0	3

Objective: To know about productivity, work study, production planning and control techniques in industry.

Course Contents

Unit I **(Lectures 8)**

Productivity: Introduction, Definition, Measurement, Productivity index, Productivity improvement; Types of Production Systems.

Work study: Meaning and benefits of work study, Time & motion study; Micro-motion study Pre determine motion time study Man machine Diagram flow chart; Motion economy; Method study; Work measurement; Work sampling; Standard time.

Unit II **(Lectures 8)**

Plant layout and material handling: Plant location; Type of layout; Principles of facility layout; Principles of material handling; Material Handling equipments.

Production planning and control: Objectives; Forecasting; Product design and development functions; steps in PPC; Planning routine, scheduling, Dispatching & follow-up; Effectiveness of PPC; Introduction of JIT.

Unit III **(Lectures 8)**

Managerial Economics : Introduction; Assumptions; Time Value of money; Step-in Break Even Analysis; Purpose; Costs: Overheads, Fixed & variable costs; Margin of safety; Angle of incidence; Profit volume graph.

Depreciation Analysis: Causes; Obsolescence; Methods.

Maintenance Management: Maintenance, Planning & Control; Maintenance Strategy.

Unit IV **(Lectures 8)**

Inventory Control: Inventory; Function; Cost; Deterministic models; Introduction to MRP; Supply-chain Management

Quality Control: Introduction; Process control; SQC control Charts; Single, double & sequential sampling; Introduction to TQM & bench marking.

Unit V **(Lectures 8)**

Industrial Ownership: Proprietorship; Partnership; Joint stock & co-operative stores.

Manpower Planning: Process.

Organization: Principles of organization; Development of Organizational charts like line, staff, line and staff & Functional types.

Job Evaluation & Merit rating: Job analysis; Job description; Job simplification and job evaluation methods & description; Merit rating; Wage incentive plans.

Text Books

1. Koontz H. Donnel C.O., *Principles of Management*: *An Analysis of Management Functions*, Tata McGraw Hill.
2. Moore J., *Manufacturing Management*", Prentice Hall.
3. Mahajan, *Industrial Engineering,* Dhanpat Rai & Sons.

Reference Books

1. Khanna O.P., *Industrial Engineering & Management*, Dhanpat Rai & Sons .
2. Shanker. Ravi, *Industrial Engineering,* Galgotia Publications.
3. Buffa E.S., *Modern Production Operations Management*, Wiley Eastern

Semester III
MACHINE DRAWING (LAB)

Course Code: EME351	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Course Contents

Part and Assembly drawing

1.To draw the Conventional representation of materials, common machine elements and parts
2. To draw the Surface roughness symbols; Machining symbols, indication of surface roughness
3.To draw the Shaft coupling-Spigot and Socket pipe joint.
4. To draw the popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws
5. To draw the Keys; cotter joints and knuckle joint
6. To draw the riveted joints for plates
7.To prepare the different types of limits, fits and tolerances
8. To prepare the part drawing of Cross heads& Eccentrics.
9. To prepare the part drawing of Screws jacks &Tailstock
10. To prepare the assembly drawing of Petrol Engine connecting rod & Piston
11. To prepare the assembly drawing of Plummer block & stuffing boxes

Reference Books

1. Narayana KL., *Machine Drawing*, New Age
2. Narayana KL., *Production drawing* , New Age
3. NageswaraRao P. *Auto CAD 14 for Engineering Drawing*, Tata Mac Graw Hill.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester III
MATERIAL SCIENCE (LAB)

Course Code: EME352	L	T	P	C
	0	0	3	1.5

I. Material Science Lab Experiments: (To conduct at least 5 of the following)

1. To make a plastic mould for small metallic specimen.
2. To prepare a Specimen for micro structural examination-cutting, grinding, polishing, etching.
3. To determine grain Size of a given specimen.
4. To compare microstructures of different specimens (mild steel, gray C.I., brass, copper)
5. To identify the material from 50 common items kept in a box.
6. To study of microstructure of welded component using microscope

II. Material Testing Lab Experiments: (To conduct at least 5 of the following)

1.To determine Strength of a given mild steel specimen on UTM and plot a stress-strain graph
2. To determine bending Strength and shear strength of a given mild steel specimen on UTM
3.To determine impact strength using Charpy impact testing machine.
4. To perform hardness test on given mild steel and compare Brinell hardness and Rockwell hardness.
5.To determine Spring index on spring testing machine.
6.To determine fatigue strength fatigue testing machine.
7.To determine deflection of beam and comparison of actual measurement of deflection with dial gauge
8.To the calculated one, and evaluation of young's modulus of beam.
9. To determine torsion strength of a rod on torsion testing machine.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester III
THERMODYNAMICS (LAB)

Course Code: EME353	L	T	P	C
	0	0	3	1.5

LIST OF EXPERIMENTS

Experiments: Minimum 10 experiments in depth and details out of following according to theory covered in applied thermodynamics theory subject (ME-302)

1. To study of Fire Tube boiler
2. To study of water Tube boiler
3. To study & working of Refrigerator
4. To study of velocity compounded steam turbine
5. To study of pressure compounded steam turbine
6. To study of impulse & Reaction turbine
7. To study of steam Engine model.
8. To study and working of two stroke petrol Engine
9. To study and working of Four stroke petrol Engine
10. To determine the Indicated H.P. of I.C. Engine by Morse Test
11. To study of Gas Turbine Model
12. To study & working of Air conditioner
13. To prepare the energy balance for Diesel/Petrol Engine
14. To study & working of two stroke Diesel Engine
15. To study & working of four stroke Diesel Engine.
16. To study of Ignition system of I.C. Engine.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester IV/III
MATHEMATICS-III

Course Code: EAS401/EAS 301	L	T	P	C
	3	1	0	4

Unit I **(Lectures 08)**

Integral Transforms: Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.
Z – Transform and its application to solve differential equations.

Unit II **(Lectures 08)**

Functions of a Complex Variable: Analytic functions; C-R equations and harmonic functions; Line integral in the complex plane; Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions; Liouvilles theorem.

Unit III **(Lectures 08)**

Functions of a Complex Variable II: Representation of a function by power series; Taylor's and Laurent's series; Singularities, zeroes and poles; Residue theorem, evaluation of real integrals; conformal mapping and bilinear transformations.

Unit IV **(Lectures 08)**

Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve Fitting and Solution of Equations: Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations, Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

Unit V **(Lectures 08)**

Numerical Technique: Bisection method, Regula – Falsi method, Newton - Raphson method.
Interpolation: Finite difference, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals; Numerical Differentiation, Numerical Integration; Trapezoidal, Simpson's 1/3 and 3/8 rule.

Text Books

1. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers.
2. Prasad C., *Engineering Mathematics for Engineers*, Prasad Mudralaya.
3. Das H.K., *Engineering Mathematics Vol-II*, S. Chand.

Reference Books

1. Kreyszig E., *Advanced Engineering Mathematics*, Wiley Eastern.
2. Piskunov N, *Differential & Integral Calculus*, Moscow Peace Publishers.
3. Narayan Shanti, *A Text book of Matrices*, S. Chand.
4. Bali N.P., *Engineering Mathematics-III,* Laxmi Publications.

Semester IV/III
PHYSICS II

Course Code: EAS402/EAS302	L	T	P	C
	3	1	0	4

Objective: To understand modern physics like nanotechnology, cryogenics etc.

Course Contents

Unit I **(Lectures 08)**

Relativistic Mechanics: Inertial and Non- inertial Frames; Michelson-Morley Experiment; Postulates of Special Theory of Relativity; Galilean and Lorentz Transformation; Length Contraction and Time Dilation; Addition of Velocities; Mass Energy Equivalence and Variation of Mass with Velocity.

Unit II **(Lectures 08)**

Modern Physics: Bragg's Law; Compton Effect; Wave Particle Duality; De Broglie matter wave; Davisson and Germer's Experiment; Phase and Group velocities; Uncertainty Principle and application.

Unit III **(Lectures 08)**

Quantum Mechanics II : Physical Interpretation of Wave Function and its Normalization; Expectation Value; Schrodinger Equation in One Dimension; Solutions of Time-Independent Schrodinger Equation for Free Particle; Particle in an Infinite Square Well; Potential Barrier and Tunneling; Hydrogen atom (qualitative

Unit IV **(Lectures 08)**

Superconductivity: Temperature dependence of resistivity; Meissner effect; Penetration depth; Type I and Type II superconductors; Temperature dependence of critical filed; BCS theory of superconductors; applications of superconductors.

Introduction to Nanomaterial: Basic principles of Nano science and technology; creation and use of buckyballs; properties and use of carbon nanotubes; applications of nanomaterial.

Unit V **(Lectures 08)**

Vacuum Physics: Mean free path; rotary and diffusion pumps; Pirani and Penning Gauges.

Nuclear Physics: Nuclear Forces; Binding Energy; Liquid Drop Model; Fission; Nuclear Reactors; Fusion and Energy Processes in Stars, Controlled Thermonuclear Reactions.

Text Books:

1. Robert Resmick, *Introduction to Special Theory of Relativity*, Wiley India Pvt. Ltd.
2. A. Beiser, *Perspectives of Modern Physics*, McGraw Hill.
3. R. Booker and E. Boysen, *Nanotechnology*, Wiley India Pvt. Ltd.
4. G. G. Haselden, *Cryogenic Fundamentals*, Academic Press.

Semester IV
PRODUCTION TECHNOLOGY –I

Course Code: EME401

L	T	P	C
3	0	0	3

Objective: To study various manufacturing processes like forming, sheet metal working, casting etc.

Course Contents

Unit I **(Lectures 8)**

Introduction: Importance of manufacturing; Economic & technological considerations in manufacturing; Survey of manufacturing processes; Materials & manufacturing processes for common items.

Metal Forming Processes: Elastic & plastic deformation, yield criteria; Hot working and cold working; Load required to accomplish metal forming operation; Analysis (equilibrium equation method) of forging process with sliding friction, sticking friction and mixed condition for slab and disc; Work required for forging; Hand, Power, Drop Forging.

Unit II **(Lectures 8)**

Metal Forming Processes (continued): Analysis of Wire/strip drawing and maximum reduction; Tube drawing; Extrusion and its application; Conditions for Rolling force and power in rolling; Rolling mills; Design, lubrication and defects in metal forming processes.

Unit III **(Lectures 8)**

Sheet Metal working: Presses and their classification; Die & punch assembly and press work methods and processes; Cutting/Punching mechanism; Blanking and Piercing; Compound Combination and Progressive die; Flat-face and Inclined-face punch and Load (capacity) needed; Analysis of forming process like cup/deep drawing and bending.

Unit IV **(Lectures 8)**

Jigs & Fixtures: Principle of locating & clamping devices; Jigs and Fixtures and their applications.

Manufacturing of Plastic components: Review of plastics and its uses and applications. Injection moulding and blow moulding; Extrusion of plastic section; Welding of plastics; Resins & adhesives.

Unit V **(Lectures 8)**

Casting : Basic principle & survey of casting processes; Types of patterns and allowances; Types and properties of moulding sand; Elements of mould and design considerations, gating, riser, runner, core; Solidification of casting; Sand-casting; Defects of casting and its remedies; Cupola and crucible furnace; Die Casting, Centrifugal casting, Investment casting etc.

Text Books

1. Ghosh and Mallik, *Manufacturing Science,* East West Pvt ltd
2. Pandey P.C., *Production Engg. Science,* Standard Publishers Ltd.
3. Jain R.K., *Production Technology*, Khanna

Reference Books

1. Rao P N., *Manufacturing Technology*, Tata. McGraw Hill
2. Paul Degarmo, *Materials and Manufacturing*, Macmillan Pub. Co

Semester IV
MEASUREMENT, METROLOGY & CONTROL

Course Code: EME402	L	T	P	C
	3	0	0	3

Objective: To study the process parameters measurement, metrology and controls.

Course Contents

Unit I **(Lectures 08)**

Mechanical Measurements

Introduction: Introduction to measurement and measuring instruments; Generalised measuring system and functional elements; Units of measurement; Static and dynamic performance characteristics of measurement devices; Calibration, concept of error, sources of error, statistical analysis of errors;

Sensors and Transducers: Types of sensors; Types of transducers and their characteristics; Signal transmission and processing devices and systems; Signal display & recording devices.

Unit II **(Lectures 08)**

Time related measurements: Counters; Stroboscopes; Frequency measurement; Measurement of displacement; Measurement of pressure; Direct and indirect type pressure transducers; Dead weight pressure gauge; Elastic; Measurement of very low pressures.

Strain measurement: Types of strain gauges and their working; Strain gauge circuits; Temperature compensation; Strain rosettes.

Measurements of force and torque: Different types of load cells; Elastic transducers, pneumatic & hydraulic systems.

Temperature measurement: Thermometers (liquid), Pt-Resistance thermometer, Thermocouples, Thermistors, pyrometers and bimetallic devices.

Vibration: Seismic instruments; vibration pick-ups and decibel meters; Vibrometers, Accelerometers.

Unit III **(Lectures 08)**

Metrology and Inspection: Standards of linear measurement-line and end standards; Limit, fits and tolerances; Interchange-ability and standardisation; Linear and angular measurements devices and systems.

Comparators: Sigma, Johansson's Microkator; Limit gauges classification; Taylor's Principle of Gauge design.

Unit IV **(Lectures 08)**

Measurement of geometric forms: Straightness, Flatness, Roundness; Tool makers microscope, profile-projector, autocollimator.

Interferometry: Principle and use of interferometry; optical flat; Measurement of screw threads and gears.

Surface texture: Quantitative evaluation of surface roughness and its measurement (Tally surf).

Unit V **(Lectures 08)**

Controls:

Introduction: Concept of Automatic Controls; Open loop & closed loop systems; Servo-mechanisms; Block diagrams; Transfer functions; Applications of Laplace Transform in control systems with simple examples; Representation of control components & Systems; Series & parallel combinations; Cascade system, analogous system.

Controllers: Introduction to Pneumatic, hydraulic and electronic controllers.

Text Books

1. Beckwith Thomas G , Mechanical Measurements, Narosa Publishing House, N. Delhi.
2. Doeblein E.O., Measurement Systems, Application Design, McGraw Hill, 1990.
3. Kumar D.S., Mechanical Measurements and Control, Metropolitan, N. Delhi.

Reference Books

1. Gupta, I.C., Engineering Metrology, Dhanpat Rai & Sons, New Delhi, 1994
2. Sirohi, R. S. and Radhakrishna H.C., Mechanical Measurements, New Age Publishers
3. Jain, R.K., Engineering Metrology, Khanna Publishers
4. Jain, R.K., Mechanical Measurement, Khanna Publishers
5. Raven, Automatic Control Theory, McGraw Hill Publishers.
6. Nagrath and Gopal, Control System Engineering, New Age Publishers.

Semester IV
OPERATION RESEARCH

Course Code: EHM 403

L	T	P	C
3	1	0	4

Objective: To learn the linear programming techniques, decision theory, transportation problems, inventory modules etc.

Unit I **(Lectures 08)**

Operations Research: History, Characteristics, Models and modelling, Methodology, Applications.
Linear programming:-Applications and Model Formation; Graphical method; Simplex method; Duality in Linear Programming.

Unit II **(Lectures 08)**

Transportation Problem: Mathematical model of Transportation problem; Transportation Algorithm; Methods for finding initial solution: North-West corner method, Least cost method, Vogel's approximation method; Test for optimality; Steps of MODI method; Variations in transportation problems: Unbalanced supply and demand, Degeneracy and its resolution; Alternative optimal solution; Maximization of transportation problem.
Assignment problems: Mathematical model of assignment problems; Hungarian method; Variations of the assignment problems: Multiple optimal solutions, maximization case; Unbalanced assignment problems.

Unit III **(Lectures 08)**

Sequencing Problem: Processing of n jobs through two-machines, three-machines, m-machines; Processing two jobs through m machines.
Decision theory: Steps of Decision making process; Types of Decision making environments; Decision making under uncertainty; Decision Making under risk; Optimization criterion; Pessimism criterion; Laplace criterion; Hurwicz criterion; Regret criterion; Expected monetary value (EMV); Expected opportunity loss (EOL); Expected value of Perfect information (EVPI); Decision Tree analysis

Unit IV **(Lectures 08)**

Inventory Models:- Inventory cost components; EOQ; Deterministic inventory cost models: Inventory model with constant demand & Instantaneous supply, EOQ model with different rates of demand, EOQ model with gradual replenishment, Multi-item inventory control models with constraint, EOQ models with warehouse space constraint; Investment constraint; Average inventory level constraint; Number of orders constraints; Selective inventory control techniques : ABC analysis, VED analysis, FSN analysis.

Unit V **(Lectures 08)**

Project Management: PERT & CPM; Network construction; Critical path analysis; Program evaluation and review technique (PERT); Project Time Cost Trade-Off; Project-crashing.

Text book:

1. Wangner M H. ,*Operations Research* , Prentice Hall (January 16, 1970)
2. Sharma S.D., *Operations Research*, Kedar Nath Ram Nath & Co.
3. Sharma J.K., *Operations Research,* SK Kataria & sons
4. Kapoor V.K., *Operations Research*, Sultan Chand & Sons.

Reference book:

1. Rao S. S *Optimization Technique*, TMH.
2. Taha ,*Operations Research*, PHI

Semester IV
NUMERICAL TECHNIQUE

Course Code: EME404	L	T	P	C
	3	0	0	3

Objective: To understand the numerical techniques and solve the mathematical problems using various numerical methods.

Course content

Unit I **(Lectures 08)**

Linear Algebraic Equations: Gauss-Elimination Method, Gauss-Seidel Method, Lower Upper Decomposition Method.

Roots of equations: Bisection Method, False position method, Newton-Raphson Method, Muller's method, Bairstow's Method.

Unit II **(Lectures 08)**

Curve fitting: Least square regression: i) Linear regression: Multiple linear regressions, Polynomial regression; ii) Nonlinear regression: Gauss-Newton method, Multiple nonlinear regression.

Unit III **(Lectures 08)**

Interpolation: Newton's divided difference formula; Lagrange's Inverse, Spline; Hermite Interpolation; Extrapolation technique of Richardson's

Unit IV **(Lectures 08)**

Eigen Values & Eigen Vectors of Matrices: Faddeev-Laeverrier's method; Power Method; Householder & Given's method.

Ordinary Differential Equations: Euler's method; Heun's method; Mid-point method; Runge-Kutta methods; Multi-step methods: Explicit Adams-Bashforth technique & Implicit Adams-Moulton technique; Adaptive RK method; Embedded RK method; Step size control; Higher order Ordinary Differential Equation; Shooting method; Nonlinear Ordinary Differential Equation; Collocation technique.

Unit V **(Lectures 08)**

Partial Differential Equations: Solution of Parabolic and Hyperbolic equations: Implicit & Explicit Schemes; Alternative Direction Implicit methods; Non-linear parabolic equations: Iteration method; Solution of elliptic equation: Jacobi method; Gauss-Seidel & Successive Over-relaxation method; Richardson's method.

Text Books

1. Jain M K. , Iyengar S.R.K. & Jain R K, *Numerical Methods for Scientific and Engineering Computation*, New Age International Publishers.
2. Garewal B.S., *Numerical Methods in Engineering and Science*, Khanna Publication.

Reference Books

1. Steven C Chapra & Raymond P Canale, *Numerical Methods for Engineers*, Tata McGraw Hill.
2. Constantinides Alkis, *Applied Numerical Methods*, McGraw Hill.
3. Jain M.K., *Numerical Solution of Differential Equations*, Wiley Eastern.
4. Veerarajan T, Ramachandran T, Ramachandran T R, Numerical Methods, McGraw Hill

Semester IV
FLUID MECHANICS

Course Code: EME 405	L	T	P	C
	3	0	0	3

Objective: To make the students aware about the basics of fluid mechanics.

Course content

Unit I **(Lectures 08)**

Introduction: Fluid and continuum; Physical properties of fluids: Viscosity, Compressibility, Surface Tension, Capillarity, Vapour pressure; Cavitations; Classification of fluids including rheological classification.

Fluid Statics: Pascal's Law; Pressure-density-height relationship; Pressure on plane and curved surfaces; The Hydrostatic law; Total Pressure and centre of pressure; Buoyancy; Measurement of pressure by manometers and mechanical gauges; Stability of immersed and floating bodies.

Unit II **(Lectures 08)**

Laminar Flow: Types of fluid flows: Steady and unsteady, Uniform and non-uniform, Laminar and Turbulent flows, 1-D,2-D,and 3-D flows; Steam lines, Path lines and steak lines; Steam tube; Equation of motion for laminar flow through pipes; Stokes law; Turbulent Flow; Equation for turbulent flow; Eddy viscosity; Mixing concept and velocity distribution in turbulent flow; Acceleration of a fluid particle along a straight and curved path; Differential and Integral form of continuity equation; Rotation, Vortices and circulation; Elementary explanation of Stream function and velocity potential; Flow net characteristics.

Unit III **(Lectures 08**

Fluid Dynamics-I: Introduction to Navier-Stokes equations; Euler's equation of motion along a streamline and its integration; Bernoulli's equation and its applications; Pitot tube; Flow through: Orifices, Mouthpieces, Nozzles, Notches, Wires; Free and forced vortex motion.

Unit IV **(Lectures 08)**

Fluid Dynamics-II: Pipe bends problems related to combined application of energy and momentum equations; Determination of coefficients of discharge; Velocity and contraction and energy loss; Equation for velocity distribution over smooth and rough surfaces; Concept of equivalent length; Branched pipes; Pipes in series and parallel; Flow in sudden expansion, contraction; Water hammer.

Unit V **(Lectures 08)**

Boundary Layer Analysis: Boundary layer thickness; Boundary layer over a flat plate; Laminar layer; Application of Von-Karman integral momentum equation; Turbulent boundary layer; Laminar sub-layer; Hydro-dynamically smooth and rough boundaries; Local and average friction coefficient; Total drag; Boundary layer separation and its control.

Text Books:

1. Fox I R J., *Introduction to Fluid Mechanics*, Wiley and sons
2. Hunter Rouse John, *Elementary Mechanics of Fluids*, Wiley and sons.
3. L H Shames, *Mechanics of Fluids*, Mc Graw Hill, International student edition.

Reference Books:

1. Grade.R J and Mirajgaonkar A G, *Engineering Fluid Mechanics (Including Hydrualic Machines)* Nemchand and Bros, Roorkee, 1983
2. Kumar K L *Engineering Fluid Mechanics,* Eurasia Publishing House (P) Ltd
3. Munson Bruce R, Donald F Young and Okishi T H *Fundamentals of Fluid Mechanics* Wiley Eastern
4. Gupta V and Gupta S K, *Fluid Mechanics and its applications* Wiley Eastern Ltd
5. Som and Biswas, *Introduction to Fluid Mechanics and Machines* TMH
6. Bansal R K, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publications

Semester IV
PRODUCTION TECHNOLOGY-I (LAB)

Course Code: EME451	**L**	**T**	**P**	**C**
	0	**0**	**4**	**2**

LIST OF EXPERIMENTS

1. To design a pattern for a given casting (containing a hole)
2. To make a wood pattern according to a given design.
3. To make a mould (with core) for casting.
4. To determine grain fineness number of Sand.
5. To prepare a component of plastics as per the given drawing using injection moulding.
6. To prepare a component as per the given drawing by hand forging process.
7. To prepare a given component using forging on power hammer.
8. To perform tube bending with a tube-bending machine.
9. To study different types of dies used on a press and to prepare a washer of specified dimension on press.
10. To prepare a wire from a soft material using wire drawing by Extrusion operation.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester IV
MEASUREMENT, METROLOGY & CONTROL (LAB)

Course Code: EME452	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To determine length, width and height of given component using vernier callipers, micrometer, and compare the result
2 To measure the angle of a given job using bevel protector
3. To Measure angle of given component using sine bar & slip gauges.
4. To adjust spark plug gap using feeler gauges
5. To compare given component sizes with standard size using dial indicator
6. To check the roundness of a circular rod using dial indicator.
7. To measure pressure using pressure gauge
8. To measure temperature using RTD and compare with thermometer
9.To measure strain using strain gauge.
10.To measure the speed of the haft using stroboscope and compare with tachometer

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester IV
FLUID MECHANICS (LAB)

Course Code: EME453

L	T	P	C
0	0	3	1.5

Perform any ten experiments out of following

LIST OF EXPERIMENTS

1. To measure the surface tension of a liquid.
2. To determine the meta-centric height of a ship model experimentally.
3. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
4. To determine the coefficients of velocity, contraction and discharge of an orifice (or a mouth piece) of a given shape. Plot the flow net for a given model using the concept of electrical analogy.
5. To find the velocity distribution in a pipe and hence to compute the discharge by integrating the velocity profile obtained.
6. To verify the Bernoulli's theorem.
7. To calibrate an orifice meter and venturimeter and to study the variation of the coefficient of discharge with the Reynolds number.
8. To calibrate and to determine the coefficient of discharge for rectangular and triangular notches.
9. To verify Darcy's law and to find out the coefficient of permeability of the given medium.
10. To verify the momentum equation.
11. To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also determine the exponent in the power law of velocity distribution.
12. To study the variation of friction factor,(f) for turbulent flow in smooth and rough commercial pipes.
13. To determine the loss coefficients for the various pipe fittings.
14. To study the flow behaviour in a pipe bend and to calibrate the cap for discharge measurement.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva voce taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (30 MARKS)			ATTENDANCE (5 MARKS)	QUIZ (5 MARKS)	VIVA (10 MARKS)	TOTAL INTERNAL (50 MARKS)
EXPERIMENT (10 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)				

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

SEMESTER V
PRODUCTION TECHNOLOGY –II

Course Code: EME501	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Objective: The objective is to study about manufacturing tools and machinery like lathe, shaper, turner etc.

Course Contents

Unit I **(Lectures 08)**

Metal Cutting and Machine Tools: Metal Cutting: Mechanics of metal cutting; Geometry of tool and nomenclature as per ASA system; Orthogonal vs. oblique cutting; Mechanics of chip formation; Types of chips; Shear angle relationship; Merchant's force circle diagram; Cutting forces; Power required for Cutting; Cutting fluids/lubricants; Tool materials; Tool wear and tool life; Machinability; Brief introduction to machine tool vibration and surface finish.

Unit II **(Lectures 08)**

(i) **Lathe**: Principle, Types, Operations; Turret/capstan, Semi/Automatic; Tool layout.
(ii) **Shaper, Slotter, Planer**: Working principle; Operations; Drives.

Unit III **(Lectures 08)**

(i) **Milling**: Milling cutters; Up milling & down milling; Dividing head & indexing; Max chip thickness & power required.
(ii) **Drilling and Boring**: Drilling; Drill-bits; Geometry of twist drills; Boring, Reaming tools.

Unit IV **(Lectures 08)**

Grinding & Super finishing: Grinding: Abrasive; Cutting action; Grinding wheel specifications; Grinding wheel wear: Attritions wear, fracture wear; Dressing and Truing; Maximum chip thickness and Guest criteria; Surface grinding, Cylindrical grinding and Centerless grinding.
Super finishing: Honing, lapping, and polishing.

Unit V **(Lectures 08)**

Metal Joining (Welding): Survey of welding and allied processes; Gas welding and cutting; Process and equipment; Arc welding: Power sources and consumables; TIG & MIG processes and their parameters; Resistance welding: spot, seam projection etc; Other welding processes such as atomic hydrogen, submerged arc, electro slag, friction welding; Soldering & Brazing; Thermodynamic and Metallurgical aspects in welding and weld; Shrinkage/residual stress in welds; Distortions & Defects in welds and remedies; Weld decay in HAZ.

Text Books

1. Ghosh & Malik, *Manufacturing Science*, E.W. Press
2. Boothroyd, *Fundamentals of Metal Cutting and Machine Tools*, Scripta Book Company
3. Jain R.K., *Production Technology, Khanna* Publicatios.

Reference Books

1. H.M.T., *Production Technology*, Tata McGraw Hill.
2. Pandey P.C., *Production Engineering Science,* Standard Publishers.
4. Juneja & Shekhon, *Funamentals of Machining & Machine Tools*, New Age Publishers Pvt Ltd.
5. Lindeberg., *Process & Materials of Manufacturing,* Allyn and Bacon.

SEMESTER V
THEORY OF MACHINES

Course Code: EME503	L	T	P	C
	3	0	0	3

Objective: The objective is to study about kinetics, force systems, mechanisms.

Course Contents

Unit I **(Lectures 08)**

Introduction: Links-types; Kinematics pairs-classification; Constraints-types; Degrees of Freedom; Grubler's equation; Linkage mechanisms; Inversions of four bar linkage; Slider crank chain and double slider crank chain; Velocity in Mechanisms-Velocity of point in mechanism; Relative velocity method; Instantaneous point in mechanism; Kennedy's theorem; Instantaneous center method.

Unit II **(Lectures 08)**

Acceleration in Mechanisms: Acceleration diagram; Coriolis component of acceleration; Klein's construction for Slider Crank and Four Bar mechanism; Analytic method for slider crank mechanism; Mechanisms with Lower Pairs Pantograph; Exact straight line motion mechanisms: Peaucellier's, Hart and Scott Russell mechanisms; Approximate straight line motion mechanisms: Grass-Hopper, Watt and Tchebicheff mechanisms; Analysis of Hook's joint; Davis and Ackermann Steering gears.

Unit III **(Lectures 08)**

Kinematics Synthesis of Planar Linkages: Movability of four bar linkages; Grashof's law; Graphical methods of synthesis: Two and Three-position synthesis of four bar and slider crank mechanisms; Analytical method: Freudenstein's equation for function generation (three position).

Unit IV **(Lectures 08)**

CAMS: Cams and Followers: Classification & terminology; Cam profile by graphical methods for uniform velocity; Simple harmonic motion and parabolic motion of followers; Analytical cam design: tangent and circular cams.

Unit V **(Lectures 08)**

Gears: Classification & terminology; Law of gearing; Tooth forms; Interference; Under cutting; Minimum number of teeth on gear and pinion to avoid interference; Simple, compound and planetary gear trains. **(Lectures 08)**

Text Books

1. Bevan Thomas, *Theory of Machines*, Longmans, Green and Company
2. Shigley, *Theory of Machines and Mechanisms*, Tata mcgraw Hill
3. Ghosh & Mallik, *Theory of Machines and Mechanisms*, East-West Press Pvt Ltd

Reference Books

1. Rao & Dukkipati, *Theory of Machines and Mechanism*, New age International
2. Bansal R.K., *Theory of Machines*, Laxmi Publications P Ltd.
3. Singh V.P., *Theory of Machines*, Dhanpat Rai & Sons.
4. Malhotra & Gupta, *Theory of Machines*, Satya Prakashan.
5. Khurmi & Gupta, *Theory of Machines*, S Chand and Co Ltd
6. Ramamurti V., *Mechanics of Machines*, Alpha Science International, Ltd

SEMESTER V
DESIGN OF MACHINE ELEMENTS

Course Code: EME504

L	T	P	C
3	1	0	4

Objective: To study the design of machine elements like spring, various weld joints etc.

Course Contents

Unit I **(Lectures 08)**

Introduction: Definition; Methods; Standards in design & selection of preferred size; Selection of materials for static & fatigue loads and creep; BIS system of designation of steels; Steels; Plastics & rubbers.

Unit II **(Lectures 08)**

Design for Static and Dynamic loads: Modes of failure; Factor of safety; Stress-strain relationship; Principal stresses; Theories of failure; Design against fluctuating load; Stress concentration; Stress concentration factors; Fluctuating/alternating stresses, Fatigue failure; Endurance limit; Design for finite & infinite life; Soderberg & Goodman criteria.

Unit III **(Lectures 08)**

Joints: Welded joints, Screwed joints, Eccentric loading of welded and screwed joints; Design for fatigue loading; Shaft, keys & coupling; Design against static and fatigue loads; Strength & rigidity design; Selection of square & flat keys & splines; Rigid & flexible couplings.

Unit IV **(Lectures 08)**

Gears: Gear nomenclature; Tooth profiles; Systems of gear teeth; Gear materials; Design of Structure; Spur gear; Design consideration.

Mechanical springs: Design of Helical and leaf springs against static & fatigue loading; Design analysis of Power Screws; Form of threads: Square threads, trapezoidal threads; Stresses in a screw; Design of screw jack.

Unit V **(Lectures 08)**

Introduction to Product Development & Design Process: Definition of Design; Design Process; Need; Analysis; Need based developments; Design by evolution; Technology based developments; Examples Case Studies; Brain-storming.

Text Books

1. Bhandari, *Design of Machine Elements*, TMH
2. Sharma & Agarwal, *Machine Design*, Kataria
3. Maleev & Hartman, *Machine Design*, C.B.S. Publishers
4. Sharif Abdulla, Design Data Book, Dhanpat Rai & Sons

Reference Books

1. Shigley, *Machine Design*, Mcgraw Hill
2. Black & Adams, *Machine Design*, Mcgraw Hill.
3. Spotts, *Design of Machine Elements,* Prentice Hall of India Pvt. Ltd

SEMESTER V
HEAT & MASS TRANSFER

Course Code: EME505

L	T	P	C
3	0	0	3

Objective: To gain knowledge of heat & mass transfer.

Course Contents

Unit I **(Lectures 08)**

Heat Transfer: Mechanisms of heat flow: conduction, convection and radiation; Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

Conduction: One-dimensional general differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems; Initial and boundary conditions; Steady State one-dimensional heat conduction for Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Thermal resistance concept; Analogy between heat and electricity flow; Thermal contact resistance; Critical thickness of insulation.

Unit II **(Lectures 08)**

Fins of Uniform Cross-sectional Area: Types of fin, Heat transfer from fin with different geometries; Fin efficiency; Fin effectiveness; Applications of the fins.

Transient Conduction: Transient heat conduction; Lumped capacitance method: Time constant; Unsteady state heat conduction in one dimension only; Heisler charts.

Unit III **(Lectures 08)**

Forced Convection: Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer.

Natural Convection: Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates.

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Unit IV **(Lectures 08)**

Thermal Radiation: Basic concepts; Radiation properties of surfaces; Laws of black-body radiation; Shape factor; Black-body radiation exchange; Radiation exchange between diffused non black bodies in an enclosure; Radiation shields; Solar radiation.

Unit V **(Lectures 08)**

Heat Exchanger: Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

Condensation and Boiling: Introduction to condensation phenomenon; Heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes: Pool boiling, curve, forced convective boiling.

Introduction to Mass Transfer: Introduction; Flick's law of diffusion; Steady state equi-molar counter diffusion; Steady state diffusion though a stagnant gas film.

Texts Books

1. Bayazitouglu & Ozisik, *Elements of Heat Transfer*, McGraw-Hill Book Company.
2. Holman J.P., *Heat Transfer*, McGraw-Hill International.
3. Pitts & Sisson, *Schaum's Outline of Heat Transfer*, McGraw-Hill International.

Reference Books

1. Frank Kreith, *Principles of Heat Transfer*, McGraw-Hill Book co.
2. James R.Welty, *Fundamentals of Momentum, Heat and Mass Transfer*, John Wiley & Sons
3. Gupta Vijay, *Heat Transfer*, New Age International (P) Ltd. Publishers
4. Rao Y.V.C., *Heat Transfer*, University Press.

SEMESTER V
TECHNICAL WRITING

Course code: EHM 501

L	T	P	C
2	0	2	3

Course Contents:

Unit I

Forms of Technical Communication: Report writing, Definition and characteristics, Steps towards report writing, Structure, style of Report writing, Types & forms of Reports, Presentation of Reports, and importance of Report writing.

Unit II

Technical Paper writing: Definition and purpose, essentials of a good technical paper/Article, Scientific Article writing, Difference between Technical paper/Article and scientific article, elements/steps in writing Technical paper & Scientific Article, Methods of writing technical paper & Scientific article.

Unit III

Technical Proposal: Definition and meaning of Technical Proposal, Significance of Proposal, Kinds, Types of proposal, Characteristics of a good Proposal, Structure, Parts, Format of Proposal, Supplementary parts, Uses of Proposals.

Unit IV

Writing Skills: Reporting events, Writing News paper, Reports, Essentials of essay writing –writing an essay of about 300 words on a given topic. Bio-Data Making, Writing of CV & Resumes, Difference between CV and Resume, Writing Job application etc.

Unit V

Value-based Text Reading: R.K. Narayan- A Bookish Topic.

1. Francis Bacon- of studies.
2. CEM Joad – The Civilization of Today.

(Note: The two periods per week may be utilized in Language Lab covering the above syllabus.)

Text Books:

1. Singh R.P., *An Anthology of English Easy* O.U.P. New Delhi.
2. Raman Meenakshi & Sharma Sangeeta, *Technical Communication-Principles & Practice* O.U.P. New Delhi. 2007.

Reference Books:

1. Monippally Matthukutty M., *Business Communication Strategies* Tata- Mc Graw Hill Publications Company, New Delhi.
2. Mohan K. & Sharma R.C., *Business Correspondence of Report Writing,*TMH, New Delhi.

Semester V
Industrial Psychology

Course code: EHM502

L	T	P	C
3	0	0	3

Unit I

Sociology in the industrial Perspective: Concept of Sociology, Sociology as a Science, Sociology of work & industry, Perspectives for sociological analysis of work, Class- Conflict in Industry, Social impact of industrialization, Corporate skills in the fast growing multinational set up. **(Lectures 08)**

Unit II

Work and Social change: Nature of modern societies, emergence of industrial capitalism, Technology & Social change, the information society after the industrial society, post-modernity, globalization & Convergence, Significance of the service sector today, work restructuring and corporate management. **(Lectures 08)**

Unit III

Work experience in Industry: The concept of alienation, Work satisfaction, Technology & work experience, and Social background of workers, Work orientations, Stress & anxiety of the worker, Work & Leisure, Unemployment, Conflicts in the work place. **(Lectures 08)**

Unit IV

General and Applied Ethics- Ethics and the professions – Standard of right and wrong, problems of Ethical Certainty, Significance of professional Ethics for Engineers, New Technology and Ethics, Applied Ethics - Cases in professional Engineering Practice, Principles of business ethics, Individual in the organization. **(Lectures 08)**

Unit V

Ethical Leadership: Decision making, corporate culture and reputation management, corporate social responsibility and social reporting. **(Lectures 08)**

Text Books:

1. Sheth N.R., *Social Frame Work of Indian Factory,* O.U.P. Bombay.
2. Gisbert P., *Fundamentals of Industrial Sociology,* O.U.P. New Delhi.
3. Watson Tony J., *Sociology: Work & Industry*, New York. Routledge.
4. Schinzinger, Roland & Mike W. Martin, *Introduction to Engineering Ethics*- Boston, McGraw Hill.

Reference Books:

1. Fleddermann Charles*, Engineering Ethics*, Upper Saddle River- N.J. Prentice Hall.
2. Miller & Form, *Industrial Sociology*, London Harper & Row.
3. Parsons Richard D., *The Ethics of Professional Practice*- Allyn & Bacon, London.
4. Govindarajan - *Engineering Ethics*- Prentice Hall (India) New Delhi.

Bhatia S.K. - *Business Ethics & Management Values*- Deep & Deep Publication. N. Delhi

Semester V
PRODUCTION TECHNOLOGY –II (LAB)

Course Code: EME552

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

Perform 10 experiments out of the following

1. To determine shear-angle and chip thickness ratio for orthogonal cutting on lathe machine.
2. To prepare a bolt (thread) on lathe machine
3. To provide tool angles on tool using Grinding Machine.
4. To perform Gear cutting on milling machine.
5. To prepare a block of given size on shaper machine.
6. To obtain a given job on surface-grinding machine.
7. To prepare a hole using drilling machine and study of twist-drill.
8. To Study different types of tools, its angles and materials.
9. To prepare weld joint using gas welding machine.
10. To prepare weld joint using manual metal arc welding machine.
11. To prepare weld joint using resistance welding machine.
12. To perform soldering & brazing on given work piece
13. To prepare a weld joint using TIG/MIG welding machine.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (25 MARKS)</td><td rowspan="2">ATTENDANCE (10 MARKS)</td><td rowspan="2">Experiment (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
<tr><td>EXPERIMENT (10 MARKS)</td><td>FILE WORK (05 MARKS)</td><td>VIVA (10 MARKS)</td></tr>
</table>

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester V
HEAT & MASS TRANSFER (LAB)

Course Code: EME553

L	T	P	C
0	0	3	1.5

List of Experiments

1. To study and determine thermal resistances of a composite wall.
2. To determine heat flow rate through the lagged pipe and thermal conductivity of lagging material.
3. To determine the critical heat flux using critical heat flux apparatus.
4. To determine the variation of heat transfer coefficient over the vertical surface in natural convection.
5. To demonstrate effective thermal conducting of heat pipe.
6. To determine heat flow rate and effectiveness of a fin for steady state of temperature distribution along the length.
7. To study forced measurement test rig.
8. To determine emissivity of test plate.
9. To ensure the speed of the shaft study speed measurement test rig.
10. To determine the LMTD of parallel and counter flow Heat exchanger.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (25 MARKS)</td><td rowspan="2">ATTENDANCE (10 MARKS)</td><td rowspan="2">Experiment (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
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</table>

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester V
INDUSTRIAL TRAINING & PRESENTATION
(PRESENTATION BASED ON INDUSTRIAL TRANING DONE AFTER THE IV SEMESTER EXAMINATION IN SUMMER)

Course Code: EME591

L	T	P	C
0	0	0	2

Students will attend Industrial training of four weeks in any industry or reputed organization after the IV semester examination in summer vacation. The evaluation of this training shall be included in the V semester evaluation.

The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the IV semester and shall be the nodal officer for coordination of the training.

Students will also be required to prepare an exhaustive technical report of the training undertaken during the V semester which will be duly signed by the officer under whom training was taken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Director of the college.

The student at the end of the V semester will present his report about the training before a committee constituted by the Director of the College which would be comprised of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director.

The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned.

Not more than three students would form a group for such industrial training/ project submission.

The marking shall be as follows.

Internal: 50 marks

By the Faculty Guide - 25 marks

By Committee appointed by the Director – 25 marks

External: 50 marks

By Officer-in-charge trainee in industry – 25 marks

By External examiner appointed by the University – 25 marks

Semester VI
REFRIGERATION & AIR CONDITIONING

Course Code: EME601

L	T	P	C
3	0	0	3

Objective: To study the working of refrigeration systems and air-conditioning systems.

Course Contents

Unit I **(Lectures 08)**

Refrigeration: Introduction to refrigeration system; Methods of refrigeration; Carnot refrigeration cycle; Unit of refrigeration; Refrigeration effect & C.O.P.

Air Refrigeration cycle: Open and closed air refrigeration cycles; Reversed Carnot cycle; Bell Coleman or Reversed Joule air refrigeration cycle; Aircraft refrigeration system; Classification of aircraft refrigeration system: Boot strap refrigeration, Regenerative, Reduced ambient; Dry air rated temperature (DART).

Unit II **(Lectures 08)**

Vapour Compression System: Single stage system; Analysis of vapour compression cycle; Use of T-S and P-H charts; Effect of change in suction and discharge pressures on C.O.P; Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle; Actual vapour compression refrigeration cycle; Multistage vapour compression system requirement; Removal of flash gas; Inter-cooling; Different configuration of multistage system; Cascade system.

Unit III **(Lectures 08)**

Vapour Absorption System: Working principle of vapour absorption refrigeration system; Comparison between absorption & compression systems; Elementary idea of refrigerant absorbent mixtures; Temperature-concentration diagram, Enthalpy- concentration diagram; Adiabatic mixing of two streams; Ammonia-water vapour absorption system; Lithium Bromide water vapour absorption system and its comparison; Refrigerants: Classification, nomenclature and desirable properties of refrigerants; Common refrigerants; Secondary refrigerants and CFC free refrigerants.

Unit IV **(Lectures 08)**

Air-Conditioning: Introduction to air-conditioning; Psychometric properties and their definitions; Psychometric chart; Different Psychometric processes; Thermal analysis of human body; Effective temperature and comfort chart; Cooling and heating load calculations; Selection of inside & outside design conditions; Heat transfer through walls & roofs; Infiltration & ventilation; Internal heat gain; Sensible heat factor (SHF); By pass factor; Grand Sensible heat factor (GSHF); Dew point apparatus.

Unit V **(Lectures 08)**

Refrigeration Equipment & Applications: Basic components of refrigeration & air-conditioning equipments; Air washers; Cooling towers; Humidifying efficiency; Food preservation; Cold storage; Refrigerators; Freezers; Ice plant; Water coolers; Elementary knowledge of transmission and distribution of air through ducts and fans; Basic difference between comfort and industrial air-conditioning**.**

Text Books

1. Prasad Manohar, *Refrigeration and Air Conditioning*, New Age International
2. Arora C.P., *Refrigeration and Air Conditioning*, McGraw Hill
3. Arora & Domkundwar, *Refrigeration and Air Conditioning*, Tata mcgraw-Hill

Reference Books

1. Stoecker & Jones, *Refrigeration and Air Conditioning*, McGraw-Hill
2. Roy J. Dossat, *Refrigeration and Air Conditioning,* John Wiley & Sons
3. Baloney P.L., *Refrigeration and Air Conditioning*, Prentice Hall
4. Kuhen, Ramsey & Thelked, *Thermal Environment Engg*, Central PublishingHouse

Semester VI
MECHANICAL VIBRATIONS

Course Code: EME603	L	T	P	C
	3	1	0	4

Objective: To study about vibration, degree of freedom etc.

Course Contents

Unit I **(Lectures 08)**

Introduction: Periodic motion; Harmonic motion; Superposition of simple harmonic motions; Beats; Fourier analysis.

Single Degree Freedom System: Free vibration; Natural frequency; Equivalent Systems; Energy method for determining natural frequency; Response to an initial disturbance; Torsional vibrations; Damped vibrations; Damping models: Structural, Coulomb and Viscous damping; Vibrations of system with viscous damping; Logarithmic decrement; Viscous dampers.

Unit II **(Lectures 08)**

Single-Degree of Freedom: Forced vibration; Harmonic excitation with viscous damping; Steady state vibrations; Forced vibrations with rotating and reciprocating unbalance; Support excitation; Vibration isolation; Transmissibility; Vibration measuring instruments: Displacement, Velocity, Acceleration and Frequency measuring instrument.

Unit III **(Lectures 08)**

Two-Degree Freedom System: Introduction; Principal modes; Double pendulum; Torsional system with damping; Coupled System; Un-damped dynamic system; Vibration absorbers; Centrifugal pendulum absorber; Dry friction damper; Un-tuned viscous damper.

Unit IV **(Lectures 08)**

Multi-degree Freedom System-I: Exact Analysis: Un-damped free and forced vibrations of multi-degree system; Influence numbers; Reciprocal Theorem; Vibration of geared system; Principal coordinates; Continuous systems: Longitudinal vibration of bars; Torsional vibrations of Circular shafts; Lateral vibration of beams.

Unit V **(Lectures 08)**

Multi-degree Freedom System-II: Critical Speed of Shafts; Shafts with one disc with and without damping; Multi-disc shafts; Secondary critical speed.

Text Books

1. Srinivasan P., *Mechanical Vibration*, TMH
2. Grover G. K., *Mechanical Vibration*, Jain Bros. Roorkee.
3. Thomson W.T., *Mechanical Vibration*, Prentice Hall

Reference Books

1. Tse, Morse & Hinkle, *Mechanical Vibration*, *Theory & Application*, Prentice Hall.
2. Rao J. S. & Gupta K., *Introduction Course on Theory and Practice of Mech. Vibration,* New Age Publishers.
3. Rama Murthy V., *Mechanical Vibration Practice with Basic Theory*, Narosa Publishers.

Semester VI
DYNAMICS OF MACHINE

Course Code: EME604

L	T	P	C
3	0	0	3

Objective: To study about of balancing of machines, brakes etc.

Course Contents

Unit I

Force Analysis, Turning Moment & Flywheel: Static force analysis of linkages; Equivalent offset inertia force; Dynamic analysis of slider crank & Bar mechanism; Piston and Crank effort; Inertia; Torque; Turning moment diagrams; Fluctuation of energy; Flywheel.

Unit II **(Lectures 08)**

Balancing of machines: Static and dynamic balancing, Balancing of rotating and reciprocating masses; Primary and secondary forces and couples.

Unit III **(Lectures 08)**

Friction: Pivot and collar friction; Friction circle; Single plate; Multi-plate and Cone clutches; Michelle & Kingsbury thrust bearing and rolling contact bearing; Belts and pulleys; Flat and V-belts; Brakes and Dynamometers (Mechanical Type): External and internal shoe brakes, Band and Block brakes, Hydraulic brakes, Absorption and Transmission dynamometers.

Unit IV **(Lectures 08)**

Governors: Dead weight and spring loaded governors; Sensitivity; Stability; Hunting; Isochronism; Effort and Power; Friction and Insensitivity; Introduction to inertia governors.

(Lectures 08)

Unit V

Gyroscopic Motion: Principles; Gyroscopic acceleration; Gyroscopic couple and Reaction; Effect of gyroscopic couple upon the stability of aero planes, ships, two & four-wheelers; Mechanical Vibration: Single degree free & forced, Un-damped & Damped vibrations; Critical speeds**.**

Text Books

1. Bevan Thomas, *Theory of Machine*, ELBS Publishers
2. Ratan S.S., *Theory of Machine*, TMH.

Reference Books

1. Mabie , *Mechanisms & Dynamics of Machines*.
2. Shiglay, *Theory of Machine & Mechanism*.
3. Bansal R.K., *Theory of Machine*, Laxmi Publication.
4. Ambekar A.K., *Mechanisms and Machine Theory*, Jain Bros.
5. Green W.T., *Theory of Machines*, Tata McGraw Hill
6. Rao & Dukhipati, *Mechanisms and Machine Theory*, New Age.
7. Ghosh & Mallik, *Theory of Machine & Mechanism*, Affiliated East-West Press (P) Ltd
8. Ballaney P.L., *Theory of Machines*, Khanna Publication.

SEMESTER VI
METALLURGY

Course Code: EME605

L	T	P	C
3	0	0	3

Objective: The objective is to study about metallic structure, various alloys.

Course Contents

Unit I **(Lectures 08)**

Structure of Metals: Bonds in Solids; Metallic bond; Crystallization of metals; Grain and grain Boundaries; Effect of grain boundaries on the properties of metal / alloys; Determination of grain size.
Constitution of Alloys: Necessity of alloying; Types of solid solutions; Hume Rotherys rules; Intermediate alloy phases, and electron compounds.

Unit II **(Lectures 08)**

Equilibrium of Diagrams: Methods of construction of equilibrium diagrams; Iso-morphous alloy systems; Equilibrium cooling and heating of alloys; Lever rule; Coring miscibility gaps; Eutectic systems; Congruent melting intermediate phases; Peritectic reaction; Transformations in the solid state: allotropy, eutectoid, peritectoid reactions; Phase rule; Relationship between equilibrium diagrams and properties of alloys; Study and important of binary phase diagrams of Cu-Ni, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

Unit III **(Lectures 08)**

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system; Annealing; Normalizing; Hardening; TTT diagrams; Tempering; Hardenability; Surface hardening methods; Age hardening treatment; Cryogenic treatment of alloys.

Unit IV **(Lectures 08)**

Ceramic materials: Crystalline ceramics, glasses, cermets, cements, abrasive materials; Nano-materials: definition, properties and applications.
Polymers: Types of polymers; Characteristics and its applications.

Unit V **(Lectures 08)**

Powder Metallurgy: Various methods of producing metal powders; Characteristics of metal powders and their correlation with the various methods of production; Hazards in metals powder production; Testing and classification of powders; Treatment of metal powders prior to compacting; Mixing and conditioning of metal powders; Compacting of cold and hot pressing and their limitations; Design of dies; Rolling, slip casting, forging and extrusion of metal powders; Implosive compaction; Factors influencing the properties of compacts; Sintering: Significance in powder metallurgy, sintering environments, importance of controlled atmosphere for sintering; Sintering equipments and their classification; Factors influencing sintering of metal powders.

Text Book

1. Sidney H. Avener., *Introduction to Physical Metallurgy*, McGraw-Hill
2. Donald R .Askeland/Thomson, *Essential of Materials Science and Engineering*, Thomson Learning
3. Sinha A.K, Powder metallurgy, Dhanpat Rai Publications P Ltd

Reference Books

1. Kodgire, *Material Science and Metallurgy*, Everest Publishing House
2. Rahgavan V., *Elements of Material Science*, PHI Learning Pvt. Ltd
3. Vinas W.G. and Mancini H.L., *An Introduction to Material Science*, Princeton University Press
4. Yesudian C.D. and Harris Samuel, *Material Science &* Metallurgy, Scitech Publications.
5. Flinn R.A. and Trojan P.K., *Engineering Materials and their Applications*, Jaico Books.

Semester VI
OPERATIONS MANAGEMENT

Course Code: EHM 602

L	T	P	C
3	0	0	3

Objective: To learn about operations management like planning, scheduling, forecasting etc.

Course Contents

Unit I **(Lectures 8)**

Operations Management: Overview; Definition of production and operations management; **Transformation process model**: Inputs, Process and outputs; Classification of operations; Responsibilities of Operations Manager; Production Cycle; New Product Development; Product Design; **Process types in manufacturing**: Project; Jobbing, Batch, Line, Mass, Continuous; Process types in services: Professional services, Services shops, Mass services.

Unit II **(Lectures 8)**

Forecasting Methods & Aggregate Planning: Forecasting as a planning tool; Time horizon in forecasting; Characteristics of forecasts; Subjective and objective forecasting methods: Casual methods; time series methods, methods for forecasting stationery series; exponential smoothing, Measurement of Errors; Monitoring and Controlling forecasting models.

The aggregate planning problem; Aggregate planning techniques; Evaluation of chase strategy & constant work force plan; Solution of aggregate problem.

Unit III **(Lectures 8)**

Inventory Control & MRP: Inventory Management: Objectives, Factors, Process, Relevant costs; The EOQ model; Selective Inventory control techniques: ABC, VED, SED, FSN analysis; Introduction to JIT; MRP: Overview; Process; Use of MRP in real world.

Unit IV **(Lectures 8)**

Operation Scheduling: Characteristics of job shop scheduling problems; Theory of sequencing for single machine sequencing rules: FCFS, SPT, EDD, critical ratio, Minimum number of tardy jobs (NT).

Unit V **(Lectures 8)**

Facility Location & Layout: Factors affecting location decisions; Techniques for locating new facilities; Subjective, Semi quantitative & quantitative techniques; Centre of gravity problem; Facility layout principles; Systematic layout planning procedure; Types of layout; Activity relationship chart; From/to chart; Line balancing.

Text Books

1. Adam Jr & Everett E. R J, *Production and Operations Management* (Prentice-Hall, 2000, 5th Edition)
2. Ashwathappa K. & Bhatt K Sridhar, *Production and Operations Management*, Himalaya Publication
3. Mahadevan B., *Operations Management- Theory and Practice*, Pearson Education,
4. Richard B Chase, *Operations Management*, Tata McGraw Hill

Reference Books

1. Kachru Upendra, *Production and Operations Management*, Text and Cases, Excel Books
2. Gaither Norman & Greg Fraizer, *Operations Management*, Thomson South Western
3. CharyS. N., *Production and Operations Management*, Tata McGraw-Hill, 1997, 9th Edition
4. Bedi Kanishka, *Production & Operations Management*, Oxford University Press, 2nd

Semester VI
Engineering and Managerial Economics

Course Code: EHM603

L	T	P	C
3	0	0	3

Objective:

- To understand the Scope of Economics, Demand Forecasting and Market Study.

Unit-I

Introduction: Meaning, Nature and Scope of Economics, Meaning of Science, Engineering and Technology; Managerial Economics and its scope in engineering perspective.

Unit-II

Demand: Basic Concepts Demand Analysis; Law of Demand; Determinates of Demand; Elasticity of Demand-Price, Income and cross Elasticity; Uses of concept of elasticity of demand in managerial decisions.

Unit-III

Forecasting: Demand forecasting; Meaning, significance and methods of demand forecasting; production function; Laws of returns to scale & Law of Diminishing returns scale.
Short and Long run Cost curves: fixed cost, variable cost, average cost, marginal cost, Opportunity cost.

Unit-IV

Market Study: Market Structure Perfect Competition; Imperfect competition: Monopolistic competition, Monopoly, Oligopoly, Duopoly Sorbent features of price determination and various market conditions.

Unit-V

Inflation: National Income; Concept of N.I. and Measurement; Inflation: Meaning of Inflation; Type, causes & prevention methods; Business Cycles, Phases of business cycle.

Text Books:

1. Koutsoyiannis, *A : Modern Microeconomics*, ELBS.
2. Kakkar, D.N., *Managerial Economics for Engineering*, New Age International Publication.

Reference Books:

1. Dwivedi, D.N., *Managerial Economics*, Vikas Publishing.
2. Maheshwari, Y., *Managerial Economics*, Prentice Hall of India.

Semester VI
REFRIGERATION & AIR CONDITIONING (LAB)

Course Code: EME651

L	T	P	C
0	0	3	1.5

LIST OF EXPERIMENTS

1. To study & determination of volumetric efficiency of Reciprocating compressor.
2. To study & determination of volumetric efficiency of Semi Sealed compressor.
3 To study & determination of volumetric efficiency of Open type compressor.
4. To determine refrigeration effect using the different types of expansion devices used in refrigeration system.
5. To study and determination of cooling effect using window air conditioner
6. To determine the fitting of storage type water cooler and its usages.
7. To identify different parts of evaporators (Forst Free) used in refrigeration systems.
8. To study and determination of cooling effect using walk In cooler.
9. To determine COP of see through freeze (Direct cooled).
10. To identify different parts of automobile AC test rig.

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
<tr><td colspan="3">PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (25 MARKS)</td><td rowspan="2">ATTENDANCE (10 MARKS)</td><td rowspan="2">Experiment (5 MARKS)</td><td rowspan="2">VIVA (10 MARKS)</td><td rowspan="2">TOTAL INTERNAL (50 MARKS)</td></tr>
<tr><td>EXPERIMENT (10 MARKS)</td><td>FILE WORK (05 MARKS)</td><td>VIVA (10 MARKS)</td></tr>
</table>

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VI
MECHANICAL VIBRATIONS (LAB)

Course Code: EME652

L	T	P	C
0	0	3	1.5

LIST OF EXPERIMENTS

1. To identify the different motions of simple linkage mechanisms
2. To determine the natural frequency of longitudinal vibration.
3. To determine the natural frequency of tensional vibration
4. To draw the characteristics of dead weight type governor
5. To draw the characteristics of spring controlled governor
6. To find the critical speed of mild steel shaft
7. To measure resisting of a moving body using gyroscope
8. To determine the coefficient of friction of braking system.
9. To analyze transmitting torque single plate/multi plate clutch.
10. To verify static/dynamic balancing

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

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</table>

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VI
Solid Works Lab

[EME 654 amended vide approval dt. Jan 11, 2017 of V.C]

Course Code: EME 654 **L T PC**
0 0 3 1.5

Objective: To make the students aware of 3D modeling of machine components using CAD software. The list of experiments is as follows.

1. Introduction to modeling software and detail discussion & familiarization about SOLIDWORKS.
2. Practice sketch Tools and Relations with in stipulated duration.
3. Practice sketcher tool, relation and dimensioning and prepare BracketDrawing with SOLIDWORKS sketcher.
4. To prepare coupling shaft using revolve command.
5. To create a machine component from the views using extrude, fillet & instant 3D.
6. To prepare the detail model of Wing Nut, Snap Head Rivet, Grub Screw & Set Screw.
7. To prepare the assembly of given experiment no. 6.
8. File Management- New, Open, Save, Save As, Page Setup, Printing, Import andExport.
9. Introduction of kinematics using SOLIDWORKS MOTION.
10. Introduction of joints using SOLIDWORKS MOTION.

Learning Outcomes:

Upon successful completion of this course the student will be able to do modeling and simulation of different machine components in 3 dimensions and analyses from prototyping to actual manufacturing.

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

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</table>

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VI
DYNAMICS OF MACHINES (LAB)

Course Code: EME653

L	T	P	C
0	0	3	1.5

List of Experiments

1. To compare practical and theoretical balancing (statically and dynamically) of rotating masses.
2. To determine the controlling force at given speed, sensitiveness at given limits of lift and governor effort and power.
3. To find the spring tension and follower displace at various angle of Cam.
4. To find the applied torque in case of gyroscope couple.
5. To determine the frequency of vibration (oscillation).
6. To determine the natural frequency of vibration in case of two rotor system
7. To identify the amplitude of vibration of beam for different damping
8. To verify for the epicyclical gear train input torque + holding torque = output torque.
9. To find the whirling speed of rotating shafts.
10. To find out the moment of inertia of a given specimen using velocity and acceleration

Evaluation of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 5 point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

<table>
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External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VII

COMPUTER AIDED DESIGN (CAD)

[EME 701 changes vide approval dt. Jan 11, 2017 of V.C]

Course Code: EME 701 **L T P C**

3 0 0 3

Objective: To learn computer aided design and apply these techniques for some practical problems.

Course Contents

UNIT-I **(Lectures 08)**

Introduction: Introduction to CAD/CAE; Element of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM; Importance of CAD& their necessity;CAD Engineering applications, Computer aided Inspection (CAI),Computer aided Testing (CAT), Co-ordinate measuring machine (CMM), Machine Vision, 3D-printing.

UNIT-II **(Lectures 08)**

Computer Graphics: Graphics input devices, Graphics display devices, Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's and mid-point circle generating algorithm

Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2-D Geometric transformations- Translation, Scaling, Shearing, Rotation & Reflection, Matrix representation, Composite transformation, 3-D transformations.

UNIT-III **(Lectures 08)**

Curves: Curves representation, Interpolation vs approximation, Properties of curve design, Parametric representation curves, Parametric continuity conditions, Synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties.

UNIT-IV **(Lectures 08)**

3D Graphics: Polygon surfaces-Polygon mesh representations, Quadric and Super-quadric surfaces, Blobby objects; Fractals, Solid modeling- Regularized set operations; Boundary representation (B-rep), Constructive solid geometry (CSG), Sweep representation, Color models. Basic commands for 2-D drafting software like AutoCAD and 3-D solid modeling software PTC Creo and Solidworks.

UNIT-V **(Lectures 08)**

Finite Element Methods: Introduction, Basic concept of the finite element method (FEM), Stages in finite element analysis, Shape functions, Development of elemental stiffness matrix and their assembly, Finite Element analysis of 1-D problems like spring, bar, truss and beam elements formulation with elimination and penalty approaches, 1-D thermal and fluid problems.

Learning Outcomes:

Upon successful completion of this course the student will learn

1. to understand use of CAD in design processes.
2. to design a part or assembly of parts using CAD software.
3. to use parametric modelling techniques to meet engineering requirements.
4. FEM analysis of basic engineering components in 1-D

Text Books-

1. Hearn D. & Baker M. P., Computer Graphics, Prentice Hall

2. Srivastava. R.K., Computer Aided Design, Umesh Publication.

Reference Books-

1. Foley D., Van Dam A., Feiner S. K., Computer Graphics: Principles and Practice in C, Pearson Education.
2. Zeid Ibrahim, CAD/CAM theory and practice, McGraw Hill International.
3. Dukkipati R. V., Rao M. A., Bhat R. , Computer Aided Analysis & Design of Machine Elements, New Age International
4. Rogers D. F.,Adams J. A., Mathematical Elements for Computer Graphics, McGraw Hill.
5. Groover M. P.&Zimmers E. W., CAD/CAM: computer-aided design and manufacturing, Prentice Hall of India Pvt Ltd.
6. S.S. Bhavikatti, Finite Element Analysis, New Age Internation Publishers.
7. Krishnamoorthy, FE Analysis Theory and Programming, Tata McGraw Hill.

***Latest editions of all the suggested books are recommended.**

Semester VII
HYDRAULIC MACHINES

Course Code: EME 707

L	T	P	C
3	0	0	3

Objectives: To gain knowledge about hydraulic machines.

Unit I **(Lectures 08)**

Impact of Jet: Impulse momentum equation; Force generation due to impact of jet; Impact of jet on fixed flat plate (vertical, inclined); Impact of jet on moving flat plates (vertical, inclined); Impact of jet on curved fixed and moving vanes.

Unit II **(Lectures 08)**

Water Turbines: Layout of hydroelectric power plant; Features of Hydroelectric power plant; Classification and selection of hydraulic turbines on the basis of head and discharge available; Construction and working principle of Impulse and Reaction turbines (Pelton wheel, Francis and Kaplan turbine); Velocity diagrams, work done, efficiencies and its calculation.

Unit III **(Lectures 08)**

Centrifugal Pump: Construction; Principle of working and applications; Types of casings and impellers; Manometric head; Velocity diagram; Work done; Manometric efficiency; Mechanical efficiency; Overall efficiency; Discharge of centrifugal pump; NPSH; Performance characteristics of centrifugal pumps; Concept of multistage of centrifugal pump; Priming and cavitation.

Unit IV **(Lectures 08)**

Reciprocating Pump: Construction, working principle and applications of single and double acting reciprocating pumps; Concept of Slip; Negative slip; Use of Air Vessel; Indicator diagram with effect of acceleration head & frictional head (no derivations); Discharge of reciprocating pump; Power required to drive a reciprocating pump; Separation and maximum speed of operation

Unit V **(Lectures 08)**

Pumping and Hydraulic Devices: Construction and working of following of air lift pump, jet pump, rotary pumps, external gear pump, internal gear pump, lobe pump, vane pump, hydraulic press, hydraulic accumulator, hydraulic intensifier.

Text Books:

1. Bansal R.K., *Fluid Mechanics and hydraulic machines*, Laxmi Publications
2. lal Jagadish, *Fluid Machinery*, Metropolitan Book Co.Pvt Ltd

Reference Books:

1. Modi P.N. & Seth, *Fluid Mechanics and hydraulic machines*, Standard Book House

Semester VII
POWER PLANT ENGINEERING

Course Code: EME 703	L	T	P	C
	3	0	0	3

Objective: To Study about power plants like nuclear, hydroelectric, steam, diesel etc.

Course Content

Unit I **(Lectures 08)**

Introduction: Power and energy; Sources of energy; Review of thermodynamic cycles related to power plants; Fuels and combustion; Calculations.

Variable Load Problem: Industrial production and power generation compared; Ideal and realised load curves; Terms and factors; Effect of variable load on power plant operation; Methods of meeting the variable load problem.

Power Plant Economics and Selection: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; Depreciation and replacement; Theory of rates; Economics of plant selection; Other considerations in plant selection.

Unit II **(Lectures 08)**

Steam Power Plant: Power plant boilers including critical and super critical boilers; Fluidized bed boilers; Boilers mountings and accessories; General layout of steam power plant; Different systems such as fuel handling system, pulverisers and coal burners, combustion system, Draft, Ash handling system, Feed water treatment and condenser and cooling system; Turbine auxiliary systems such as governing, Feed heating, reheating , flange heating and gland leakage; Operation and maintenance of steam power plant; Heat balance and efficiency.

Unit III **(Lectures 08)**

Diesel Power Plant: General layout; Performance of diesel engine; Fuel system; Lubrication system; Air intake and admission system; Supercharging system; Exhaust system; Diesel plant operation and efficiency; Heat balance.

Gas Turbine Power Plant: Elements of gas turbine power plants; Gas turbine fuels; Cogeneration; Auxiliary systems such as fuel, controls and lubrication; Operation and maintenance; Combined cycle power plants.

Unit IV **(Lectures 08)**

Nuclear Power Plant: Principles of nuclear energy; Basic components of nuclear reactions; Nuclear power station.

Hydro Electric Station: Principles of working; Applications; Site selection; Classification and arrangements; Hydro- electric plants; Run off size of plant and choice of units; Operation and maintenance; Hydro systems; Inter connected systems.

Non Conventional Power Plants: Non-conventional power plants (Solar, wind, geothermal, tidal)

Unit V **(Lectures 08)**

Electrical System: Generators and generator cooling; Transformers and their cooling; Bus bar; Instrumentation: Classification; Selection and application; Recorders and their use; Listing of various control rooms.

Pollution: Pollution due to power generation.

Text Books

1. Verma Mahesh, *Power Plant Engineering*, Metropolitan Book Company Pvt. Ltd. New Delhi.
2. El-Vakil, *Power Plant Technology*, McGraw Hill.

Reference Books

1. Nag, P.K., *Power Plant Engineering*, Tata McGraw Hill.
2. Yadav R., *Steam & Gas Turbines & Power Plant Engineering*, Central Publishers.

Semester VII
IC ENGINES

Course Code: EME704

L	T	P	C
3	0	0	3

Objective: To study about two stroke & four stroke IC engines, ignition & injection system.

Course Contents

Unit I **(Lectures 08)**

Introduction to I.C Engines: Engine classification; Air standard cycles; Otto, Diesel, Stirling, Ericsson cycles; Actual cycle analysis; Two and four stroke engines; SI and CI engines; Valve timing diagram; Rotary engines; Stratified charge engine.

Fuels: Fuels for SI and CI engine; Important qualities of SI engine fuels; Rating of SI engine fuels; Important qualities of CI engine fuels; Dopes; Additives; Gaseous fuels; LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.

Unit II **(Lectures 08)**

SI Engines: Carburetion; Mixture requirements; Carburettor types; Theory of carburettor; MPFI. Combustion in SI engine; Flame speed; Ignition delay; Abnormal combustion and its control; Combustion chamber design for SI engines; Ignition system requirements; Magneto and battery ignition systems; Ignition timing and spark plug; Electronic ignition.

Unit III **(Lectures 08)**

CI Engine: Fuel injection in CI engines; Types of injection systems; Fuel pumps; Fuel injectors; Injection timings; Combustion in CI engines; Ignition delay; Knock and its control; Combustion chamber design of CI engines; Scavenging in 2 Stroke engines; Pollution and its control.

Unit IV **(Lectures 08)**

Engine Cooling: Different cooling systems; Radiators and cooling fans; Lubrication: Engine friction; Lubrication principal; Type of lubrication; Lubrication oils; Crankcase ventilation; Supercharging: Effect of altitude on power output; Types of supercharging; Testing and Performance: Performance parameters; Basic measurements; Testing of SI and CI engines.

Unit V **(Lectures 08)**

Compressors: Classification; Reciprocating compressors: Single and multi stage; Inter cooling; volumetric efficiency; Rotary compressors: Centrifugal compressor; Elementary theory; Vector diagram; Efficiencies; Elementary analysis of axial compressors; Surging and stalling; Roots blower; Waned compressor; Performance analysis.

Text Books

1. Obert E.F., *I.C Engine Analysis & Practice,* Tata Mc Graw Hill Publishers
2. Ganeshan, *I.C Engine*, Tata Mc Graw Hill Publishers.
3. Mathur & Sharma, *A Course in International Combustion Engines*, Dhanpat Rai & Sons.

Reference Books

1. Chlumsky, *Reciprocating and Rotary Compressors*, SNTI Publications Czechoslovakia.
2. Yadav R*., I.C Engine*, Central Publishing House, Allahabad

Semester VII
ENGINEERING MATERIALS

Course Code: EME 706	L	T	P	C
	3	0	0	3

Objectives: To study the properties of various engineering materials.

Course Content:

Unit I **(Lectures 08)**

Ferrous Materials: Plain carbon steels: Properties and application; Effects of alloying elements in plain carbon steels; Alloy steels, tools steels, stainless steels, low and high temperature resisting steels, high strength steels; Selections, specifications, form and availability of steel; Cast irons: White, grey, modular malleable and alloy cast irons; Recognized patterns of distribution of graphite flakes in grey cast iron.

Unit II **(Lectures 08)**

Heat Treatment of Steels: TTT diagrams; Annealing, normalizing, hardening and tempering of steel, austempering and martempering of steel; Hardenibility, Jominy end quench test, Effect of grain on the properties of steel; Surface hardening of steel: Carbonising, nitriding, carbo-nitriding, cyaniding; Induction hardening.

Unit III **(Lectures 08)**

Nonferrous Materials: Properties and application; Brasses, Bronzes, Cupronickel alloys, Aluminium, Magnesium and Titanium alloys, bearing materials; Selection, specific form and availability; Heat treatment of nonferrous materials: Solutionizing and precipitations hardening.

Unit IV **(Lectures 08)**

Composites: Polymer; Metal-metal, ceramic–ceramic, ceramic-polymer, metal-ceramic, metal polymer composites; Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites.

Unit V **(Lectures 08)**

Elastomers and Masullaneous: Types, properties and identifications of different types of rubbers; Vulcanization; Fabrication and forming techniques of rubber; Application and process;
Smart Materials: Introduction and types; Selection of materials and factors effecting deflection.

Text Books

1. Budinski Kenneth G. & Budinski Michael K., *Engineering Materials*, Prentice-Hall of India

References Books

1. Callister William D, *Material Science and Engineering*, John Wiley and Sons .
2. Raghavan.V., *Materials Science and Engineering*, Prentice Hall of India Pvt. Ltd.
3. Avner Sydney H., *Introduction to Physical Metallurgy*, McGraw-Hill Book Company.

Semester VII
AUTO MOBILE ENGINEERING

Course Code: EME 702	L	T	P	C
	3	0	0	3

Objective: To study about automobiles, working of their components, accessories, gear mechanism, power transmission.

Course Content

Unit I **(Lectures 08)**

Power Unit and Gear Box: Principles of Design of main components; Valve mechanism; Power and Torque characteristics; Rolling; Air and gradient Resistance; Tractive effort; Gear Box; Gear ratio determination; Design of Gear box.

Unit II **(Lectures 08)**

Transmission System: Requirements; Clutches; Torque converters; Over Drive and free wheel; Universal joint; Differential gear mechanism of rear axle; Automatic transmission; Steering and front axle; Castor angle, Wheel camber & toe in toe out; Steering geometry; Ackerman mechanism; Under-steer and over-steer.

Unit III **(Lectures 08)**

Braking System: General requirements; Road tyre adhesion; Weight transfer
Brakes: Mechanical brakes, Hydraulic brakes, Vacuum and air brakes; Thermal aspects.
Chassis and Suspension System: Loads on the frame; Strength and stiffness; Various types of suspension systems.

Unit IV **(Lectures 08)**

Electrical System: Types of starting motors; Generator & regulators; Lighting system; Ignition system; Horn; Battery.
Fuel Supply System: Diesel & Petrol vehicle system such as Fuel Injection Pump; Injector & Fuel Pump; Carburetor; MPFI.

Unit V **(Lectures 08)**

Automobile Air-Conditioning: Requirements; Cooling & heating systems.
Lubrication System: Different type of lubrication system.
Maintenance system: Preventive maintenance; Break down maintenance and over hauling system**.**

Text Books

1. Hietner, *Automotive Engineering*, East West Press
2. Singh Kripal, *Automobile Engineering*, Standard Publishers

Reference Books

1. Narang, *Automobile Engineering*, Khanna Publisher
2. Crouse, *Automotive Mechanics*, Tata McGraw Hill
3. Newton & Steeds, *Automobile Engineering*, ELBS Publishing

Semester VII
ENVIRONMENTAL PROTECTION AND MANAGEMENT

[EME 708 amended vide approval dt. Jan 16, 2018 of V.C]

Course Code: EME708

L	T	P	C
3	0	0	3

Objective: To study about Toxic Materials and its environmental & health effects.

Course Contents

Unit I **(Lectures 08)**

Introduction; Importance of environmental protection for engineering & scientists; Chemistry of hazardous material

Unit II **(Lectures 08)**

Toxic materials and their environmental & health effects

Unit III **(Lectures 08)**

Fundamentals of environmental laws; Laws related to air pollution; Water pollution; Toxic substance; Safe drinking water; Occupational safety, health & noise control.

Unit IV **(Lectures 08)**

Environmental hazards and their control; General principle of hazards control; Hazard & its control from chemicals, noise & vibration, radiation; hazardous waste, heat & cold, fire, tools & machines; Personal protective equipment

Unit V **(Lectures 08)**

Environmental impact assessment; Rationale for assessing impact; Phases of environmental impact assessment; Air and water quality managements

Text Books

1. Walter E. Westman Ecology, Impact Assessment & Environmental Planning, Johuwilly & jons U.S.A.
2. Carson Tom Hand Book on Hazardous Materials Management, Inptitute of Hazardous materials management, USA.

Reference Books

1. Gordon Arbuckle J., *Environmental Law Handbook,* Government Institutes Inc. Rockville, M.D., USA.
2. Roger L.Brauer, *Safety & Health for Engineers*, Van Nostrance Reinhold – Newyork, USA.
3. Stanley E. Manehan, *Environmental Chemistry*, Books/Cole Publishing Company Motherly,
4. California.
5. Paul R. Portney, *Public Policies for Environmental Protection- Resources for the Future*. Washington D.C.

Semester VII
CAD (LAB)

Course Code: EME751	L	T	P	C
	0	0	3	1.5

LIST OF EXPERIMENTS

1. To write the algorithm for drawing a line, prepare program and run it on computer
2. To write the algorithm for drawing a circle, prepare program and run it on computer
3. To write algorithm for translation/rotation: and prepare program and running it on computer
4. To write the program for design of machine element and running it on computer
5. To write a program for optimizing a function and running it on computer
6. To prepare given drawing using Auto CAD commands
7. To prepare a given machine component drawing using Auto CAD
8. To prepare the drawing of components and assemble them using Auto CAD
9. To prepare the drawing of connecting rod assembly using Auto CAD.
10. To prepare the drawing of screw jack components and assemble them using Auto CAD

Evaluation Scheme of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VII

CAD (LAB)

[EME 753 amended vide approval dt. Jan 11, 2017 of V.C]

Course Code: EME 753 **L T P C**
0 0 3 1.5

Objective: To learn computer aided design and apply these techniques for some practical Problems.

1. Introduction to Drafting/Modeling/Analysis/Management.
   Example- Creo, Solidworks, ANSYS, MSP/PPM
2. To prepare the given sketch using **Creo Sketcher**.
3. To prepare Bracket using **Creo Sketcher**.
4. To prepare the given machine component using **Creo**.
5. To prepare the Flange and Drum using **Creo Sketcher**.
6. To prepare elbow and suspension component using **Creo Sketcher**.
7. To prepare the connecting rod and piston assembly using **Creo.**
8. To prepare the component of Plummer Block and Assembly using **Creo**.
9. **Finite Element Methods**: Introduction, principle of FEM, types of element-Introduction to FEM - 1D, 2D and 3D elements - shape functions - preprocessing - boundary conditions, structured. **(ANSYS)**
10. **Exercises on finite element analysis-** free mesh generation - analysis - linear and nonlinear analysis - static and dynamic analysis, post processing- setup, solution and result. **(ANSYS)**

Learning Outcomes:

Upon successful completion of this course the student will learn to
1. sketch, model, validate design and visualize product design.
2. do free form, 2-D and evolutionary concept design.
3. do detailed designing and making later stage design changes.
4. do direct drafting, direct modelling as well as parametric 3D modelling.
5. solve engineering problems using ANSYS software.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VII
IC Engine (LAB)

Course Code: EME752	L	T	P	C
	0	0	3	1.5

LIST OF EXPERIMENTS

1. To identify the different part of a 2 stroke petrol engine
2. To identify the different part of a 4 stroke diesel engine
3. To measure the fuel consumption in four stroke petrol engine.
4. To measure the fuel consumption in four stroke diesel engine.
5. To determine the brake thermal efficiency of 4 stroke petrol engine
6. To do tuning and servicing of carburetor.
7. To determine the indicated power of multi cylinder 4 stroke petrol engine
8. To compare features of common small cars (such as fiat, Maruti, Santro and Indica)
9. To analyze fuel saving by application of MPFI system.
10. To analyze the power transmission of a car.
11. Industrial visit to a automobile industry

Evaluation Scheme of Practical Examination:
Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VII
INDUSTRIAL TRAINING & PRESENTATION
(BASED ON INDUSTRIAL TRAINING DONE AFTER THE VI SEMESTER EXAMINATION IN SUMMER)

Course Code: EME791

L	T	P	C
0	0	0	3

Students will have to undergo industrial training of six weeks in any industry or reputed organization after the VI semester examination in summer. The evaluation of this training shall be included in the VII semester evaluation.

The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the VI semester and shall be the nodal officer for coordination of the training.

Students will prepare an exhaustive technical report of the training during the VII semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Director of the college.

The student at the end of the VII semester will present his report about the training before a committee constituted by the Director of the College which would comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director.

The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned.

Not more than three students would form a group for such industrial training/ project submission.

The marking shall be as follows.

Internal: 50 Marks

By the faculty guide - 25 marks

By committee appointed by the director – 25 marks

External: 50 Marks

By officer-in-charge trainee in industry – 25 marks

By external examiner appointed by the university – 25 marks

Semester VII
PROJECT WORK PHASE-1
(Synopsis, Literature Survey & Presentation)

Course Code: EME799	L	T	P	C
	0	0	6	3

A group of students, not more than three, will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified in the starting of the VII semester.
The group will carry out the literature search and collect required material for carrying out the project.
The group will prepare a report not exceeding 15 pages at the end of semester.
The assessment of performance of students should be made at least twice in each semester i.e. VII and VIII. In this semester the student shall present the progress of project live as also using overheads project or power point presentation on LCD to the internal committee as also the external examiner.
The evaluation committee shall consist of faculty members constituted by the college which would comprise of at-least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director.

The marking shall be as follows.

Internal: 100 Marks
By The Faculty Guide - 50 Marks
By Committee Appointed By the Director – 50 Marks

Semester VIII

TOTAL QUALITY MANAGEMENT

Course Code: EHM801

L	T	P	C
3	0	0	3

Objective: To study about quality concepts, management policies, control charts.

Course Contents

Unit I **(Lectures 08)**

Quality Concepts: Introduction; Meaning; Quality characteristics of goods and services; Evolution of Quality control, TQM; Modern concept, Basic concepts of quality; Dimensions of quality; Juran's quality trilogy; Deming's 14 principles; PDCA cycle; Total quality management (TQM) models.

Unit II **(Lectures 08)**

Quality Management: Organizational structure and design; Quality function; Decentralization; Designing and fitting organization for different types products and company; Human Factor in Quality: Attitude of top management; Co-operation of groups; Operators attitude, responsibility; Causes of operators error and corrective methods; Quality circles.

Unit III **(Lectures 08)**

Quality improvement and cost reduction: 7 QC tools and new QC tools; Economics of quality value and contribution; Quality cost; Optimizing quality cost; Quality assurance.

Unit IV **(Lectures 08)**

Control Charts: Theory of control charts; Control charts construction: Construction of Mean & Range charts, fraction defective chart and number of defective charts; Attributes control charts: Defects, construction and analysis of c-chart.

Unit V **(Lectures 08)**

IS0-9000, Six sigma and TPM: ISO 9000 series; Concept of Six Sigma and its application; Total Productive Maintenance (TPM).

Text Books

1. Sharma D.D *Total Quality Management*,S.Chand
2 LaI H., *Total Quality Management*, Wiley Eastern Limited.
3. Greg Bounds, *Beyond Total Quality Management*, McGraw Hill.

Reference Books

1. Menon, H.G., *TQM in New Product Manufacturing*, McGraw Hill 1992.

Semester VIII

TOTAL QUALITY MANAGEMENT

[EHM803 amended vide approval dt. Jan 16, 2018 of V.C]

Course Code: EHM803

L	T	P	C
3	0	0	3

Objective: To study about quality concepts, management policies, control charts.

Course Contents

Unit I **(Lectures 08)**

Quality Concepts: Introduction; Meaning; Quality characteristics of goods and services; Evolution of Quality control, TQM; Modern concept, Basic concepts of quality; Dimensions of quality; Juran's quality trilogy; Deming's 14 principles; PDCA cycle; Total quality management (TQM) models.

Unit II **(Lectures 08)**

Quality Management: Organizational structure and design; Quality function; Decentralization; Designing and fitting organization for different types products and company; Human Factor in Quality: Attitude of top management; Co-operation of groups; Operators attitude, responsibility; Causes of operators error and corrective methods; Quality circles.

Unit III **(Lectures 08)**

Quality improvement and cost reduction: 7 QC tools and new QC tools; Economics of quality value and contribution; Quality cost; Optimizing quality cost; Quality assurance.

Unit IV **(Lectures 08)**

Control Charts: Theory of control charts; Control charts construction: Construction of Mean & Range charts, fraction defective chart and number of defective charts; Attributes control charts: Defects, construction and analysis of c-chart.

Unit V **(Lectures 08)**

IS0-9000, Six sigma and TPM: ISO 9000 series; Concept of Six Sigma and its application; Total Productive Maintenance (TPM).

Text Books

1. Sharma D.D *Total Quality Management*,S.Chand
2 LaI H., *Total Quality Management*, Wiley Eastern Limited.
3. Greg Bounds, *Beyond Total Quality Management*, McGraw Hill.

Reference Books

1. Menon, H.G., *TQM in New Product Manufacturing*, McGraw Hill 1992.

Semester VIII

COMPUTER AIDED MANUFACTURING (CAM)

Course Code: EME802	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Content:

Objective: To know about automation, numerical control (NC) machines and computer aided manufacturing systems.

Unit- I **(Lectures 08)**

Automation:

Introduction to CAM; Automated Manufacturing system; Need of automation; Basic elements of automation; Levels of automation; Advantages & disadvantages of automation.

NC Machines: Features of NC Machines; Fundamental of Numerical Control; CNC machines; Direct Numerical Control (DNC); Elements of NC machine tools; Classification of NC machine tools; Advantages; and limitations of NC machine tools; Application of NC system; Factors affecting selection of components for machining on CNC machine tools.

Unit II **(Lectures 08)**

NC Part Programming:

(a) Manual programming; Examples of Drilling; Turning and Milling operations; Canned cycles; Subroutine and macro.

(b) APT programming, Geometry; Motion and additional statements; Macro- statement.

Control of NC Systems: Open and closed loops; Control of point to point systems; Incremental and absolute systems; Control loop in contouring systems; Adaptive control.

Unit III

Group Technology: Introduction, part families, part classification and coding; Machining cells; Benefits of group technology; Computer aided process planning: Retrieval and generative types.

Unit IV **(Lectures 08)**

Computer Integrated Manufacturing System: Introduction to CIM, Elements of CIM, CIM wheel, Benefits of CIM.

Flexible Manufacturing System: Introduction & Component of FMS; Needs of FMS; General FMS consideration; Objectives, types and advantages of FMS, Automatic storage and retrieval system, Automated guided vehicles; Computer aided inspection.

Unit V **(Lectures 08)**

Robotics: Introduction; Basic elements of a robot; Classification of robot; Physical configuration of robot; Basic robot motions; Technical features; Actuators; Sensors; Robot application; Robot applications; economics, Intelligent robots, interfacing of a vision system with a Robot.

Robot programming methods

Text Books

1. Groover Mikell P., *Automation, Production Systems and Computer Integrated Manufacturing*, Prantice Hall
2. Kundra, Rao & Tiwari, *Computer Aided Manufacturing*, Tata McGraw Hill.
3. Koren, *Computer Control of Manufacturing Systems*, McGraw-Hill
4. Adithan M. & Pabla B. S., *CNC Machines*, New Age Publishers

References Books

1. Martin S.J., *NC Machine Tools*, English University Press
2. Groover, *CAD/CAM*, Prantice Hall
3. Chang Tien Chien, *Computer Aided Manufacturing*, Pearson Education
4. Koren Y. *Robotics for Engineer*, McGraw Hill

5. Sinha S.K. *CNC programming*, Golgotia publications.
6. Rao P. N., *CAD/CAM, Principles and Applications*, McGraw Hill.
7. Vajpayee S. Kant, *Computer integrated manufacturing*, Prentice Hall of India
8. Radhakrishnan P., "*Computer Numerical Control*", New Central Book Agency

Semester VIII

UNCONVENTIONAL MANUFACTURING PROCESSES

Course Code: EME803

L	T	P	C
3	0	0	3

Objective: To study about principle of working and applications of various types of unconventional manufacturing processes.

Course Contents

Unit I **(Lectures 08)**

Introduction: Limitations of conventional manufacturing processes; Need of unconventional manufacturing processes and its classification.

Unit II **(Lectures 08)**

Unconventional Machining Process: Principles, working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, Ultrasonic machining, Abrasive jet machining.

Unit III **(Lectures 08)**

Principles, working and application of unconventional machining processes such as Laser beam machining, Electron beam machining, Ultrasonic machining

Unit IV **(Lectures 08)**

Unconventional welding processes: Explosive welding and cladding; Under-water welding; Metalizing; Plasma arc welding/cutting

Unit V **(Lectures 08)**

Unconventional Forming processes: Principles, working and applications of High energy forming processes such as explosive forming, electromagnetic forming, electro-discharge forming, water hammer forming; Explosive compaction.

Text Books

1. Pandey P.C., *Modern Machining Processes,* Tata McGraw Hill

Reference Book

1. Jain V.K., Unconventional Machining, Allied Publishers Pvt. Ltd

Semester VIII

NON- DESTRUCTIVE TESTING

Course Code: EME804

L	T	P	C
3	0	0	3

Course Contents

Unit I **(Lectures 08)**

Introduction: Scope and advantages of N.D.T; Some common NDT methods used: Visual inspection, ringing test and chalk test; Their effectiveness in detecting surface cracks; Bond strength and surface defects.

Unit II **(Lectures 08)**

Common NDT Methods: Dye penetrate tests: Principle, scope, equipment and techniques; Zyglo testing; Magnetic Particle Tests: Scope of test; Principle equipment and technique; DC and AC magnetization; Use of day and wet powders magna glow testing; Interpretations of results.

Unit III **(Lectures 08)**

Radiographic Methods: X-ray radiography: Principle, equipment and methodology; Interpretation of radiographs; Limitations; Gama ray radiography: Principle, equipment, source of radioactive material and technique; Precautions against radiation hazards; Advantage over x-ray radiography methods.

Unit IV **(Lectures 08)**

Ultrasonic Testing Methods: Introduction, Principle of operation; Piezoelectricity; Ultrasonic probes; Cathode; ray oscilloscope techniques; Advantages, limitation and typical applications.

Unit V **(Lectures 08)**

Testing of Castings, Forgings & Weldments: Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples; Case studies; Sample testing in the lab

Text Book

1. Halmsha P., Non-Destructive Testing

Reference Book

1. Metals Handbook, Nondestructive Inspection and Quality Control, American Society for Metals

Semester VIII

MECHATRONICS

Course Code: EME801

L	T	P	C
3	0	0	3

Objective: The objective is to know about robots, mechanical systems, interfacing.

Course Contents

Unit I **(Lectures 08)**

Introduction: Definition, trends, control methods; Stand alone, PC based (Real Time Operating Graphical User Interface, Simulation); Applications: SPM, Robot, CNC, FMS, CIM

Unit II **(Lectures 08)**

Signal Conditioning: Introduction; Hardware; Digital I/O; Analog input: ADC, resolution, speed channels; Filtering noise using passive components; Resistors, Capacitors; Amplifying signals using OP amps; Software; Digital Signal Processing; Low pass, high pass, notch filtering.

Unit III **(Lectures 08)**

Precision Mechanical Systems: Pneumatic actuation systems; Electro-pneumatic actuation systems; Hydraulic actuation systems; Electro-hydraulic actuation systems; Timing belts, Ball screw and nuts; Linear motion guides; Linear bearings, Harmonic transmission; Bearings; Motor drive selection.

Unit IV **(Lectures 08)**

Electronic Interface Subsystems: TTL, CMOS interfacing; Sensor interfacing; Actuator interfacing; Solenoids; Motors isolation schemes: Opto coupling, Buffer IC's, Protection schemes: Circuit breakers, over current sensing, reset able fuses; Thermal dissipation; Power Supply; Bipolar transistors; mosfets.

Unit V **(Lectures 08)**

Electromechanical Drives: Relays and solenoids; Stepper Motors; DC brushed motors; DC brushless motors; DC servo motors; 4-quadrant servo drives; PWM's: Pulse width modulation, Variable Frequency Drives; Vector Drives; Drive System load calculation.

Text Books

1. Bolton W., *Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering*, Pearson Education Press.
2. Singh M.D., Joshi J.G., *Mechatronics*, PHI.

Reference Books

1. Newton C Braga, *Mechatronics Source Book*, Thomson Publications, Chennai.
2. Shanmugam N. & Anuradha, *Mechatronics*, Agencies Publishers.
3. Devdas Shetty, Richard & Thomson , *Mechatronics System Design*, PWS Publishing

Semester VIII

CAM (LAB)

Course Code: EME853

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. To write a part-program for a given job for lathe and running on NC machine.
2. To write a part-program for a job for drilling operation (point-to- point) and running on NC machine.
3. To write a part program for a job for milling operation and running on NC machine.
4. To generate a part program for lathe operation using software.
5. To generate a part program for drilling operation using software.
6. To generate a part program for milling operation using software.
7. To obtain different types of motion for Robots.
8. To identify the differences between conventional lathe machine and NC lathe machine.
9. To generate automatic process plan for a given diagram.
10. To learn the grouping of parts according to Group Technology philosophy.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VIII

UNCONVENTIONAL MANUFACTURING PROCESS (LAB)

Course Code: EME852

L	T	P	C
0	0	3	1.5

LIST OF EXPERIMENTS

1. To prepare a cavity with Abrasive jet machining.
2. To study effect of parameters of EDM on MRR.
3. To study effect of parameters of EDM on surface finish.
4. To prepare hole in mild steel plate on EDM.
5. To prepare a given profile in mild steel plate using Laser beam machining.
6. To prepare a weld joint using Plasma arc welding
7. To cut the given shape in a mild steel plate using Plasma arc machine
8. To prepare a given shape with the help of water hammer forming.
9. To prepare a given job using ultrasonic machining.
10. To compare the surface roughness of the surface prepared on EDM and ultrasonic machining.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VIII

NON- DESTRUCTIVE TESTING LAB

Course Code: EME855	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENTS

1. To determine the approximate temperature of a given component using chalk test.
2. To detect the surface flaw using Die penetrate test.
3. To find the sub-surface defect using Magnetic Particle Inspection
4. To find the number and location of defect using Ultrasonic testing methods
5. To detect the defect with the help of Eddy Current Inspection
6. To determine the internal defects in a welded component using radiography test.
7. To determine the internal defects in a casted component using radiography test.
8 To determine the internal defects in a forged component using radiography test.
9. To find the defects in a given component by visual inspection.
10. To determine the accuracy in a given profile using profile projector.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VIII

MECHATRONICS (LAB)

Course Code: EME851	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

LIST OF EXPERIMENT

1. To measure speed using Inductive pickup/Proximity sensor
2. To measure temperature using thermocouple/thermistor/RTD
3. To measure displacement using LVDT
4. To measure position and velocity encoders
5. To measure angles using capacitive transducer.
6. To control speed of DC motor using PLC.
7. To test Relays using PLC.
8. To identify amplified signals using OP amps
9. Linear actuation of hydraulic cylinder with counter and speed control.
10. Hydrometer rotation with timer and speed control.
11. Sequential operation of pneumatic cylinders.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Semester VIII

PROJECT WORK PHASE-2

Course Code: EME899	**L**	**T**	**P**	**C**
	0	**0**	**18**	**9**

Guidelines

Students should devote themselves to make a project which preferably should be a working model of their thoughts based on their subject of choice.

The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the VI semester.

The project shall be finalized by the students before the start of the VII semester and shall be completed and submitted at least one month before the last teaching day of the VIII semester, date of which shall be notified in the academic calendar.

The assessment of performance of students should be made at least twice in each semester i.e. VII and VIII and each internal assessment shall be for 25 marks. The student shall present the final project live as also using overheads project or power point presentation on LCD to the internal committee as also the external examiner.

The evaluation committee shall consist of faculty members constituted by the college which would be comprised of at-least three members - the Department Coordinator, Class Coordinator and a nominee of the Director. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director.

Not more than three students would form a group for such industrial training/ project submission. The marking shall be as follows.

Internal: 50 marks

By the Faculty Guide -25 marks

By Committee appointed by the Director –25 marks

External: 50 marks

By External examiner appointed by the University – 50 marks