Undergraduate Degree Courses in Engineering & Technology

BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)

General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)/week	0.5 credits 1 credit

B. Structure of Undergraduate Engineering program:

S. No.	Category	Suggested Breakup of Credits (Total 160)
1.	Basic Science Courses (BSC)	20
2.	Engineering Science Courses (ESC)	30
3.	Humanities, Social Science and Management Courses (HSMC)	10
4.	Professional Core Courses (PCC)	60
5.	Professional Elective Courses (PEC)	18
6.	Open Elective Courses (OEC)	14
7.	Seminar	2
8.	Project	10
9.	Internships in industry	8
10.	Mandatory Courses (MC)	NC
	Total Credits	172

C. Course code and definition:

Course code	**Definitions**
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses

**Minor variation is allowed as per need of the respective disciplines.*

Table: Structure of B.E. Program

S. No.	Courses		Credits							Actual Credits
		Total Credits	I & II	III	IV	V	VI	VII	VIII	
1.	Basic Science Courses (BSC)	20	17	4						21
2.	Engineering Science Courses (ESC)	30	19	8	4					31
3.	Humanities, Social Science and Management Courses (HSMC)	10	4				3	3		10
4.	Professional Core Courses (PCC)	60		8	18	13	19			58
5.	Professional Elective Courses (PEC)	18				4		8	7	19
6.	Open Elective Courses (OEC)	14				3		3	8	14
7.	Seminar	2						2		2
8.	Project	10						3	7	10
9.	Internships in industry	8		2		2		3		7
10	Mandatory Courses (MC)	NC								
	Total Credits	172	40	22	22	22	22	22	22	172

B.E II Year (Semester-III) Mechanical Engineering
Course Structure & Evaluation Scheme

S No.	Category	Code	Subject	Periods			Sessional Marks			End Semester Marks		Total	Credit
				L	T	P	CT	TA	Total	TE	PE		
1	BSC	BSC301	MATH III	3	1	0	30	10	40	60	-	100	4
2	PCC	BME301	STRENGTH OF MATERIALS	3	1	0	30	10	40	60	-	100	4
3	ESC	BME302	MATERIAL SCIENCE	3	0	0	30	10	40	60	-	100	3
4	PCC	BME303	ENGINEERING THERMODYNAMICS	3	1	0	30	10	40	60	-	100	4
5	ESC	BME304	MACHINE DRAWING	2	0	0	30	10	40	60	-	100	2
6	MC	BMC301	ENVIRONMENTAL & ECOLOGY	2	0	0	30	10	40	60	-	100	0
7	ESC	BME352	MATERIAL SCIENCE LAB	0	0	2	20	20	40	-	60	100	1
8	ESC	BME354	MACHINE DRAWING LAB	0	0	4	20	20	40	-	60	100	2
9	Project (Internship)	BME355	MINI PROJECT/ INTERNSHIP ASSESMENT*	0	0	2	-	-	100	-	-	100	2
			Total	16	3	8	220	100	420	360	120	900	22

* The Mini Project or Internship (3-4 weeks) conducted during summer break after II semester & will be assessed during III semester.

B.E II Year (Semester-IV) Mechanical Engineering
Course Structure & Evaluation Scheme

S No.	Category	Code	Subject	Periods			Sessional Marks			End Semester Marks		Total	Credit
				L	T	P	CT	TA	Total	TE	PE		
1	ESC	BME401	MEASUREMENT & METROLOGY	3	0	0	30	10	40	60	-	100	3
2	PCC	BME402	ENGINEERING FLUID MECHANICS	3	1	0	30	10	40	60	-	100	4
3	PCC	BME403	MANUFACTURING SCIENCE-I	3	0	0	30	10	40	60	-	100	3
4	PCC	BME404	THEORY OF MACHINES-I	3	1	0	30	10	40	60	-	100	4
5	PCC	BME405	APPLIED THERMODYNAMICS	3	1	0	30	10	40	60	-	100	4
6	MC	BMC402	HUMAN VALUES AND PROFESSIONAL ETHICS	2	0	0	30	10	40	60	-	100	0
7	ESC	BME451	MEASUREMENT & METROLOGY LAB	0	0	2	20	20	40	-	60	100	1
8	PCC	BME452	ENGINEERING FLUID MECHANICS LAB	0	0	2	20	20	40	-	60	100	1
9	PCC	BME453	MANUFACTURING SCIENCE I LAB	0	0	2	20	20	40	-	60	100	1
10	PCC	BME455	APPLIED THERMODYNAMICS LAB	0	0	2	20	20	40	-	60	100	1
			Total	17	3	8	260	140	400	360	240	1000	22

B.E III Year (Semester-V) Mechanical Engineering
Course Structure & Evaluation Scheme

S No.	Category	Code	Subject	Periods			Sessional Marks			End Semester Marks		Total	Credit
				L	T	P	CT	TA	Total	TE	PE		
1	DE-ME	DE-ME 501	MANUFACTURING SCIENCE – II (PEC - I)	3	0	0	30	10	40	60	-	100	3
2	PCC	BME502	INTERNAL COMBUSTION ENGINE	3	0	0	30	10	40	60	-	100	3
3	PCC	BME503	THEORY OF MACHINES-II	3	1	0	30	10	40	60	-	100	4
4	PCC	BME504	MACHINE DESIGN –I	3	1	0	30	10	40	60	-	100	4
5	OE-ME	OE-ME 505	INDUSTRIAL ENGINEERING & AUTOMATION (OEC - I)	3	0	0	30	10	40	60	-	100	3
6	HSMC	BMC501	OCCUPATIONAL HEALTH AND SAFETY	2	0	0	30	10	40	60	-	100	0
7	DE-ME	DE-ME 551	MANUFACTURING SCIENCE- II LAB	0	0	2	20	20	40	-	60	100	1
8	PCC	BME552	INTERNAL COMBUSTION ENGINE LAB	0	0	2	20	20	40	-	60	100	1
9	PCC	BME553	THEORY OF MACHINES LAB	0	0	2	20	20	40	-	60	100	1
10	Project (Internship)	BME554	INTERNSHIP	0	0	4	-	-	100	-	-	100	2
			Total	17	2	10	240	120	460	360	180	1000	22

*** The Internship (04 weeks) conducted during summer break after IV semester and will be assessed during V semester.**

B.E III Year (Semester-VI) Mechanical Engineering
Course Structure & Evaluation Scheme

S No.	Category	Code	Subject	Periods			Sessional Marks			End Semester Marks		Total	Credit
				L	T	P	CT	TA	Total	TE	PE		
1	PCC	BME601	MACHINE DESIGN - II	3	1	0	30	10	40	60	-	100	4
2	PCC	BME602	FLUID MACHINERY	3	1	0	30	10	40	60	-	100	4
3	PCC	BME603	HEAT AND MASS TRANSFER	3	1	0	30	10	40	60	-	100	4
4	PCC	BME604	AUTOMOBILE ENGINEERING	3	0	0	30	10	40	60	-	100	3
5	HSMC	BHS601	ECONOMICS FOR INDUSTRY	3	0	0	30	10	40	60	-	100	3
6	PCC	BME651	MACHINE DESIGN - II LAB	0	0	2	20	20	40	-	60	100	1
7	PCC	BME652	FLUID MACHINERY LAB	0	0	2	20	20	40	-	60	100	1
8	PCC	BME653	HEAT AND MASS TRANSFER LAB	0	0	2	20	20	40	-	60	100	1
9	PCC	BME654	AUTOMOBILE ENGINEERING LAB	0	0	2	20	20	40	-	60	100	1
			Total	15	3	8	230	130	360	300	240	900	22

B.E IV Year (Semester-VII) Mechanical Engineering
Course Structure & Evaluation Scheme

S No.	Category	Code	Subject	Periods			Sessional Marks			End Semester Marks		Total	Credit
				L	T	P	CT	TA	Total	TE	PE		
1	DE-ME	DE-ME 701	PROFESSIONAL ELECTIVE COURSE - II	3	0	0	30	10	40	60	-	100	3
2	DE-ME	DE-ME 702	PROGRAM ELECTIVE COURSE – III	3	0	0	30	10	40	60	-	100	3
3	HSMC	BHS-703	Entrepreneurship	3	0	0	30	10	40	60	-	100	3
4	OE-ME	OE-ME 701	OPEN ELECTIVE COURSE- II	3	0	0	30	10	40	60	-	100	3
5	DE-ME	DE-ME 751	PROFESSIONAL ELECTIVE COURSE - II LAB	0	0	2	20	20	40	-	60	100	1
6	DE-ME	DE-ME 752	PROGRAM ELECTIVE COURSE – III LAB	0	0	2	20	20	40	-	60	100	1
8	Project (Internship)	BME753	INTERNSHIP *	0	0	4	20	20	40	-	60	100	3
9	SEMINAR	BME754	SEMINAR #	0	0	4	20	20	40	-	60	100	2
10	Project (Internship)	BME755*	MINOR PROJECT #	0	0	6	-	150	150	-	150	300	3
			Total	12	0	18	200	270	470	240	390	1100	22

*** Internship (04 - 06 weeks) conducted during summer break after VI semester and will be assessed during VII semester through internal evaluation.**
 # Internal evaluation.

B.E IV Year (Semester-VIII) Mechanical Engineering
Course Structure & Evaluation Scheme

S No.	Category	Code	Subject	Periods			Sessional Marks			End Semester Marks		Total	Credit
				L	T	P	CT	TA	Total	TE	PE		
1	DE-ME	DE-ME 801	(PROGRAM ELECTIVE COURSE-IV)	3	0	0	30	10	40	60	-	100	3
2	DE-ME	DE-ME 802	(PROGRAM ELECTIVE COURSE-V)	3	0	0	30	10	40	60	-	100	3
3	OE-ME	OE-ME 801	OPEN ELECTIVE COURSE III	3	1	0	30	10	40	60	-	100	4
4	OE-ME	OE-ME 803	OPEN ELECTIVE COURSE IV	3	1	0	30	10	40	60	-	100	4
5	DE-ME	DE-ME 851	(PROGRAM ELECTIVE COURSE-IV) LAB	0	0	2	20	20	40	-	60	100	1
6	Project (Internship)	BME854	MAJOR PROJECT *	0	0	14	-	150	150	-	150	300	7
			Total	12	2	16	140	210	350	240	210	700	22

***External evaluation**

List of Program Elective and Open Electives Courses

B.Tech. (Mechanical Engineering)

DEPARTMENTAL ELECTIVE - ME I **4[3-0-2]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	DE-ME -505	Rapid Prototyping & Rapid Tooling	3	0	2	4
2.	DE-ME -506	Tribology	3	0	2	4

DEPARTMENTAL ELECTIVE - ME II **4[3-0-2]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	DE-ME -701	Mechanical Vibration	3	0	2	4
2.	DE-ME -702	Finite Element Method	3	0	2	4
3.	DE-ME -703	Advanced Welding Technology	3	0	2	4

DEPARTMENTAL ELECTIVE - ME III **4[3-0-2]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	DE-ME -704	Refrigeration and Air Conditioning	3	0	2	4
2.	DE-ME -705	Design & Analysis of Heat Exchangers	3	0	2	4
3.	DE-ME -706	Turbo Machines	3	0	2	4

DEPARTMENTAL ELECTIVE - ME IV **4[3-1-0]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	DE-ME -801	Computer Aided Design and Manufacturing	3	0	2	4
2.	DE-ME -802	Computational Fluid Dynamics	3	0	2	4
3.	DE-ME -803		3	0	2	4

DEPARTMENTAL ELECTIVE - ME V **3[3-0-0]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	DE-ME -804	Un Conventional Manufacturing	3	0	0	3
2.	DE-ME -805	Experimental Stress Analysis	3	0	0	3
3.	DE-ME -806	Reliability and Maintenance	3	0	0	3
4.	DE-ME -807		3	0	0	3

OPEN ELECTIVE - ME I **3[3-0-0]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	OE-ME -501	Industrial engineering & Automation	3	0	0	3
2.	OE-ME -502	Total Quality Management	3	0	0	3
3.	OE-ME -503	Production Planning and Control	3	0	0	3
4.	OE-ME -504	Value Engineering	3	0	0	3

OPEN ELECTIVE - ME II **3[3-0-0]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	OE-ME -701	Non-Conventional Energy Resources	3	0	0	3
2.	OE-ME -702	Robotics	3	0	0	3
3.	OE-ME -703	Mechatronics	3	0	0	3

OPEN ELECTIVE - ME III **4[3-1-0]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1	OE-ME -801	Operation Research	3	1	0	4
2	OE-ME -803	Composite Materials	3	1	0	4
3	OE-ME -804	Nanotechnology	3	1	0	4
4	OE-ME -805	Non-Destructive Evaluation	3	1	0	4
5	OE-ME -806	Introduction to Micro Machining	3	1	0	4

OPEN ELECTIVE - ME IV **4[3-1-0]**

Sr. No.	Subject Code	Course Title	L	T	P	Credits
1.	OE-ME -803	Power Plant Engineering	3	1	0	4
2	OE-ME -804	Optimization Methods in Engineering	3	1	0	4
3	OE-ME -805		3	1	0	4
4.	OE-ME -806		3	1	0	4

MATHEMATICS-III

COURSE CODE: BSC-301

III SEMESTER (ECE, CSE, EE, ME, CE)

L T P C

Course Details: **3 1 0 4**

Unit – I:

Fourier Transform :

Fourier integral, conditions of convergence, Fourier sine and cosine integrals, complex form, applications, Inversion formula for Fourier transform, operational properties. Discrete and Fast Fourier transform. Applications of Fourier transform to solve boundary value problems.

Unit- II:

Functions of a Complex Variable and Conformal mapping:

Limit, Continuity, Differentiability and Analyticity of functions of a complex variable, Cauchy-Riemann equations, Harmonic functions, Complex functions as mappings, Linear Transformation, Inverse transformation, Bilinear Transformations, Conformal Mapping & applications.

Unit- III:

Integration of Complex Functions:

Contour integrals and evaluations, Cauchy's Theorem, Cauchy's Integral Formulae, Liouville's theorem, Convergence of power series, Taylor series, Laurent series, Zeros and Singularities of a complex function, Residues and Residue theorem, Evaluation of definite and improper integrals.

Unit- IV:

Curve- Fitting & Probability:

Curve-fitting: method of least- squares, Normal equations, Normal equation in case of straight line, Fitting a straight line, Polynomial, non-linear and exponential curves, Change of origin. Probability: Basics of probability, random variables, Expectation, Baye's theorem and probability distributions, Binomial, Poisson and Normal distributions.

Unit- V:

Statistical Methods:

Sampling Theory, Parameters of Statistics, Tests of hypothesis and significance, z-test, t-test, $\chi 2$- test ,Goodness of fit test, Time series analysis, Index numbers, Quality control chart and acceptance sampling, Introduction to design of experiments, Forecasting models.

Books Recommended:

1.R.K. Jain & S.R.K. Iyengar; Advanced Engineering Mathematics, Narosa Publishing House, 2002.
2.Erwin Kreyszig; Advanced Engineering Mathematics, John Wiley & Sons, 1962.
3.R.V. Churchill and J.L. Brown, Complex Variables and Applications, McGraw Hill, 1990.
4.B.S.Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
5.J.H. Mathews and R.W. Howell, Complex analysis for Mathematics and Engineering, 3rd Ed. Narosa, 1998.

Course Objective :

1. Fourier transform is useful in study of frequency response of filter, In the theories of communication engineering, wave propagation, transmission lines and solution of boundary value problems. Discrete and fast fourier transform are used in signal analysis.Fourier transform is also used in electromagnetic field, medical application and in error control coding. Discrete analysis playes an important role in the development of communication engineering.
2. Complex Analysis is the study of analytic functions. It is an elegant and powerful method useful in the study of heat flow, fluid dynamics and electrostatics. Two-dimensional potential problem can be solved using analytic functions.
3. The other important applications of this theory is to evaluate many real integrals which can not be evaluated by usual methods.
4. In many engineering problems to establish a linear, quadratic, cubic or exponential relationship between two quantities, it is required two or more unknowns in such a way that these follow whole data, such situations occur in the problems of curve fitting etc.
5. In analyzing and interpreting data probability theory involves an element of "chance" or uncertainty, probability theory plays a vital role in the theory and application of statistics. Probability distribution is the theoretical counterpart of frequency distribution and plays an important role in the theoretical study of populations

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Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Solve the Fourier Transform of function.
2. Compute poles & zeros.
3. Evaluate the real & complex integrals with the help of Cauchy's Residue Theorem.
4. Utilize curve fitting techniques for data representations and computation in engineering analysis.
5. Use Binomial, Poisson & Normal Distribution to solve statistical problems.

STRENGTH OF MATERIALS (BME-301)

	Type	L	T	P	Credits
	ESC	3	1	0	4

Prerequisite: Students must have knowledge of engineering mechanics basic engineering applications.

Course Content:

Unit I

Compound stress and strains: Introduction, normal stress and strain, shear stress and strain, stresses on inclines sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional states of stress & strain, equilibrium equations, generalized Hook's law, theories of failure.

Unit II

Thin cylinders & spheres: Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

Unit III

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columns in mechanical equipment and machines.

Unit IV

Stresses in Beams: Pure Bending**,** normal stresses in beams, shear stresses in beams due to transverse and axial loads, composite beams.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams, Castigliano's Theorem

Torsion: Torsion, combined bending & torsion of solid & hollow shafts, torsion of thin walled tubes.

Unit V

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

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

Textbooks:

1. Strength of Materials by R.K.Bansal
2. Strength of Materials by R.K. Rajput

Reference books:

1. Engineering Mechanics by Irving H. Shames, Prentice-Hall
2. Mechanics of Materials by E.P.Popov, PHI
3. Strength of Materials by Ryder
4. Mechanics of Material by Gere & Timoshenko
5. Engineering Mechanics by A. Nelson
6. Engineering Mechanics by U.C. Jindal
7. Engineering Mechanics Statics by J.L. Meriam & L.G.Kraige

Course Objectives:

The objective of this subject is elaborate on the knowledge of engineering mechanics (statics). Understanding the stresses and Deformations developed in mechanical and structural elements under different loads.

MATERIAL SCIENCE (BME-302)

Type	L	T	P	Credits
ESC	3	1	1	5

Prerequisite: Fundamental knowledge of Intermediate level physics and chemistry.

Course Content:

Unit-I

Introduction: Historical perspective, importance of materials. Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

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

Mechanical properties and Testing : Stress strain diagram, Ductile & brittle material, Stress VS strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testings such as Strength testings, Hardness testing, Impact testings, Fatitue testing Creep testing, Nondestructive testing (NDT)

Microstructural Exam : Microscope principle and methods. Preperation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of varuious metals & alloys such as Mild steel, CI, Brass.

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

Unit-III

Ferrous materials : Iron and steel manufacture, furnaces. Various types of carbon steels, alloy steels and cast irons, its properties and uses.

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

Non-Ferrous metals and alloys : Non-ferrrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys.

Unit-IV

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

Electric properties : Energy band concept of conductor, insulator and semi-conductor. Intrinsic & extrinsic semi-conductors. P-n junction and transistors. Basic devices and its application. Diffusion of Solid. Super conductivity and its applications. Messier effect. Type I & II superconductors. High Te superconductors.

Unit-V

Ceramics : Structure types and properties and applications of ceramics. Mechanical/Electrical behaviour and processing of Ceramics.

Plastics : Various types of polymers/plastics and its applications. Mechanical behaviors and processing of plastics. Future of plastics.

Other materials : Brief description of other material such as optical and thermal materials concrete, Composite Materials and its uses.

Performance of materials in service: Brief theoretical consi-deration of Fracture,

Fatigue, and Corrosion and its control.

Text books:

1. Material Science & Engineering by W.D. Callister, Jr., Addison-Wesley Pub.Co.
2. Engineering Materials, Vol. I &II by Ashby & Jones, Pergemon Press.
3. Material Science by V Raghvan, Pretice Hall of India.
4. Material Science by K M Gupta.

Reference books:

1. Elements of Material Science & Engineering by Van Vlack, John Wiley & Sons
2. Material Science by V. Raghvan, Prentice Hall of India.
3. Elements of Material Science & Engineering by Van Vlash John Wiley & Sons.
4. Science of Materials Engineering by Srivastava, Srinivasan Newage.

MATERIAL SCIENCE LAB (BME 352)

Any 8 experiments out of following:

1. To identify different kind of materials by observation.
2. To prepare specimen for metallographic examination.
3. To perform Jominy End Quench Test to determine hardenability of steel.
4. Making a plastic mould for small metallic specimen.
5. Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
6. Grain Size determination of a given specimen.
7. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, cooper etc.)
8. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
9. Faradays law of electrolysis experiment.
10. Study of HCP FCC BCC and
11. Study of corrosion and its effects.
12. Study of microstructure of welded component and HAZ. Macro & Micro Examination.
13. To determine Rockwell Hardness of given test specimen.
14. To determine Brinell Hardness of given test specimen.
15. To determine Vicker's hardness of given test specimen.
16. To perform tensile test on given specimen using UTM.
17. To perform Compression Test on given specimen using UTM.
18. To perform Izod & Charpy Impact test.
19. To perform Torsion test on given specimen.
20. To perform fatigue test on given specimen.
21. To perform Creep test.

Course Objectives:

The objective of the subject is to know the fundamental science and engineering principles relevant to materials. To understand the structure, properties, processing and performance of the principal classes of materials.

ENGINEERING THERMODYNAMICS (BME-303)

Type	L	T	P	Credits
PCC	3	1	1	5

Prerequisite: Physics of Class XII

Course Content:

Unit – I:

Fundamental Concepts and Definitions: Introduction and definition of thermodynamics, Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Pressure and its measurement, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasistatic process, Energy and its forms, Work and heat, Gas laws, Ideal gas.

Zeroth law of thermodynamics: Zeroth law of thermodynamics, Temperature and its measurement, Temperature scales.

First law of thermodynamics: Thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics, PMM-I.

Unit – II:

Second law of Thermodynamics: Devices converting heat to work, Thermal reservoir, Heat Source, Heat Sink, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries, thermodynamic temperature scale, PMM-II.

Entropy : Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Unit – III

Properties of steam and thermodynamics cycles: Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier charts, Dryness factor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle, Brayton cycle.

Unit – IV

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function, Availability analysis.

Thermodynamic relations: Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron Equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic & Isothermal compressibility; Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases.

Unit - V

Fuels and Combustion: Combustion analysis, Heating Values and its measurement, Air requirement, Air/Fuel ratio, Standard heat of Reaction and effect of temperature on standard heat of reaction, heat of formation, Chemical Equilibrium, adiabatic flame temperature, Exhaust gas analysis.

Textbooks:

1. Basic and Applied Thermodynamics by PK Nag, MCGRAW HILL INDIA.
2. Fundamentals of Thermodynamics by Sonntag, Van Wylen, Borgnakke, JohnWiley & Sons
3. Thermodynamics : An engineering approach by Cengel & Boles, Mc Graw Hill

Reference books:

1. Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
2. Thermodynamics by J.P. Holman, McGraw Hill.

Course Objective: The objective of this course is to understand and apply knowledge of Basic thermodynamics for the design and development of systems for thermal application.

MACHINE DRAWING (BME-304)

Type L T P Credits

ESC 2 0 2 3

Prerequisite: Basic knowledge of Engineering Graphics and Design.

Course Content:

Unit-I

Review of engineering graphics, IS & ISO codes, fit and tolerance, Surface Finish , Design of Simple machine elements; (Threaded fasteners, locking arrangements, Guides) of some assemblies.

Unit-II

Riveted Joints: Introduction, Rivets and Riveting, Rivet Heads, Classification of Riveted Joints and Welded Joint. **Keys and Cotters:** Keys, Cotter joints. Shaft and Couplings.

Unit-III

Screwed (Threaded) fastners: Introduction, Screw thread nomenclature, Forms of threads, Thread series, Thread designation. Representation of threads, Bolted joints, locking arrangements for nuts, Foundation bolts.

Unit-IV

Free hand sketching: Introduction, Need for free hand sketching, Free hand of sketching of some threaded fasteners and simple machine components.

Unit- V

Assembly drawing & part list; Ball bearing, shaft, crane hook, Plummer block, stop valve, tailstock, engine block assembly.

Computer aided drawing of machine components, Valves etc.'

A drawing Project on reverse engineering.

Text/Reference Books:

Textbooks:

1. A Text Book of Machine Drawing by Lakshmi narayanan .v. & Marhur, M. L Jain Brothers' N. Delhi.
2. Design of Machine Elements by V. B. Bhandari TMH N. Delhi.

Reference Books:

1. Machine Drawing by Siddheswar, N. , Kannaiah. P. & Sastry V.V.S TMH N. Delhi.
2. Mechanical Engg. Design by Shigley & Mische Mc Graw Hill

Course Objective:

By going through the contents students will be able to

1. Understand the drawing and develop capacity to represent any metal/object with help of picture.
2. Produce orthographic drawing of different machine parts.
3. Develop skill to produce assembly drawing.
4. Develop skill to produce detailed drawing of machine parts from assembly drawing.

MACHINE DRAWING LAB (BME-354)

1. Drawing sheet(1 sheet) – Scales, Types of Lines, Section Line, Dimensioning.
2. Drawing sheet(1 sheet) – Orthographic Projection in First and Third Angle, Isometric Projection.
3. Drawing sheet(2 sheet) –Screwed Fasteners
4. Drawing sheet(1 sheet) – Keys and Cotters and Pin joints.
5. Drawing sheet(1 sheet) – Shaft Coupling.
6. Drawing sheet(1 sheet) – Riveted joint
7. Drawing sheet(3 sheet) – Assembly Drawing.

ENVIRONMENT AND ECOLOGY (MC 301/ MC 401) 2 0 0 0

L T P C

UNIT-I: Nature of Environment Introduction to Environmental Science - Definition and scope and need for public awareness Ecosystems Concept, structure and functions, restoration of damaged ecosystems Biodiversity – Definition, description at national and global level, threats and conservation Natural Resources - Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle. Conventional and Non-conventional Energy Sources – fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel

UNIT-II: Impact of Human Activity on Environment Human Population and Environment – Population growth, population explosion and migration; Impact of farming, housing, mining, transportation and industrial growth Social Issues Related to Environment– Sustainable development, urban problems (related to water and energy conservation and waste management), resettlement and rehabilitation Environmental ethics

UNIT-III: Environmental Changes and Human Health Environmental Pollution–Definition, causes and effects, control measures for water, air, soil, marine, land, noise, thermal pollution, Climate change– Greenhouse effect and global warming, acid rain, ozone layer formation and depletion Impact on human health – water and air borne diseases, diseases induced by residual impurities in drinking water (fluoride and arsenic); Toxic wastes and carcinogens; Nuclear hazards

UNIT- IV: Environmental Protection through Assessment and Education Indicators and Impact Assessment – Bio-indicators, Natural disasters and disaster management, Impact assessment through inventorying and monitoring Environmental Protection– Role of individuals, organizations and government in pollution control Laws, Conventions and Treaties–National legislation, issues in the enforcement of environmental legislation, initiatives by non- governmental organizations, global efforts in environmental protection Environmental education–women and value education Recommended

Textbook: Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India.

Recommended Reference Books:

1. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
2. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, McGrawHill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology, Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill

MEASUREMENT AND METROLOGY (BME-401)

	Type	L	T	P	Credits
	ESC	3	0	1	4

Prerequisite: Basic knowledge of Engineering physics, Fundamental Concept of Workshop Practice, Engineering thermodynamics etc.

Course Content:

Unit-I

Mechanical Measurements: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors. **Sensors and Transducers:** Types of sensors, types of transducers and their characteristics. **Signal transmission and processing:** Devices and systems, Signal Display & Recording Devices.

Unit-II

Time related measurements: Counters, stroboscope, frequency measurement by direct comparison, Measurement of displacement. **Measurement of pressure:** Gravitational, directing acting, elastic and indirect type pressure transducers, Measurement of very low pressures. **Strain measurement:** Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration. **Measurements of force and torque:** Different types of load cells, elastic transducers, pneumatic & hydraulic systems. **Temperature measurement:** By thermometers, bimetallic, thermocouples, thermistors and pyrometers. **Vibration:** Seismic instruments, vibration pickups and decibel meters, vibrometers accelerometers.

Unit-III

Metrology and Inspection: Standards of linear measurement, line and end standards. Limit, fits and tolerances. Interchangeability and standardization. Linear and angular measurements devices and systems. **Comparators:** Sigma, Johansson's Microkrator. Limit gauges classification, Taylor's Principle of Gauge Design.

Unit-IV

Measurement of geometric forms like straightness, flatness, roundness, Tool makers microscope, profile project autocollimator, Interferometry : principle and use of interferometry, optical flat. Measurement of screw threads and gears, Surface texture : quantitative evaluation of surface roughness and its measurement.

Unit-V

Introduction: Concept of Automatic Controls–open loop & closed loop systems. Servomechanisms. Block diagrams, transfer functions. Applications of Laplace- Transform in control systems with simple examples / numerical. **Representation of control components & Systems:** Translation & rotational mechanical components, series & parallel combinations, cascade system, analogous system. **Controllers:** Brief introduction to Pneumatic, hydraulic and electric controllers.

Textbooks:

1. Engineering Metrology by R K Jain, Khanna Publishers.
2. Engineering Measurement by R K Jain, Khanna Publishers
3. Engineering Metrology by I C Gupta, Dhanpat Rai & Sons, New Delhi, 1994.
4.

References 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.
4. Hume K.J., "Engineering Metrology", MacDonald and Co. 1963.
5. Sirohi, "Mechanical Measurement" New Age Publishers.

MEASUREMENTAND CONTROL LAB (BME 451)

Any 7 experiments out of followings:

1. To measure the taper of a given shaft.
2. To measure the dimensions of a gear tooth using vernier calipers.
3. Study of slip gauges.
4. Study of limit gauges.
5. To measure out of roundness of a shaft.
6. To perform the concentricity test on a spur gear.
7. To calibrate a dial gage.
8. To study and use of autocollimator.
9. To determine the speed of pedestal fan using stroboscope.
10. To calibrate and measure temperature using Thermocouple.

Course Objectives:

The objective of the subject is to know the fundamentals of measurement, measuring instruments and controls.

ENGINEERING FLUID MECHANICS (BME-402)

Type	L	T	P	Credits
PCC	3	1	1	5

Prerequisite: Basic knowledge of engineering physics.

Course Content:

UNIT-I

Introduction: Scope and importance of Fluid Mechanics, Physical properties of fluids ,viscosity-Newton's law of viscosity, Newtonion and non-Newtonion fluids, Compressibility, Surface tension and Capillarity, vapours pressure), Rheological classification of fluids, Ideal fluid, Real Fluid.

Fluid Statics: Pressure, Pascal's Law, Hydrostatic Law, Pressure measurement devices – Piezometer, manometers, Mechanical gauges, Forces on plane and curved surfaces, Centre of pressure and pressure diagram, Buoyancy, Metacentre, Stability of Submerged and floating bodies, Fluid masses subjected to accelerations.

UNIT-II

Fluid Kinematics: Concept of control volume, Velocity and acceleration of fluid Particle, Lagrangian and Eulerian approach, Classification of fluid flow, Streamlines, Path lines and Streak lines, Equipotential lines, Stream Function and Velocity Potential, Flow Net, Continuity equation, Rotation, Vorticity and Circulation, Free and Forced vortex motion.

UNIT-III

Fluid Dynamics: Flow characteristics, the Reynolds Transport Theorem, application of continuity equation, energy equation and momentum equation. Forces acting on fluid in motion, Euler's equation, Bernoulli's Theorem and applications – Pitot Tube, Venturimeter, Orificemeter, Orifices and Mouthpieces.

Dimensional Analysis: Units and Dimensions, Dimensional analysis, Rayleigh's method, Buckingham's Π theorem, Non-dimensional numbers & their significance. Hydraulic Similitude and Model Studies: Model and prototype; Similitude; Geometric, Kinematic and Dynamic similarity; Model Laws; Un-distorted model studies.

UNIT-IV

Viscous Flow: Laminar flow: Reynold's Experiment, Navier's Stokes' Equation, Coutte & Hagen Poisulle's Equation for viscous flow between parallel plates and circular pipes, Power absorbed in in viscous flow, Stokes law; Darcy's Law; Transition from laminar to turbulent flow. Introduction to Turbulant flow: Velocity distribution and Shear stresses in turbulent flow, Prandtl mixing length theory, Introduction to Moody's Chart.

Losses in pipes: Darcy - Wiesbach Equation, factors affecting friction, Minor Losses in pipes, Concept of HGL & TEL. Concept of equivalent length of pipe for different pipe fittings, Equivalent diameter of pipes, Hydraulic Power, transmission by pipe, Pipes in parallel, Series, Syphon, two reservoir problems, Water hammer in pipes, Surge tanks - function, location and uses, Pipe network.

Unit-V

Laminar Boundary layer theory: Concept, Boundary layer along thin plate- Characteristics, Laminar, Turbulent Boundary Layer, laminar sub layer, Various Thicknesses- Nominal, displacement, Momentum, Energy, Hydraulically smooth and Rough boundaries, Separation of Boundary layer, control of Separation.

Forces on submerged bodies: Introduction to Drag and Lift on submerged bodies (like Flat plates, Sphere, Cylinder, aerofoil), stokes law, Drag and Lift coefficients. Introduction to Computational Fluid Dynamics (CFD)

Text Book:

1.Intro To Fluid Mechanics & Fluid Machines, Som and Biswas, Tata McGraw Hill Pvt Ltd.

2.Fluid Mechanics and hydraulics machines, Sukumar pati, Tata McGraw Hill Pvt Ltd.

3.A Textbook of Fluid Mechanics and Hydraulic Machines, R.K. Bansal,Laxmi Publications

Reference Book:

1.Fluid Mechanics, White,Tata McGraw Hill

2.Fluid Mechanics, Cengel&Cimbala, Tata McGraw-Hill

3.Introduction to Fluid Mechanics, Fox and Pritchard, Seventh Edition. Wiley India,

4.Fluid Mechanics and Hydraulic Machines: Problems and Solutions,K.Subramanya, McGraw Hill Education

Course Objective:

To understand and use differential equations to determine pressure and velocity variations in internal and external flow. To understand the conservation principles of mass, momentum, and energy for fluid flow. To learn to use equations in combination with experimental data to determine losses in flow systems. To learn to use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity. To apply the basic applied-mathematical tools that support fluid mechanics.

ENGINEERING FLUID MECHANICS LAB (BME-452)

Objectives:

1. To understand the principles and performance characteristics of flow and thermal devices.
2. To know about the measurement of the fluid properties.

List of Experiments:(At least 8 of the following)

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

MANUFACTURING SCIENCE I (BME-403)

Type	L	T	P	Credits
ESC	3	0	1	4

Prerequisite: Course on Workshop Technology

Course Content:

Unit-I

Introduction: Importance of manufacturing towards technological and social economic development. Classification of manufacturing processes.

Casting: Basic principle of casting processes. Types of patterns and allowances. Types and properties of moulding sand. Introduction and Design of Gating system. Risering design. Solidification of casting. Types of casting- Die Casting, Centrifugal casting. Investment casting, CO_2 casting, casting defects & remedies ,Cupola furnace.

Unit-II

Metal Forming Processes: Nature of plastic deformation-Hot working and cold working.

Rolling: Principle, types of rolling mills, rolling load calculation, rolling defects.

Forging: Types of forging operations-smith, drop, press and machine forging. Forging load estimation. Forging defects.

Extrusion: Principle, Hot extrusion, Cold extrusion processes. Extrusion defects. Tube drawing and wire drawing: Introduction and defects.

Unit-III

Sheet Metal working: Introduction to shearing operations, Blanking, piercing, Drawing, Spinning, Bending, Embossing and coining processes Presses and their classification, die and punch assembly, sheet metal die- progressive, compound and combination dies.

Unit-IV

Welding: Principle of welding, classification of welding, HAZ, Arc welding concept, Arc blow, **Arc welding operation:** Tungsten inert gas welding, gas metal arc welding, submerged arc welding. Resistance welding and its types, Gas welding- oxy acetylene welding, Soldering and Brazing. Residual stresses in welding and its remedies, welding defects.

Unit-V

Powder Metallurgy:

Introduction, production of metallic powder, processing methods-mixing and blending, compacting, sintering, secondary operations, Advantages of powder metallurgy.

Text books:

1. Manufacturing Technology by P.N. Rao., TMH.
2. Manufacturing Science by Ghosh and Mallik.
3. Production Engg. Science by P.C. Pandey.

Reference books:

1. Production Technology by R.K. Jain
2. Materials and Manufacturing by Paul Degarmo.
3. Manufacturing Engineering & Technology by Kalpakjian, Pearson Pub.

Course Objectives:

The course aims at understanding of fundamental manufacturing process such as casting, forming, sheet metal forming, welding and powder metallurgy.

MANUFACTURING SCIENCE - I LAB (BME 453)

Any 8 experiments out of following:

1. Design of pattern for a desired casting (containing hole)
2. Pattern making
3. Making a mould (with core) and casting.
4. Injection moulding with plastics
5. Hand forging processes
6. Forging - power hammer study & operation
7. Tube bending with the use of sand and on tube bending m/c.
8. Press work experiment such as blanking/piercing, washer, making etc.
9. Bending & spring back.
10. Jigs & Fixture experiment

Course Objectives:

The course aims at understanding of fundamental manufacturing process such as casting, forming, sheet metal forming and powder metallurgy.

THEORY OF MACHINES-I (BME-404)

Type	L	T	P	Credits
PCC	3	1	1	5

Prerequisite: A course on Engineering Thermodynamics and Engineering Drawing.

Course Content:

UNIT I

Introduction: Links-types, Kinematics pairs-classification, Constraints-types, Degree 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

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

Kinematics Synthesis of Planar Linkages: Movability of four bar linkages, Grashoff'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

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

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.

Textbooks:

1. Theory of Machines by S. S. Rattan
2. Theory of Machines by J E Shingley

References Books

1. Theory of machines by Thomas Bevan.
2. Theory of machines and mechanisms by Ghosh & Mallik
3. Theory of machines and mechanisms by Rao & Dukkipati.
4. Theory of Machines by R. K. Bansal.
5. Theory of Machines by V. P. Singh.
6. Theory of Machines by Malhotra & Gupta.
7. Theory of Machines by Khurmi & Gupta.
8. Mechanics of Machines by V. Ramamurti.
9. Kinematics by HN Tyson.

Course Objectives:

To provide knowledge of transfer of motions and conversion of motions using mechanisms.

APPLIED THERMODYNAMICS (BME-405)

Type	L	T	P	Credits
PCC	3	1	0	4

UNIT -I

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flametemperatureChemical equilibrium and equilibrium composition calculations use freeenergy. Introduction and Otto, Diesel and Dual cycles.

UNIT- II

Vapour Power cycles: Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.

Fuels and Combustion: Combustion analysis, heating values, air requirement, Air/Fuel ratio, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.

UNIT- III

Boilers:

Classifications and working of boilers, boiler mountings and accessories, Draught and its calculations, air pre-heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, air leakage, condenser performance parameters.

UNIT -IV

Steam and Gas Nozzles: Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Shock waves stationary normal shock waves, Effect of friction on nozzle, Super saturated flow.

Steam Turbines: Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

UNIT V

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles.

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines andtheir processes, Principle of rocket propulsion, Introduction to Rocket Engine.

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressureratio, effect of intercooling, minimum work for multistage reciprocating compressors.

Books and References:

1. Basic and Applied Thermodynamics by P.K. Nag, Mcgraw hill india.
2. Engineering Thermodynamics, by P.K. Nag, Mcgraw hill india.
3. Applied thermodynamics by Onkar Singh, New Age International.
4. A Course in Thermal Engineering, Domkundwar and Kothandaraman Dhanpat Rai & Co. (P) Limited
5. Applied Thermodynamics by Venkanna And Swati, PHI.
6. Thermodynamics: An Engineering Approach, Yunus A Cengel; Michael A Boles, McGraw-Hill Education

Course Objectives:

1. To learn about of I law for reacting systems and heating value of fuels.
2. To learn about gas and vapour cycles and their first law and second law efficiencies.
3. To understand about the properties of dry and wet air and the principles of psychometric.
4. To learn about gas dynamics of air flow and steam through nozzles.
5. To learn the about reciprocating compressors with and without intercooling.
6. To analyze the performance of steam turbines.

APPLIED THERMODYNAMICS LAB(BME-455)

Types L-T-P Credit

PCC 0-0-2 1

Objectives: To understand the principles and performance of various boilers and engines.

List of Experiments: (At least 8 of the following)

1. Study of Fire Tube boiler.
2. Study of Water Tube boiler.
3. Study and working of Two stroke petrol Engine.
4. Study and working of Four stroke petrol Engine.
5. Determination of Indicated H.P. of I.C. Engine by Morse Test.
6. Prepare the heat balance sheet for Diesel Engine test rig.
7. Prepare the heat balance sheet for Petrol Engine test rig.
8. Study and working of two stroke Diesel Engine.
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine.
11. Study of Pressure compounded steam turbine.
12. Study of Impulse & Reaction turbine.
13. Study of steam Engine model.
14. Study of Gas Turbine Model.

ENVIRONMENT AND ECOLOGY (MC 301/ MC 401) 2 0 0 0

L T P C

UNIT-I: Nature of Environment Introduction to Environmental Science - Definition and scope and need for public awareness Ecosystems Concept, structure and functions, restoration of damaged ecosystems Biodiversity – Definition, description at national and global level, threats and conservation Natural Resources - Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle. Conventional and Non-conventional Energy Sources – fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel

UNIT-II: Impact of Human Activity on Environment Human Population and Environment – Population growth, population explosion and migration; Impact of farming, housing, mining, transportation and industrial growth Social Issues Related to Environment– Sustainable development, urban problems (related to water and energy conservation and waste management), resettlement and rehabilitation Environmental ethics

UNIT-III: Environmental Changes and Human Health Environmental Pollution–Definition, causes and effects, control measures for water, air, soil, marine, land, noise, thermal pollution, Climate change– Greenhouse effect and global warming, acid rain, ozone layer formation and depletion Impact on human health – water and air borne diseases, diseases induced by residual impurities in drinking water (fluoride and arsenic); Toxic wastes and carcinogens; Nuclear hazards

UNIT- IV: Environmental Protection through Assessment and Education Indicators and Impact Assessment – Bio-indicators, Natural disasters and disaster management, Impact assessment through inventorying and monitoring Environmental Protection– Role of individuals, organizations and government in pollution control Laws, Conventions and Treaties–National legislation, issues in the enforcement of environmental legislation, initiatives by non- governmental organizations, global efforts in environmental protection Environmental education–women and value education Recommended

Textbook: Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India.

Recommended Reference Books:

1. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
2. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications
6. Environmental Studies, Soli. J Arceivala, Shyam, R Asolekar, 9781259006050, McGrawHill India, 2012.
7. Environmental Studies, D.L. Manjunath, 9788131709122 Pearson Education India, 2007
8. Textbook of Environment Ecology, Singh, Acme Learning
9. Perspective in Environmental Studies, Kaushik, New Age International
10. Environmental Studies, B. Joseph, 2nd Ed, 978-0070648134, Tata McGraw Hill