CURRICULUM & SYLLABUS

For

B.E. (FULL TIME)

(MECHANICAL ENGINEERING)

(Choice Based Credit System)

(With effect from 2018)

DEPARTMENT OF MECHANICAL ENGINEERING

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

SCSVMV

(Deemed to be University U/S 3 of UGC Act 1956)

Accredited with "A" Grade by NAAC

Enathur, Kanchipuram – 631 561

Semester - I (First year)

SL.No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	BSC	BMEF 181T10	Mathematics –I (Calculus & Linear Algebra)	3	1	-	4
2.	BSC	BMEF 181T20	Engineering Chemistry	3	-	-	3
3.	ESC	BMEF 181T30	Basic Electrical Engineering	3	-	-	3
4.	ESC	BMEF 181P40	Engineering Graphics & Design	2	-	2	3
5.	BSC	BMEF 181P50	Chemistry Lab	-	-	3	2
6.	ESC	BMEF 181P60	Basic Electrical Engineering Lab	-	-	3	2
Total Credits							**17**

Semester - II (First year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	HSMC	BMEF 182T10	English	2	1	-	3
2.	BSC	BMEF 182T20	Mathematics – II (Calculus, Ordinary Differential Equations, and Complex Variables)	3	1	-	4
3.	BSC	BMEF 182T30	Applied Physics for Engineers	3	-	-	3
4.	ESC	BMEF 182T40	Programming for Problem Solving	2	1	-	3
5.	MC*	BMEF 182T50	Environmental Science and Engineering*	2	-	-	2*
6.	BSC	BMEF 182P60	Physics Lab	-	-	3	2
7.	ESC	BMEF 182P70	Programming for Problem Solving Lab	-	-	3	2
8.	ESC	BMEF 182P80	Workshop/Manufacturing Practices	-	-	3	2
Total Credits							**19+2***

Semester - III (Second year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	BSC	BMEF 183T10	Mathematics III (PDE, Probability & Statistics)	3	1	-	4
2.	ESC	BMEF 183T20	Engineering Mechanics	2	1	-	3
3.	PCC	BMEF 183T30	Fluid Mechanics & Machinery	2	1	-	3
4.	PCC	BMEF 183T40	Thermodynamics	3	-	-	3
5.	PCC	BMEF 183T50	Materials Engineering	3	-	-	3
6.	PCC	BMEF 183P60	Fluid Mechanics and Machinery Lab	-	-	3	2
7.	PCC	BMEF 183P70	Materials and Metallurgy Lab	-	-	3	2
8.	MC*	BETF18 3MC3	Soft Skill - I	-	-	-	1*
Total Credits							20+1*

Semester - IV (Second year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	ESC		Basic Electronics Engineering	3	-	-	3
2.	PCC		Applied Thermodynamics	3	-	-	3
3.	PCC		Strength of Materials	2	1	-	3
4.	PCC		Kinematics of Machines	2	1	-	3
5.	PCC		Manufacturing Processes	3	-	-	3
6.	MC		Sanskrit and Indian Culture	2	-	-	2*
7.	PCC		Thermal Engineering Lab	-	-	3	2
8.	PCC		Strength of Materials Lab	-	-	3	2
9.	MC*		Soft Skill - II	-	-	-	1*
Total Credits							19+3*

Semester - V (Third year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	PCC		Heat and Mass Transfer	3	-	-	3
2.	PCC		Dynamics of Machines	2	1	-	3
3.	PCC		Instrumentation and Control	3	-	-	3
4.	PCC		Design of Machine Elements	3	-	-	3
5.	PCC		Manufacturing Technology	3	-	-	3
6.	PCC		Metrology and Quality Control	3	-	-	3
7.	PCC		Manufacturing Technology Lab	-	-	3	2
8.	PCC		Dynamics and Measurements Lab	-	-	3	2
9.	MC*		Soft Skill - III	-	-	-	1*
Total Credits							**22+1***

Semester - VI (Third year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	HSMC		Operation Research & Management	2	1	-	3
2.	PCC		Automobile Engineering	3	-	-	3
3.	PCC		Power Plant Engineering	3	-	-	3
4.	PCC		CAD/CAM	3	-	-	3
5.	PEC		Professional Elective – I	3	-	-	3
6.	OEC		Open Elective – I	3	-	-	3
7.	PCC		Heat Transfer Lab	-	-	3	2
8.	PCC		CAD/CAM Lab	-	-	3	2
9.	MC*		Soft Skill - IV	-	-	-	1*
Total Credits							**22+1***

Semester - VII (Forth year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	HSMC		Engineering Economics	3	-	-	3
2.	PCC		Mechatronics	3	-	-	3
3.	PEC		Professional Elective – II	3	-	-	3
4.	PEC		Professional Elective – III	3	-	-	3
5.	OEC		Open Elective – II	3	-	-	3
6.	PCC		Computer Aided Analysis Lab	-	-	3	2
7.	PCC		Mechatronics Lab	-	-	3	2
8.	PROJ-ME		Project work Phase - I	-	-	4	2
9.	PROJ-ME		Industrial Internship and Training	-	-	-	3
Total Credits							**24**

Semester - VIII (Forth year)

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	PCC		Automation in Manufacturing	3	-	-	3
2.	PCC		Fluid Power Systems	3	-	-	3
3.	PEC		Professional Elective – IV	3	-	-	3
4.	PROJ-ME		Project Work Phase - II	-	-	12	10
Total Credits							**19**

PROFESSIONAL ELECTIVE COURSES

SL. No	Code	Category	Course Title	Hours per week			Credit
				L	T	P	
1.		**PEC – I**	Finite Element Analysis	**3**	**-**	**-**	**3**
2.			Engineering Fracture Mechanics				
3.			Product Design & Development				
4.			3D Printing				
5.			Tribology				
6.		**PEC – II**	Refrigeration & Air Conditioning	**3**	**-**	**-**	**3**
7.			I.C. Engines				
8.			Turbo Machines				
9.			Energy Conservation in Industries				
10.			Gas Dynamics & Jet Propulsion				
11.		**PEC – III**	Sustainable Manufacturing	**3**	**-**	**-**	**3**
12.			Design for Manufacturing				
13.			Theory of Metal Forming				
14.			Digital Manufacturing				
15.			Composite Materials				
16.		**PEC - IV**	Total Quality Management	**3**	**-**	**-**	**3**
17.			Entrepreneurship Development				
18.			Non-Traditional Machining Process				
19.			Non Destructive Evaluation				
20.			Flexible Manufacturing Systems				

OPEN ELECTIVE COURSES

SL. No	Category	Code	Course Title	Hours per week			Credit
				L	T	P	
1.	OEC – I		Cloud Computing	3	-	-	3
2.			Web Design				
3.			Digital Image Processing				
4.			Data Analysis				
5.			German Primer				
6.			Astro-Physics				
7.			Business Administration				
8.			Chemistry in Crime Investigation				
9.			French Primer				
10.			Japanese				
11.			Bioinformatics				
12.			Communication Skills				
13.			Finance for Non Finance Managers				
14.			Fuel Cell and Batteries				
15.			Hindi Literatures				
16.	OEC - II		Autotronics	3	-	-	3
17.			Artificial Intelligence & Machine Learning				
18.			Nano Technology & Surface Engineering				
19.			Disaster Management & Mitigation				
20.			Robotics				
21.			HR Management				
22.			Nuclear and particle physics				
23.			Internet of Things (IOT)				
24.			Psychology				
25.			Statistical methods with excel				
26.			Key Board				
27.			Logistics and Supply Chain				
28.			Panini Grammar				
29.			Violin				
30.			Vocal Music				

SEMESTER-I

BMEF181T10	MATHEMATICS - I (Calculus and Linear Algebra)	L T P C 3 1 0 4

OBJECTIVES

- To familiarize the prospective engineers with techniques in calculus, multi-variable calculus and sequence and series.
- To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics.

Unit-I: Calculus

Evaluation of definite and improper integrals- Beta and Gamma functions and their properties - Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-II: Numerical Methods

Solution of polynomial and transcendental equations – Bisection method-Newton-Raphson method-Regula-Falsi Method. Interpolation- Newton's forward and backward difference formulae- Interpolation with unequal intervals-Newton's divided difference and Lagrange's formulae-Numerical Differentiation.

Unit-III: Sequences and Series

Convergence of sequence and series-tests for convergence- Comparison test- D'Alembert's ratio test-Raabe's test-Logarithmic test- Cauchy's root test- Fourier series: Half range sine and cosine series-Parseval's theorem.

Unit-IV: Multivariable Calculus (Differentiation)

Limit-Continuity - Partial derivatives, total derivatives- Directional Derivatives-Tangent plane and normal line-Maxima, minima and saddle points-Method of Lagrange multipliers – Gradient Curl-Divergence.

Unit-V: Matrices

Matrices: Rank of a matrix-rank-nullity theorem-System of linear equations- Symmetric matrices-Skew symmetric matrices- Orthogonal matrices; Eigen values and Eigenvectors-Cayley-Hamilton theorem-Diagonalization of matrices.

TEXT BOOK

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.

REFERENCES

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson, 2002.
2. T. Veerarajan, Engineering Mathematics, McGraw-Hill, New Delhi, 2008.
3. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill, New Delhi, 2010.
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications,2010.
5. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.

BMEF181T20 **ENGINEERING CHEMISTRY** **L T P C**
3 0 0 3

OBJECTIVE
To learn the basics of atomic structure, bonding, analytical methods and various types of reactions in organic chemistry.

UNIT-I: Atomic structure
Comparison between Rutherford's model of atom and Bohr's model - Bohr-Sommerfeld model (Concepts only)-its limitations - de Broglie theory-Heisenberg's uncertainty principle - Schrodinger's wave equation (derivation not needed)-significance of Ψ and Ψ^2 – shapes of different orbital's –Aufbau principle-Pauli Exclusion Principle- Hund's rule. Electronic configuration of atoms- Mosley's law – Modern periodic table - periodic properties: atomic size-ionization energies- electron affinity- electro negativity.

UNIT-II: Chemical Bonding
Types of bonds – ionic - covalent – coordinate bond - Molecular Orbital Theory –types of molecular orbitals- energy level diagrams- e-ns filling in MO – bond order – MO diagrams of H_2, He_2, N_2, O_2, CO and HF – molecules- Metallic bond – band theory of solids (primitive treatment only) and the role of doping on band structures - Hybridization – definition - geometry of the molecules- CH_4, C_2H_4, C_2H_2 - Molecular forces-Ionic, dipolar, van der waals interactions.

UNIT-III: Thermal and electrochemical equilibria
Thermodynamic functions: State functions, Path functions, Internal energy, enthalpy, entropy and free energy-Gibbs Helmholtz equation and its applications. Feasibility of reaction - Ellingham diagrams.
Types of electrodes- Standard electrodes-Standard hydrogen electrode, standard calomel electrode, Single electrode potential, electrochemical series - galvanic cell - emf - Nernst equation and its applications - Glass electrode, Potentiometric acid base titrations and Solubility equilibria-Corrosion-types- Chemical corrosion-electrochemical corrosion-factors influencing and control measures.

UNIT-IV: Spectroscopic techniques and applications
Electromagnetic radiations – wavelength – frequency – energy of a radiation – electromagnetic spectrum – changes brought about by the radiations - components of a spectrometer – rotational spectra of diatomic molecules – rigid and non-rigid rotor models (energy expressions only) - selection rule– schematic instrumentation – types of vibrations in molecules (CO_2, H_2O) – vibrational spectra(primitive treatment) – selection rule- instrumentation and applications – electronic transitions – electronic spectra - Beer-Lambert's law- instrumentation and applications – NMR – principle – chemical shift - instrumentation – NMR spectra of CH_4 – CH_3OH – xylene isomers – MRI (Introduction only)

UNIT-V: Stereochemistry & Organic Reactions
Stereochemistry - Representation of 3D structures **-** Fisher projection, Newman and Sawhorse projection formulae – Ethane, 3-bromo-2-butanol Conformation of Ethane, Butane & Ethylene glycol, , Symmetry and Chirality - Stereo isomers, Enantiomers, Diastereomers. Configuration - R-S system. Optical activity **-** Lactic acid, Tartaric acid- Geometrical isomerism – *cis-trans* & E-Z notations.

Organic Reactions – Substitution - S_N1 & S_N2 (simple examples, mechanism not expected) – electrophilic substitutions – Friedel Crafts alkylations - Additions – 1,2-addition **–** types-addition of HX - Elimination – E^1 & E^2 (Examples only, mechanism not expected) - Oxidations – *cis*-hydroxylation with OsO_4, Reductions – Clemmensen & wolff-Kishner reductions, Cyclization – Diels Alder, Ring-Opening – Nylon-6 from caprolactum.
Synthesis of most commonly used drugs – Aspirin, Paracetamol.

OUTCOMES

The students will be able to,

- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalize periodic properties.
- List major chemical reactions that are used in the synthesis of various organic molecules.

TEXT BOOKS

1. Textbook of Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons, Delhi, 2013. (For units I and II)
2. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and Madan S. Pathania, Shoban Lal Nagin Chand & Co., Jalandhar, 2000. (For units III and IV)
3. Advanced Organic Chemistry, B. S. Bahl and Arun Bahl, S.Chand, Delhi, 2012. (For unit V).

REFERENCES

1. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publishing Co Pvt. Ltd., New Delhi, 2008.
2. Applied Chemistry, K. Sivakumar, Anuradha Publications, Chennai, 2009.
3. Textbook of Engineering Chemistry, S.S.Dara & S.S. Umare, S.Chand, Delhi, 2004.
4. Fundamentals of Molecular Spectroscopy, C.N.Banwell and Elaine.M.McCash, 4th Edition, McGraw Hill Education, 2017.
5. Physical Chemistry, P. W. Atkins and Julio De Paula, 10th Edition, Oxford University Press,2014.

BMEF181T30 BASIC ELECTRICAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES

To understand and analyze basic electric and magnetic circuits.
To study the working principles of electrical machines and power converters.
To introduce the components of low voltage electrical installations.

UNIT-I: DC Circuits

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

UNIT-II: AC Circuits

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

UNIT-III: Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, Torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

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

UNIT-IV: Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

UNIT-V: Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.

Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

REFERENCES

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

BMEF181P40 ENGINEERING GRAPHICS & DESIGN L T P C

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

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

Computer Graphics
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).
(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

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

UNIT-II: Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT-III: Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc

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

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

UNIT-VI: Overview of Computer Graphics-theory of CAD software-Drawing Area, Dialog boxes and windows- Different methods of zoom as used in CAD-Isometric Views of lines, Planes, Simple and compound Solids- Customisation & CAD Drawing-ISO and ANSI standards for coordinate dimensioning and tolerancing; dimensions to objects-various ways of drawing circles, Annotations, layering & other functions-Setting up and use of Layers, layers to create drawings-color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling-Introduction to Building Information Modelling (BIM)

Sl No	List of Experiments
I.	Introduction to engineering design (CAD)
II.	Introduction to Auto cad
III.	Introduction to BIM

1. Drafting and modelling with co-ordinate systems
2. Creation of a simple machined component
3. Creation of title block
4. Creation of orthographic views of a cone, cylinder and hexagon
5. Creation of sectional views of a cone, cylinder and hexagon
6. Creation of orthographic views
7. Creation of isometric view of a V-block.
8. Conversion of 3D to 2D drawings
9. Creation of 3D solid machine component
10. Creation of 3D solid V block
11. Building plan of a simple office
12. Building plan of a simple home
13. Creation of simple steel truss

TEXT BOOKS

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2010), Engineering Drawing and Computer Graphics, Pearson Education.

REFERENCES

1. Agrawal B. & Agrawal C. M. (2017), Engineering Graphics, TMH Publication.
2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
3. AUTO CAD User Manual.

OUTCOMES

On successful completion of this course, the student will be able to

- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

BMEF181P50 **CHEMISTRY LAB** **L T P C**
0 0 3 2

OBJECTIVES:

- To make the students familiar with the way of systematic experimenting in the laboratory.
- To learn the basics and perform experiments involving volumetric analysis, colligative properties, simple synthesis and other instrumental techniques.

Any ten experiments of the following

1. Determination of surface tension and viscosity of a liquid or a solution
2. Thin layer chromatography / Paper chromatography for separation of a mixture.
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water by volumetry.
5. Determination of M.wt of a non-volatile solute by Rast's method.
6. Determination of the rate constant of the reaction between $K_2S_2O_8$ and KI – Clock reaction method.
7. Conductometry -Verification of Debye-Huckel-Onsager equation for a strong electrolyte.
8. Potentiometry - Determination of formal redox potential of Fe^{3+}/Fe^{2+} couple
9. Synthesis of Nylon 66 by interfacial polymerization method.
10. Determination of Saponification/acid value of oil.
11. Systematic qualitative analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces – computational experiment.
14. Chemical oscillations- Potentiometric study of the oscillations of Belousov-Zhabotinsky reaction
15. Determination of the partition coefficient of I_2 between water and CCl_4
16. Verification of Freundlich isotherm for adsorption of acetic acid / oxalic acid by charcoal.
17. Determination of isoelectric point of Gelatin sols by using capillary viscosmeter.

OUTCOMES

After the course the students will be able to,

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

TEXT BOOKS

1. Advanced Practical Physical Chemistry, J.B.Yadhav, Krishna Prakasan Media, 2016.
2. Experiments in Applied Chemistry, Sunita Rattan, S.K. Kataria& Sons, 2012

BMEF181P60 BASIC ELECTRICAL ENGINEERING LAB L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Study of Electric Motors (AC & DC Motors).
2. Load Test on Single Phase Induction Motor.
3. Load Test on Three Phase Induction Motor.
4. Load Test on Single Phase Transformer.
5. Load Test on Three Phase Alternator.
6. Speed Control of DC Motor.
7. Speed Control of Three Phase Induction Motor (Pole Changing Method).
8. Study of Multi meter, CRO and LCR Meter.
9. Measurement of Voltage, Current and Power.
10. Verification of Kirchoff's Law.
11. Verification of Thevenin's Theorem.
12. B-H Curve of a Magnetic Material.
13. Rectifier Circuit Analysis (AC – DC).
14. Inverter Circuit Analysis (DC – AC).
15. Chopper Circuit Analysis (DC – DC).
16. Series and Parallel RLC Circuit Analysis.

SEMESTER – II

BMEF182T10 **ENGLISH** **L T P C**
2 1 0 3

UNIT-I: Vocabulary Building
1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

UNIT-II: Basic Writing Skills
2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

UNIT-III: Identifying Common Errors in Writing
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

UNIT-IV: Nature and Style of sensible Writing
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

UNIT-V: Writing Practices
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

PRACTICE: ORAL COMMUNICATION
(This unit involves interactive practice sessions in Language Lab)
- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

REFERENCES

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

BMEF182T20 **MATHEMATICS - II** **L T P C**

(Calculus, Ordinary Differential Equations, and Complex Variables) **3 1 0 4**

OBJECTIVES

- To familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
- To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

UNIT-I: **Multivariable Calculus (Integration)**

Multiple Integration: Double and Triple integrals (Cartesian) - Change of order of integration in double integrals - Problems on Green, Gauss and Stokes theorems.

UNIT-II: Ordinary Differential Equations of Higher Orders

Operator D – Rules for finding complementary function – Rules for finding particular integral - Second order linear differential equations with variable coefficients: Cauchy-Euler equation - Method of variation of parameters.

UNIT-III: **Partial Differential Equations of Higher Orders**

Definition of Partial Differential Equations- Formation of Partial differential equations, solutions of a Partial differential equation -Linear equations of the first order - Solution to homogenous and non-homogenous linear partial differential equations of second order by complementary function and particular integral method.

UNIT-IV: Complex Variable – Differentiation

Differentiation - Cauchy-Riemann equations - Analytic functions - Harmonic functions, Finding Harmonic conjugate - Conformal mappings: $z+c$, $1/z$, cz, z^2, $z+1/z$, e^z - Mobius transformations and their properties.

UNIT-V: Complex Variable – Integration

Contour integrals: Cauchy - Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Taylor's series - Laurent's series - Zeros of analytic functions –singularities – Residues - Cauchy Residue theorem (without proof) – Simple problems.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

REFERENCES

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

BMEF182T30 **APPLIED PHYSICS FOR ENGINEERS** **L T P C**

(Common to Mechanical, Civil and Civil & Structural Engg.) **3 0 0 3**

UNIT- I: Properties of Matter

Stress – Strain – Hooke's law – Elastic Behavior of Material – Young's modulus by cantilever depression – Non-uniform bending – Uniform bending- Application -I-shaped girders. Torsional Pendulum – Couple per unit twist of a wire-Time period-Application-Determination of Rigidity Modulus.

UNIT- II: Technical Acoustics

Acoustics of buildings – Reverberation- Weber Fechner law- Factors affecting acoustics of a building and remedies –Sabine's formula for reverberation time- Absorption coefficient.

Ultrasonic waves - Properties - Generation – Piezoelectric method – Detection- Kundt's tube-Application of Ultrasonics in industries – NDT.

UNIT- III: Photonics

Einstein's theory of matter radiation interaction and A and B coefficients; Properties of laser-spontaneous and stimulated emission, amplification of light by population inversion, different types of lasers: solid-state laser(Neodymium), gas lasers (CO_2), applications –IR Thermography.

Optical fibre- principle [TIR]-types-material, mode, refractive index- Fibre loss-Expression for acceptance angle and numerical aperture. Application- Communication.

UNIT -IV: Quantum Physics

Black body radiation-Planck's law – Energy distribution function, Wave – particle duality-de Broglie matter waves – Concept of wave function and its physical significance – Heisenberg's Uncertainty Principle – Schrodinger's wave equation – Time independent and Time dependent equations – Particle in a one dimensional rigid box – tunneling (Qualitative) – Scanning tunneling microscope

UNIT - V: Engineering Materials

Dielectric materials- definition – dielectric breakdown – dielectric loss – internal field – claussius mossotti relation.

Superconducting materials -introduction – properties-meissner effect – type i & type ii superconductors – bcs theory-applications.

Nanomaterials- introduction – synthesis of nano materials – top down and bottom up approach- ball milling- pvd method- applications.

Smart materials- shape memory alloys-biomaterials (properties and applications)

TEXT BOOKS

1. Applied Physics for Engineers – K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech) (2014)
2. Applied Engineering Physics – Rajendran&Marikani(Tata McGraw Hill) (2009)
3. Quantum Mechanics by Sathyaprakash, Pragati Prakashan, Meerut. [unit 4]
4. Engineering Physics – Bhattacharya, Bhaskaran – Oxford Publications(2012)
5. Engineering Physics I & II – G.Senthilkumar, VRB publications (2012)

REFERENCES

1. Engineering Physics - M.N.Avadhanulu, S.Chand & Company Ltd.
2. Concepts of Modern Physics by Arthur Beisser, McGraw Hill, 7th edition.
3. Introduction to Solid state Physics – C.Kittel, Wiley Student Edition
4. Modern Physics - R.Murugesan, S.Chand& Company Ltd.
5. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, (Wiley)
6. Quantum Mechanics by V. Devanathan, Narosa, Chennai, 2005.
7. Quantum Mechanics by V K Thangappan, Wiley Eastern

BMEF182T40	PROGRAMMING FOR PROBLEM SOLVING USING C and C++	L T P C
		2 1 0 3

UNIT-I

Introduction to components of computer system-Generation of programming languages-Types of Computers-Organization of Computers-Types of memory, Number systems-Idea of Algorithm-Pseudo code- Flow Chart with examples.

UNIT-II

Introduction to C-Character set, Constants, Variables, Data Types-Operators – Arithmetic expressions and precedence-Decision Making statement - Looping statements.

UNIT-III

Arrays and its types-Functions –Parameter passing in functions-call by value- call by reference – Passing array to functions-Recursive function.

UNIT-IV

String operations, Structures and array of structures –Union, Introduction to Pointers

UNIT-V

Basic Concepts of OOPS -Class and Object, Constructor-Destructor-Inheritance-Templates

TEXT BOOKS

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006.
3. Fundamentals of Computing and Programming- V.Ramesh Babu, R.Samyuktha, M.Muniratham by VRB Publishers 2012 edition.
4. Robert Lafore, "Object-Oriented Programming in C++" Pearson Education India,Fourth Edition

REFERENCES

1. Let Us 'C' - Yashawant Kanetkar, (Unit 2 to 5), BPB publications, 10th Edition, 2010.
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
3. Venugopal.K and Kavichithra.C, "Computer Programming", New Age International Publishers, First Edition, 2007.
4. Kernighan B.W and Ritchie,D.M , The C programming language: second edition, Pearson education,2006.

BMEF182T50 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**

2 0 0 2

Unit-I: Introduction to environment and environmental studies

Introduction to environment – components – nature of environment - need of awareness – reasons for environmental problems – anthropocentric and eco centric views.

Environmental studies - multidisciplinary nature – scope and aim – sustainable development-principles – RRR concept-Indian environmental movements – environmental calendar.

Unit-II: Ecosystem and Biodiversity

Ecosystem – structure – functions – simplified ecosystem models (food chain and food webs and their types,energy flow) - forest – grassland – pond –ecosystems – ecological succession - ecological pyramids – Bio-geochemical cycles of water – oxygen-carbon-phosphorous and sulphur.

Biodiversity – definition – types – species – genetic and ecosystem diversities- values of biodiversity – threats to biodiversity – conservation of biodiversity – endemism – biodiversity hotspots – Indian biodiversity– endemic species of India – IUCN lists -red-green and blue data books.

Unit-III: Natural resources

Natural resources – definition – types – forest resources – uses –deforestation- reasons - effects – water resources – dams – effects of dams - food resources – modern agriculture– ill effects - energy resources- types – hydel –nuclear – solar –wind and biomass energy - world scenario – Indian scenario.

Population and environment – reasons for over exploitation of resources – population – demography – population curves – population explosion – effects – consumerism – effects – urbanization – reasons and effects- role of an individual.

Unit-IV: Environmental Pollution

Pollution – definition – types – air pollution – causes and effects – effects of CO_2 – CO – NOx – SOx – particulates – control of air pollution – water pollution – causes – effects – remedies – soil pollution – solid waste management – e waste – ill effects of e-waste – proper recycling- Noise pollution – reasons – effects – control – nuclear pollution – cases – effects and control –thermal pollution causes – effects and remedies.

Legal provisions for protecting environment – article 48 A – 51 A (g) – Environment act 1986 – Air act 1981 – Water act 1974 – wild life protection act – Forest act 1980- problems in implementation–reasons.

Unit-V: Social issues and environmental ethics

Present environmental scenario – green house effect – climate change – The Kyoto Protocol – ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms, Disaster management.

Environmental ethics – introduction – people getting affected - resettlement and rehabilitation – issues involved –Sardhar Sarovar project – Tawa Matsya sang - Melting icebergs of Arctic.

TEXT BOOK

1. Anubha Kaushik and C.P. Kaushik, ”Prospects of Environmental Science”, New Age International publishers, 2013.

REFERENCES

1. Environmental Studies, N. Nandini, N. Sunith a and Sucharita Tandon, Sapna Book House, 2007.
2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.
3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002.
4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999.
5. Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford University Press, 2000.
6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006.

BMEF182P60	PHYSICS LABORATORY	L T P C 0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Rigidity Modulus & Moment of Inertia using Torsional Pendulum.
2. Determination of Young's Modulus by non-uniform bending method.
3. Determination of Wavelength of Laser light using transmission grating by normal incidence Method.
4. Measurement of numerical aperture and acceptance angle of an optical fiber.
5. Determination of radius of curvature of the given lens using Newton's Rings.
6. NAND-Universal building block.
7. NOR-Universal building block

REFERENCES

1. Practical Physics - Ouseph and Rangarajan.
2. Engineering Practical Physics-K. Srinivasan.
3. Engineering Practical Physics - M.N. Avadhanulu.
4. Experimental Physics – K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech)

BMEF182P70 **PROGRAMMING FOR PROBLEM SOLVING LABORATORY** **L T P C**

0 0 3 2

1. Basic programs in data types.

2. Problems in Decision making statements.
    a. Find the Biggest among 3 numbers.
    b. Find Even or odd
    c. Arithmetic operations using Switch - Case Statements.

3. Problems in looping statements.
    a. Find the Sum of digits using (i) For loop (ii) While loop
    b. Generate the Fibonacci series
    c. Check whether the number is prime or not.

4. Matrix Manipulation-Addition, Subtraction and Multiplication.

5. String operations-string copy, string reverse, string concatenate.

6. Swapping of numbers using call by value, call by reference.

7. Find factorial using recursive functions.

8. Display the student information & marks using Structure & Unions.

9. Evaluate Expressions using library Function using C++
    a. πr^2
    b. (A+B+(2C/3A)+A2+2B)
    c. $\sqrt{S(S-A)\ (S-B)\ (S-C)}$
    d. LOG $(x^3+y^3+z^3)$
10. Numerical Methods-Quadratic Equation using C++

11. Class and object

12. To implement Constructor and Destructor.

13. To implement Inheritance.

BMEF182P80 WORKSHOP/MANUFACTURING PRACTICES L T P C
1 0 2 2

OBJECTIVES
To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

Lectures & videos: (10 hours)

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures).**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

LIST OF EXERCISE

Sl no	Manufacturing/ fabrication lab	Experiment name
1.	Machine shop	Turning and facing practice
		step turning
		drilling practice
		Preparation of bottle using blow moulding machine
		Preparation of given glass profile using diamond glass cutter
		Sheet metal jobs
2.	Fitting shop	V- fitting
		Square fitting
3.	Carpentry shop	Planning practice
		Half lap T- joint
		Half lap cross joint
4.	Welding shop	Straight bead welding
		Butt joint – gas welding process
		Lap joint - arc welding process
5.	Smithy shop	Fabrication of square rod
6.	Casting	Preparation of green sand mold using a gland piece pattern
7.	Electrical Lab	Two lamps in series controlled by one-way switch
		Two lamps in parallel controlled by one-way switch
8.	Civil work	Simple Plumbing exercises

OUTCOMES

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate the operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities

TEXT BOOKS

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2018.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.

REFERENCES

1. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House 2017.

SEMESTER- III

BMEF183T10	MATHEMATICS - III (PDE, Probability & Statistics)	L T P C 3 1 0 4

UNIT-I: Basic Probability

Probability spaces, conditional probability, Independent random variables, sums of independent random variables, Bayes' Theorem, Discrete and Continuous one-dimensional random variables - Expectations, Moments, Variance of a sum, Moment generating function, Tchebyshev's Inequality.

UNIT-II: Probability Distributions

Discrete Distributions – Binomial, Poisson and Negative Binomial distributions, Continuous Distributions - Normal, Exponential and Gamma distributions.

UNIT-III: Basic Statistics

Measures of Central tendency: Averages, mean, median, mode, Measures of dispersion – Range, Mean deviation, Quartile deviation and Standard deviation, Moments, skewness and Kurtosis, Correlation and regression – Rank correlation.

UNIT-IV: Applied Statistics

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

UNIT-V: Applications Partial Differential Equations

Method of separation of variables – Vibration of a stretched string: Wave equation – Solution of Wave equation - D'Alembert's solution of wave equation – One dimensional heat flow – Solution of heat equation.

OUTCOMES

Upon the completion of this course the students will be able to

- to familiarize the students with statistical techniques.
- to equip the students with standard concepts and tools at an intermediate
- to advanced level that will serve them well towards tackling various problems in the discipline.

TEXT BOOKS

1. T. Veerarajan, Probability, Statistics and Random Processes, Third edition, Tata McGraw-Hill, New Delhi, 2010.
2. S.P. Gupta, Statistical Methods, 31st edition, Sultan chand and sons, New Delhi, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

REFERENCES

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

BMEF183T20 ENGINEERING MECHANICS L T P C
2 1 0 3

OBJECTIVES

1. To familiarize the basics laws of physics, vector operations and forces.
2. To understand the principles of beams, supports and equilibrium of rigid bodies.
3. To know the area and mass property calculations of various sections and solids.
4. To study and analyse the dynamics of particles by various methods.
5. To understand the applications of friction and rigid body dynamics.

UNIT-I STATICS OF PARTICLES

Introduction – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces, Principle of transmissibility, Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Single equivalent force.

UNIT-II EQUILIBRIUM OF RIGID BODIES

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT-III PROPERTIES OF SURFACES AND SOLIDS

Determination of Area and Volume – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moment of inertia.

Unit-IV DYNAMICS OF PARTICLES

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse-Momentum principle – Impact of elastic bodies.

UNIT-V FRICTION AND RIGID BODY DYNAMICS

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction-Ladder friction- Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of bodies.

TEXT BOOKS:

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2007)3rd Edition.
2. Dr. N. Kotteswaran, "Engineering Mechanics – Statics & Dynamics", Sri Balaji Publications 2004.
3. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, Tata McGraw-Hill International Edition, 2017, 11th edition

REFERENCES

1. Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2017).
2. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
3. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd.,(2008).
4. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).
5. K.L. Kumar, "Engineering Mechanics" Tata McGraw-hill, 2017, 4th Edition
6. S.S. Bhavikatti, " Engineering Mechanics", New Age International Publishers, 2006
7. R. S. Khurmi, " Engineering Mechanics", S. Chand Publishers, 2018.

BMEF183T30 **FLUID MECHANICS & MACHINERY** **L T P C**

2 1 0 3

OBJECTIVES

- To understand the properties of fluids and concept of control volume.
- To understand the applications of the conservation laws to flow through pipes.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

UNIT–I FLUID PROPERTIES & FLOW CHARACTERISTICS

Units and dimensions - Types of flows - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure – Gas laws - Surface tension and capillarity. Flow characteristics – concept of control volume – Bernoulli's Theorem – Concept of control volume – Application of continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Hydraulic and energy gradient-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT–III-DIMENSIONAL ANALYSIS

Dimensional analysis – methods of dimensional analysis - Similitude –types of similitude – Dimensionless parameters- Application of dimensionless parameters – Model analysis.

UNIT–IV HYDRAULIC PUMPS

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies - velocity triangles - Centrifugal pumps– Multi stage centrifugal pumps - working principle - work done by the impeller - performance curves – Priming – Cavitation - Reciprocating pump-working principle – Air vessels – Indicator diagram - Rotary pumps – Working Principles.

UNIT–V HYDRAULIC TURBINES

Hydraulic turbines – Classification - working principles - Pelton wheel, Kaplan turbines - Francis turbines - velocity triangles - theory of draft tubes – Performance – Specific speed – Unit Quantities - Selection of turbines - governing of turbines - hydraulic coupling - Torque converters.

OUTCOMES:

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Mathematically predict the nature of physical quantities
- Analyse the performance of pumps
- Analyse the performance of turbines.

TEXTBOOKS

1 K.L. Kumar, Engineering Fluid Mechanics, S. Chand Publishing, 2016.

2 Modi P.N. & Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

REFERENCES

1. R.K Bansal, Fluid Mechanics & Hydraulic Machines. 2018, 9th Edition.
2. S. K. Som, G. Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2008, 3rd Edition.
3. K. R. Arora, Fluid Mechanics Hydraulics and Hydraulic Machines, Standard Publishers, 2007, 9th Edition
4. C. P. Kothandaraman & R. Rudramoorthy. Fluid Mechanics and Machinery, New Academia Science, 2011, 3rd Edition
5. Douglas J.F, Solving Problems in Fluid Mechanics Vol I & II, John Wiley & Sons Inc., 1986.
6. Victor L. Streeter and E. Benjamin Wylie & Keith W.Bedford. Fluid Mechanics, Mc Graw-Hill 1999, 8th Edition.

BMEF183T40 **THERMODYNAMICS** **L T P C**
3 0 0 3

(Use of approved Thermodynamic property tables like Steam tables, Mollier chart, Psychrometric chart are permitted in all the examinations**)**

OBJECTIVES:

- To learn about the basic concepts of thermodynamics & first law of thermodynamics
- To learn about application of II law and to understand the concept of entropy/availability
- To evaluate the changes in properties of pure substances
- To understand various thermodynamic relations & ideal gas concept
- To learn about the concept of psychrometry

UNIT - I BASIC CONCEPTS AND FIRST LAW

Concept of continuum- microscopic and macroscopic approach-Path and point functions - Properties – Thermodynamics system and their types - Thermodynamic Equilibrium - State, path and process - Quasi-static, reversible and irreversible processes - Modes of work - P-V diagram - Zeroth law of thermodynamics – Concept of temperature & heat - First law of thermodynamics - application to closed and open systems – steady and unsteady flow processes.

UNIT- II SECOND LAW & AVAILABILITY ANALYSIS

Statements of second law and its corollaries – Carnot theorem - Carnot cycle & Reversed Carnot cycle - Clausius inequality. Concept of entropy, entropy of ideal gas - Principle of increase in entropy. Applications of II Law. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT - III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

Formation of steam & its thermodynamic properties - P-v, P-T, T-v, T-s, h-s diagrams. P-v-T surface. Use of Steam Table & Mollier Chart - Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles.

UNIT - IV IDEAL GAS & THERMODYNAMIC RELATIONS

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor- Generalized Compressibility Chart -. Simple Calculations.

Maxwell relations, Tds equations, Specific heat capacities - Energy equation - Joule-Thomson co-efficient, Clausius -Clapeyron equation – Third law of thermodynamics.

UNIT V PSYCHROMETRY

Psychrometric properties - Psychrometric chart - Psychrometric processes – Adiabatic saturation - Sensible heating and cooling, humidification, dehumidification, Evaporative cooling and adiabatic mixing of air streams - Property calculations.

OUTCOMES

Upon the completion of this course the students will be able to

1. Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
2. Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
3. Apply Rankine cycle to steam power plant and compare few cycle improvement methods
4. Derive simple thermodynamic relations of ideal and real gases
5. Calculate the properties of gas mixtures and moist air and its use in psychometric processes

TEXT BOOKS

1. R. K. Rajput, "Engineering Thermodynamics" 5th edition, 2017.
2. Yunus A, Cengel & Michael A. Boles, "Thermodynamics – An Engineering Approach", 8th edition, 2017.

REFERENCES

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2012.
2. Borgnakke & Sonnatag, "Fundamental of Thermodynamics", 8th edition, 2016.
3. Chattopadhyay P, "Engineering Thermodynamics", Oxford University Press, 2016.
4. J.P Holman, Thermodynamics – Tata McGraw Hill, 2012, 9th edition.
5. Nag. P. K., "Engineering Thermodynamics", 6th edition, Tata McGraw-Hill, New Delhi, 2017.
6. Vanwvylen & Sonntag, Introduction to Thermodynamics, Classical & Statistical – Wiley Eastern, 2007, 4th edition.

BMEF183T50 MATERIALS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

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

UNIT-I: Crystal Structure

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

UNIT-II: Mechanical Property measurement

Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength. Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, Introduction to nondestructive testing (NDT)

UNIT–III: Alloys, substitutional and interstitial solid solutions-Phase diagrams

Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-carbon phase diagram and microstructure aspects of ledeburite, austenite, ferrite and cementite, cast iron.

UNIT–IV: Heat treatment of Steel

Annealing, tempering, normalizing and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

UNIT–V: Metals and Alloys

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

OUTCOMES

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

TEXT BOOKS

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 2004, 5th Edition.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

BMEF183P60	FLUID MECHANICS AND MACHINERY LABORATORY	L T P C
		0 0 3 2

OBJECTIVES:

- To understand the concept of Bernoulli's Theorem.
- To study the performance behaviour of various pumps.
- To study the performance behaviour of various turbines.
- To calibrate venturi / Orifice meter.
- To study the major and minor energy losses and also to study the application of Notches and Weirs.

LIST OF EXPERIMENTS

1. Verification of Bernoulli's equation
2. Calibration of orifice meter and Venturi meter
3. Flow through nozzle
4. Flow through notches and weirs
5. Flow through pipes and losses in pipes
6. Buoyancy experiment – Meta centric height
7. Performance characteristics of centrifugal pump
8. Performance characteristics of reciprocating pump
9. Performance characteristics of gear pump
10. Performance characteristics of submergible pump
11. Performance Characteristics of Francis turbine
12. Performance Characteristics of Pelton wheel
13. Performance Characteristics of Kaplan turbine

OUTCOMES:

Upon the completion of the course, the students will able to

- Draw the performance Characteristics curves of various pumps and analyse their behaviour.
- Draw the performance Characteristics curves of various turbines and analyse their behaviour.
- Use the measurement equipments for fluid flow.
- Understand Bernoulli's theorem
- Determine the friction factor for a given set of pipes

BMEF183P70 MATERIALS AND METALLURGY LABORATORY L T P C
0 0 3 2

Course objective

- To know the micro structure of different materials
- To impart the required material for products based on micro structure
- To know the properties of materials at higher elevated temperatures
- To refine grain size by heat treatment properties

LIST OF EXPERIMENTS

1. Preparation of specimen, macro micro etching techniques for metallographic examination
2. Study and use of metallurgical microscope, different types and their operations
3. Identification of plain and high carbon steel, quenched and tempered steel
4. Identification of stainless steel – HSS and alloy steel.
5. Identification of Grey C.I, White C.I, Malleable iron, SG iron.
6. Identification of Cu alloys, Mg alloys, Al alloys, Ni alloys, Bearings metals
7. Measurements of harden ability – Jomny end quench test
8. Grain size measurement by comparison with ASTM chart
9. Study of microstructure and hardness value before and after heat treatment such as annealing, normalizing, hardening and tempering.
10. Demonstration of various sand testing methods (moisture determination, permeability testing, & green strength testing)

Course outcomes

- Ability to relate properties to microstructures
- Understand various crystal structures and relationship to properties
- Understanding metals and their use un industries
- Understanding heat treatment procedures and the change of properties
- Understanding heat treatment procedures and the change of properties
- Improving material properties by different heat treatment processes.

SEMESTER – IV

BASIC ELECTRONICS ENGINEERING **L T P C**
3 0 0 3

OBJECTIVE:

- To provide an overview of electronic device components to Mechanical engineering students.

UNIT-I: Semiconductor Devices and Applications

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

UNIT-II: Operational amplifier and its applications

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

UNIT-III: Timing Circuits and Oscillators

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

UNIT-IV: Digital Electronics Fundamentals

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

UNIT-V: Electronic Communication Systems

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

OUTCOMES

At the end of this course students will demonstrate the ability to,

- Understand the principles of semiconductor devices and their applications.
- Design an application using Operational amplifier.
- Understand the working of timing circuits and oscillators.
- Understand logic gates, flip flop as a building block of digital systems.
- Learn the basics of Electronic communication system.

TEXT BOOKS & REFERENCES

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

APPLIED THERMODYNAMICS L T P C
3 0 0 3

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

OBJECTIVES

- To apply the concept of thermodynamic`s to steam Nozzle & to understand the velocity triangle diagram of various turbines
- To understand the various systems of I.C. Engines
- To analyse the different gas power cycles
- The principles of reciprocating & rotary air compressors are studied
- To apply the concepts of thermodynamics to refrigeration & Air conditioning

UNIT–I Flow Through Nozzle & Steam Turbines
One-dimensional flow of steam through nozzle – Nozzle types - Critical pressure ratio – Nozzle efficiency - Super saturated flow in nozzles.
Impulse and Reaction turbine Principles - Compounding – Types - Velocity diagrams for simple and multistage turbines - Speed regulations – Governors.

UNIT–II I.C. Engines
Classification – Working Principle - Components and their function. Valve timing & port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Simple Carburettor Diesel pump and injector system - Ignition System - Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculations

Unit-III Gas Power Cycles
Air Standard Cycles - Otto, Diesel, Dual & Brayton cycle Analysis – methods of cycle improvement. Regenerative, intercooled, reheated cycles and their combinations –Performance Calculations.

UNIT–IV Air Compressors
Reciprocating Air Compressors – Classifications - Working principle – work done - Effect of clearance volume - Single and multi-stage compressors, Volumetric efficiency – calculation of power requirement – Rotary compressors (Working Principle).

UNIT–V Refrigeration & Air Conditioning
Refrigeration cycles- Reversed Carnot – Bell Coleman cycle - Vapour compression system – Super heating/Sub cooling - Vapour absorption refrigeration system- Properties of refrigerants. – Simple Problems on VCR system
Principles of air-conditioning - Types of A/C Systems –Industrial, Summer, Winter - Comfort and Year-round air conditioners – Window & Centralised A/C - Concept of GSHF – RSHF - ESHF

OUTCOMES:

- Upon completion of this course, the students will be able to
- Analyse the problems of nozzles & turbines.
- Explain the functioning & features of I.C. Engines & Calculate the performance of I.C.Engines.
- Analyse & solve the problems of air standard cycles.
- Analyse the performance behaviour of single & multi stage reciprocating air compressors.
- Understand the different Refrigeration & A/C systems and solve the problems of VCR system.

TEXT BOOKS

1. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2016
2. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2017

REFERENCES

1. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 2017
2. Ganesan V.." Internal Combustion Engines",3rd Edition, Tata McGraw-Hill 2017
3. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
5. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
6. P. L. Ballaney, Thermal Engineering, Khanna Publishers, 2007, 24th Edition.

STRENGTH OF MATERIALS

L	T	P	C
2	1	0	3

OBJECTIVES

- To understand the nature of stresses developed in simple and composite bars.
- To understand the nature of stresses developed in beams.
- To understand the slope and deflection developed in beams.
- To calculate the elastic deformation occurring in various simple geometries for different types of loading.
- To understand the nature of stresses developed in cylinders and spheres for various types of simple loads.

UNIT - I SIMPLE STRESS AND STRAIN

Deformation in solids– Hooke's law– stress and strain –tension, compression and shear stresses– composite bars - elastic constants and their relations–Volumetric, linear and shear strains.

UNIT - II SHEAR FORCE AND BENDING MOMENT DIAGRAM

Beams and types–Transverse loading on beams– shear force and bend moment diagrams– Types of beam supports–Simply supported, over-hanging beams and cantilevers– Theory of bending of beams–bending stress distribution and neutral axis–shear stress distribution– point and distributed loads.

UNIT – III DEFLECTION OF BEAMS

Deflection of a beam using double integration method, moment area method and macaulay's method– computation of slopes and deflection in beams–Maxwell's reciprocal theorems.

UNIT – IV TORSION OF SHAFT AND SPRINGS

Torsion–Stresses and deformation in circular and hollow shafts– stepped shafts–Deflection of shaftsfixed at both ends–Stresses and deflection of helical springs, laminated or spring - principal stresses andprincipal planes– Mohr's circle.

UNIT – V THIN AND THICK CYLINDER

Axial and hoop stresses in cylinders subjected to internal pressure–Deformation of thick and thincylinders–Deformation in spherical shells subjected to internal pressure.

OUTCOMES

The Students can able to

- Recognize various types loads applied on machine components of simple and composite bars.
- Recognize the stresses developed on various types of beams.
- Recognize the slope and deflection developed on various types of beams.
- Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Understand the nature of internal stresses.

TEXTBOOKS

1 S. Ramamrutham and R. Narayan, Strength of Materials, Dhanpat Rai and Sons, New Delhi.2007, 15th Editon.

2 Dr. R. K. Bansal, Strength of Materials, Lakshmi Publishers, 2007, 4th Edition.

3 L.S. Srinath, Advanced Mechanics of Solids, TMH, 2009, 3rd Edition

REFERENCE BOOKS

1 Beer & Johnson, Mechanics of materials, SI Metric Edition, McGraw Hill, ISE, 2017.

2 Gere and Timensenko, Mechanics of Materials, CBS, 2006.

3 S.P. Timoshenko J.N Goodier, Theory of Elasticity, Mc Graw Hill International Edition, 2017.

4 S.M.A.Kazimi, Solid Mechanics, Tata McGraw Hill Publishing Company Ltd., 2004.

5 Timoshenko & D.H. Young, J.V. Rao, Sukumar Pati, Engineering Mechanics, McGraw Hill, 2017.

6 J. B. K Das & P.L. Srinivasa Murthy, Mechanics of Materials, Sapna Book House, 2018.

KINEMATICS OF MACHINES

L T P C
2 1 0 3

OBJECTIVES

- To understand the basic components and layout of linkages in the assembly of a system / machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT–I: Introduction to links, Pairs and Chains

Links, Pairs, Chains, Mechanisms, Inversion of machines, Structure - Degrees of freedom, inversion, Four bar chains. Velocity and acceleration: Velocity and acceleration of simple mechanism by relative velocity method. Klein's constructions for slider crank chain oscillating cylinder and swivel bearing mechanisms. Analytical solution for slider crank mechanisms.

UNIT–II: Cams

Introduction to Cams, Types of cams and followers, displacement, velocity & acceleration curves for uniform velocity, uniform acceleration and retardation. SHM, cycloidal curves, lay out of profile of plate cams of the above types with reciprocating and oscillating followers – knife edge rollers and flat faced followers, cylindrical and face cams, polynomial cams, cams with special contours.

UNIT–III: Theory of gearing

Introduction to Toothed gears, law of gearing, minimum number of teeth, length of arc of contact, interference.

UNIT–IV: Gear trains

Introduction to gear trains, Types, velocity ratio and torque calculation in epicyclic gear trains and differential gear train.

UNIT-V: Drives and Lubrication

Belt and rope drives, single plate, multiple plate, cone clutches, power transmitted, Brakes. Lubrication: Theory of lubrication, hydrostatic and hydrodynamic bearings, frictional loss, power in bearing.

OUTCOMES

Upon the completion of this course the students will be able to

- Understand the basics of mechanism
- Calculate velocity and acceleration in simple mechanisms
- Develop CAM profiles
- Solve problems on gears and gear trains
- Examine friction in machine elements

TEXTBOOKS

1. Amitabh Ghosh and Ashok Kumar Mallik, Theory of mechanism and Machines – 3nd Edition, Affiliated East West Press Limited, 2017.
2. J.E.Shigley and J.J.Vicker Jr. Theory of Machines and Mechanism, 2nd ed. Mc GrawHill ISE 1995
3. R.S. Khurmi & Gupta. J.K, A text book of Theory of Machines, S. Chand & Co., 2008, 14th Edition.

REFERENCES

1 J.Hannah and R.C Stephens Arnold, Mechanics of Machines – ISE 1999.
2 Beer & Johnston 11th Edition, Vector Mechanics for Engineers. McGraw Hill. ISE 2017.
3 Thomas Bevan – 3rd Edition, The Theory of Machines – CBS, Pearson 2009.
4 P.L.Ballaney, Theory of Machines, Khanna Publishers, 2005, 24th Edition.
5 S.S.Rattan, Theory of Machines, TMH. 2017, 2nd Edition, 2017.
6 Rao .J.S. & Dukkipati. R.V. Mechanism and Machine Theory, 2nd ed. Wiley Eastern Ltd., 2007,
7 Hamilton H. Mabie & Charles F. Reinnoltz, Mechanisms and Dynamics of Machinery, 4th ed. John Wiley & Sons, 1995
8 Thomson W.T, Theory of Vibration and Applications, PHI, 1997.
9 Sadhu Singh, Theory of Machines, Pearson Education Ltd, 2011.
10 Ashok G. Ambekar, Mechanism and Machine Theory, Eastern Economy Edition. 2007.
11 John. J. Uicker, Theory of Machines and Mechanisms, Oxford University Press, 2008, 3rd Edition.

MANUFACTURING PROCESSES

L T P C

3 0 0 3

OBJECTIVES:

- To motivate and challenge students to understand the basic casting techniques.
- To introduce the concepts of basic metal forming processes
- To provide the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling and drilling.
- To learn the various joining process.
- To learn the basic concepts of unconventional machining processes

UNIT–I: Casting and molding

Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

UNIT–II: Metal forming processes

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

UNIT–III: Metal cutting

Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining, Additive manufacturing: Rapid prototyping and rapid tooling

UNIT–IV: Joining/fastening processes

Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

UNIT–V: Unconventional Machining Processes

Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire cut EDM; Electro-chemical machining (ECM), etchant &maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining.

OUTCOMES

Upon the completion of this course the students will be able to

- Apply the concepts of different metal casting processes, associated defects
- Gain the knowledge in various sheet metal making processes.
- Understand the mechanism of material removal processes
- Compare the different metal joining processes
- Understand the different unconventional Manufacturing Methods employed for making different products.

TEXT BOOKS

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2009.
3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing, 12th Edition 2017.

REFERENCES

1 Banga T.R, Agarwal. R.K. & Manghrani. T.M., "Foundry Engineering", Khanna Publishers, New Delhi, 1995

2 Jain.R.K. "Production Technology" Khanna Publishers, 1988

3 Bhattacharyya.A. "Metal Cutting Theory and Practice", Central Book Publishers, 1984

4 S. K. Hajra Chowdhery, & A. K. Hajra Chowdhery, Elements of Workshop Technology, Vol 1 & 2, Media Promoters and Publishers, 2007, 14th Edition.

5 C. Elanchezhian, Production Technology, Easwar Press, 2005.

THERMAL ENGINEERING LAB

L T P C
0 0 3 2

OBJECTIVES

- To study the valve timing and Port timing diagram of I.C. Engines.
- To study the properties of fuels / lubricants used in I.C. engines
- To conduct the performance test on single / twin cylinder I.C. engines using different loading arrangements.
- To study the heat balance behaviour of I.C. engines
- To study the performance behaviour of compressor / blower

LIST OF EXPERIMENTS

1. Performance test on single stage reciprocating air compressor
2. Performance test on constant speed centrifugal air blower
3. Valve timing diagram on single cylinder four stroke petrol engine
4. Port timing diagram on single cylinder two stroke petrol engine
5. Load test on single cylinder petrol engine
6. Performance test on high speed diesel engine with alternator loading
7. Preparation of heat balance sheet on diesel engine
8. Performance test on slow speed – diesel engine
9. Performance test on twin cylinder diesel engine
10. Performance, Noise and Smoke Measurement of computerized diesel engine.
11. Performance characteristic and Morse test on a multi cylinder petrol engine
12. Testing of fuels and lubricants using Saybolt and Redwood viscometer
13. Flash and fire point of fuels and lubricating oil.
14. Performance testing of Solar flat plate collector.
15. Performance testing of concentric (Parabolic) collector

OUTCOMES

Upon the completion of the course, the students will able to

- Analyse the performance behaviour of petrol / diesel engine.
- Draw up the heat balance sheet of I.C. engines
- Analyse the power developed by each cylinder in a multi cylinder engine
- Analyse the properties of fuels / lubricants used in I.C. engines.
- Understand the various strokes & scavenging process of I.C. engines.

STRENGTH OF MATERIALS LABORATORY

L T P C
0 0 3 2

OBJECTIVES

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads.
- This would enable the student to have a clear understanding of the design for strength and stiffness.

LIST OF EXPERIMENTS

1. Tension test on MS rod and twisted bar (Electronic UTM)
2. Compression test on bricks and concrete blocks (Electronic UTM)
3. Comparison of hardness value of steel, copper and aluminium using Rockwell, Brinell and Vickers hardness measuring machines
4. Estimation of notch toughness of steel using impact testing machine
5. Fatigue test on steel
6. Compression test on wood
7. Estimation of spring constant under tension and compression
8. Tension test on MS wire (Tensile Testing Machine)
9. Double shear test (Electronic UTM)
10. Torsion test on mild steel.

OUTCOMES

- Ability to perform different destructive testing.
- Ability to characteristic materials.