BHAGWANT GLOBAL UNIVERSITY KOTDWAR

(Approved by UGC & Established by Govt. of Uttarakhand Under Act. No. 39 of 2016)

Evaluation Scheme & Syllabus
B.Tech (ME)
Choice Base Credit System

1

FIRST YEAR

(I SEMESTER)

BHAGWANT GLOBAL UNIVERSITY KOTDWAR

Approved by UGC & Established by Govt. of Uttarakhand Under Act. No. 39 of 2016

B.Tech IstYear (Common to All B.Tech Courses)

Year: I, Semester-1

S.No.	Course Code	Subject	Periods			EVALUATION SCHEME		Ex. Exam.	Subject Total	CREDT
						SESSIONAL EXAM				
			L	T	P	Mid Term	Assign.			
1	01BME 101	Engineering Mathematics - I	3	1	0	15	25	60	100	4
2	01 BME 102	Engineering Chemistry	3	1	0	15	25	60	100	4
3	01 BME 103	BTC	3	0	0	15	25	60	100	3
4	01 BME 104	Mechanical Engineering	3	1	0	15	25	60	100	4
5	01 BME 105	FEE	3	1	0	15	25	60	100	4
		Practical's								
						Internal		External		
1	01 BME 201	Engineering Chemistry	0	0	2	30	20	50	100	2
2	01 BME 202	Mechanical Engineering	0	0	2	30	20	50	100	2
3	01 BME 203	FEE	0	0	2	30	20	50	100	2
4	01 BME 204	Engineering Drawing	0	0	2	30	20	50	100	2
5	01 BME 301	General Proficiency	0	0	0	30	20	50	100	1
		TOTAL							1000	28

Note-

BTC-I - Basic Technical Communication
FEE – Fundamentals of Electronic Engineering

Subject Name- Engineering Mathematics-1
Subject Code- 01BME101
Semester-1stSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-1
Matrices
Elementary row and column transformations Rank of matrix, linear dependence, Consistency of linear system of equations, Characteristic equation, Cayley-Hamilton theorem, Eigen values and Eigen vectors, Diagonalization, Complex and unitary matrices.
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UNIT-2
Differential Calculus-I
Leibnitz theorem, Partial Differentiation, Euler's theorem, Change of variables, Expansion of functions of several variables.
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UNIT-3
Differential Calculus-II
Jacobian, Approximations and errors, Extrema of functions of several variables, Lagrange method of multipliers.

UNIT-4
Multiple Integrals
Double and triple integrals, Change of order, Change of variables, beta and gamma functions, Application to area, volume, Drichlet integral and applications.
Vector Calculus
Point functions, Gradient, divergence and curl of a vector and their physical interpretation, Line, surface and volume integrals, Green, Stokes and Gauss divergence theorem.

References:
1. Advanced Engineering Mathematics, Kreyszig, WileyIndia
2. A Text book of Engineering Mathematics (Vol.1) by Peter V. O' Neil, CengageLearning
3. B. S. Grewal: higher EngineeringMathematics, KhannaPublications.
4. N. Piskunov: Differential & Integral Calculus, Moscow PeacePublications.
5. G Shankar Rao, Text book of engineering mathematics,BS Publication,Hyderabad

Subject Name- Engineering Chemistry
Subject Code- 01 BME 102
Semester-1stSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT – I: GENERAL & ORGANIC CHEMISTRY

Molecular orbital diagram of diatomic molecules, valence bond theory & molecular orbital Theory linear combination of atomic orbitals, hybridization, hydrogen bonding, band theory of solids, liquid crystals with their classification applications, Bragg's Law, Fullerenes & their application , Nature of organic molecules, attacking reagents, inductive effect, electromeric, mesomeric (resonance) effect, hyper conjugation, reaction intermediates types of organic reaction (substitution, addition, elimination reaction & organic rearrangements), Saytzeff's rule, organic name reactions (cannizzaro's reaction, aldol condensation, Pinnacol-pinnacolon rearrangement, Beckmann's rearrangement, Hoffmann's rearrangement), Optical isomerism & confirmations, E-Z nomenclature, R-S configuration.

UNIT – II: PHYSICAL & WATER CHEMISTRY

Rate of reaction, order & molecularity of reaction, Zero order, First Order, Second order reaction, steady state approximation, concept of activation energy, energy barrier, cell potential, liquid junction potential, conductance & its variation with dilution, Transport no. Kohlraush's Law and its application, pH, buffer solution, calculation of pH of buffer mixture solubility & solubility Product, Nernst distribution law & its application, corrosion, its type, Mechanism & control , Theory of Electrochemical corrosion. Hardness of water, boiler feed water, Softening of water (Calgon Process, Zeolite process, Lime Soda process & Ion exchange process), Reverse osmosis, treatment of boiler feedwater.

UNIT – III: CHEMISTRY OF ENGINEERING MATERIALS

Introduction & classification of polymers, Types of Polymerization, bulk solution, suspension & emulsion, copolymers, vulcanization, PVC, Polyamides, Polyurethane, Polyethylene, Poly propylene, PET, Resins (Phenol Formaldehyde), PMMA, PAN, Rubber, Conducting and Biodegradable polymers, Pyroceramics, Toughened glass, Strengthening of glass, Refractories, Nano Composites, Protective Coatings, Fe, Al, Cu, Pb & Zn alloys, Organometallics & their applications.

UNIT – IV: FUELS & COMBUSTION

Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter, Coal, Biomass and Biogas, Bio Fuel, Esterification & Transesterification,Introduction of Lubricants, Mechanism of Lubrication, Classification of Lubricant, Bio Lubricant, Flash and Fire Point, Pour Point, Cloud Point, Aniline point, Viscosity index.

UNIT – V ANALYTICAL METHODS AND APPLICATIONS

Titrimetric analysis with reference to acid-base, redox, precipitation and complexometrictitrations. Elementary ideas and simple applications of UV, visible, mass and NMR spectral techniques $_H$NMR spectral techniques.

REFERENCE BOOKS
       1. Engineering Chemistry – Wiley India
       2. Engineering chemistry by Sivasankar, TMH, NewDelhi.
       3. Organic Chemistry byMorrisson & Boyd, PearsonPublication.
       4. Organic Chemistry by Loudon, Oxford University Press

Subject Name- Engineering Chemistry lab
Subject Code-01BME 201
Semester-1stSemester   **Credit Value- 2[P=2, T=0,L=0]**

LIST OF EXPERIMENTS

1. Determination of alkalinity in the given watersample.
2. Determination of temporary & permanent hardness in water sampleusing EDTA
as standardsolution.
3.Determination of available chlorine in bleachingpowder.
4. Determination of chloride content in the given water sample by Mohr'smethod.
5. Determination of iron content in the given ore by using externalindicator.
6. Determination of Acid & Base no. in lubricating oil by potentiometricmethod.
7.Determination of Equivalent weight of Iron by the chemical displacementmethod.The
equivalent weight of copper is63.5
(Note : The procedure to be followed in carrying the above experiment is given
as annexure)
8. Determination of viscosity index of lubricatingoil.
9. Determination of iron concentration in sample of water by colorimetricmethod.
10. The method involves the use of KCNS as colour developing agent & the measurements are
carried out at ?max 480nm.
Note : The general procedure of estimation is given on pp653-8 of the textbook Of
Quantitative Chemical Analysis by A.I.Vogel 6 thEdition, Publisher : Pearson Education
Ltd.2000
11. Determination of heat of neutralization of Hydrochloric acid & Sodiumhydroxide
12. Determination of flash & fire point of lubricatingoil
13.Determination of Carbon residue of lubricatingoil.
14. Determination of Sulphated ash of motoroil.
15. Determination of saponification value of lubricating oil & vegetableoil.
16. Separation of metal ions by paperchromatography.

Subject Name- Basic Technical Communication
Subject Code- 01BME103
Semester-1ˢᵗSemester   **Credit Value- 3[L=3, T=0,P=0]**

UNIT – I: COMMUNICATION
1) Communication – Definition. Process ofcommunication,
2) Types of communication—Verbal and Non-Verbal communication; Formal andInformal communication (grapevine) and theirsignificance.
3) Barriers to Communication—Semantic barriers, Physical barriers, Psychological barriers, Interpersonal barriers and Organizational barriers. Language as a tool ofcommunication.
4) Importance of communication with reference to students, professionals businessetc.
5) Technical communication: Definition, Oral and Written technical communication. Difference between general writing and technical writing.
6) Computer-aided TechnicalCommunication.
7) Style in Technical Communication. Features of technicalwriting.
8) Importance of TechnicalCommunication

UNIT-2: READING SKILLS
1) Importance of Reading Skills, Types of Reading Skills, Methods of ImprovingReading Skills, Objectives of Improving ReadingSkills
2) Vocabulary Building: Antonyms, Synonyms, Homophones, Word formation(Prefixes and Suffixes). One Word substitution,
3) Jargon/Technical Terminology – Use of Jargon and examples ofJargon.
4) Paragraph: Definition. Requirements of a paragraph -- Understanding, Unit y, Coherence and Emphasis in a paragraph. Identifying the Topic Sentence. Development ofa Paragraph using Deductive order, Inductive order, Chronological Order (Time Order), Spatial Order (Space Order), Expository Order, Question and Answer Order, Comparison and Contrast Order. Devices used to impart Coherence and Emphasis in a Paragraph. Analysis of a given Paragraph in terms of Unity, Coherence and Emphasis.
5) Developing Reading Skills and Reading Comprehension through the study ofthematic and value based critical reading of the following essays–
1. Of Discourse by FrancisBacon
2. Unity of Minds by Dr. A.P.J. AbdulKalam

UNIT-3:- WRITING SKILLS.
1) Importance of Writing Skills, Types of Writing Skills, Methods forImproving Writing Skills, Objectives of Improving WritingSkills
2) Functional Grammar- Parts ofSpeech.
3) Common Grammatical Errors: Errors of Syntax, Concordetc.
4) Sentence and Paragraph construction. Writing Expository, Argumentative, Deductive etc. Paragraphs.
5) PrécisWriting
6) Letter writing: Formal and InformalLetters.
7) Developing Writing Skills through the study of thematic and value basedcritical reading of the following shortstories–
1. After Twenty Years by O.Henry
2. The Open Window by Saki (H.H.Munro)

UNIT 4:- LISTENING SKILLS

1) Importance of Listening Skills, Process of listening, listening and hearing, Activeand Passive Listening. Types of Listening: Academic listening, Appreciative listening, Attentive Listening, Critical Listening, and Discriminative listeningetc.

2) Methods for Improving Listening Skills, Objectives of Improving ListeningSkills.

3) Barriers to listening: Semantic barriers, Physical barriers, and Psychologicalbarriers.

4) Listening Comprehension: Identifying general content, Identifying specificinformation.

5) Listening for Note taking and drawinginferences.

6) Developing listening skills and listening comprehension through the study of thematic and value based critical reading of the following one-actplay.

1. The Refund by Fritz Karinthy

7) Practice of Listening Skills through Language Laboratory

1. Listening to a recording of a telephone conversation for identifying specificinformation as well asdetails.

2. Listening to a recording of a railway / airport announcement for selective listeningand identifying specificinformation.

3. Listening to a recording of a radio / television news bulletin for identifying specificas well as over-allinformation

4. Listening to a recording of the description of a place, event or inc ident fornote-taking, identifying details, descriptions and overall idea.

5. Listening to a recording of a lecture / talk on for note taking and identifying factsand drawingconclusions.

6. Listening to a recording of a television panel discussion on any topic for identifyingfacts, analyzing those drawing inferences and explaining the conclusion of the discussion in a logicalmanner.

7. Listening to passages that are read out for practicing note taking and identifyinggeneral and detailedcontent.

8. Listening to dialogues that are read out for identifying specific, general anddetailed content.

UNIT-5:- SPEAKING SKILLS.

1) Importance of Speaking Skills, Types of Speaking, Methods for Improving SpeakingSkills, Objectives of Improving SpeakingSkills

2) Organs of Speech,Mechanism ofSpeech.

3) Phonetics: Classification of English Sounds, Vowel (short vowels and long vowels), Consonants, Diphthongs, Phonemes, Allophones, Phonetictranscription.

4) Syllable: Definition, Types of Syllable. Monosyllabic, Polysyllabic wordsetc.

5) Stress, Rhythm, Intonation: Rising Tone, Falling Tone and Rising-FallingTone.

6) Everyday Conversation: Tips and characteristics of a good conversation. Commonmannersand etiquette.

7) Debate,Making a speech, Roleplay,

8) Extempore, JAM Session (just a minutesession).

9) Practice of Speaking Skills through LanguageLaboratory

1. Practicing the following modules through self-learningsoftware:

a. Grammar with special emphasis onTenses

b. Pronunciation: of consonants, vowels, syllables and individual wordsc.

Word Stress: based on accentual patterns

d. Rhythm in speech based on content words and strong words e.
Intonation: rising, falling and rising-falling tone
f. Pause groups
g. Speech making / publicspeaking
2. Introducing self and others keeping in mindkinesics.
3. Common conversation practice (making small talketc.).
4. Asking forpermission.
5. Makingrequests.
6. Describing events / people /places
7. Extempore.
8. JAM Session (Just a MinuteSession).
9. Role play
10. Holding informaldiscussions.
11. Logical presentation of one's views on a given topic.
12. Delivering a speech using Stress, Rhythm andIntonation.

SUGGESTED REFERENCES BOOKS:
1. Kavita Tyagi & Padma Misra Basic Technical Communication, PHI, NewDelhi
2. Norman Lewis: Word Power Made Easy, W.R Goyal Pub. &Distributors.
3. Ruther Ford A: Basic Communication Skills; Person Education, N.Delhi

Subject Name- Mechanical Engineering
Subject Code- 01 BME 104
Semester-1ˢᵗSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-1

Fundamental Concepts and Definitions
Definition of thermodynamics, System, Surrounding and universe, Phase, Concept of continuum, Macroscopic & microscopic point of view. Density, Specific volume, Pressure, temperature. Thermodynamic equilibrium, Property, State, Path, Process, Cyclic and non cyclic processes, Reversible and irreversible processes, Quasi static process, Energy and its forms, Enthalpy.

UNIT-2

Zeroth law:
Zeroth law, Different temperature scales and temperature measurement **First law:**First law of thermodynamics. Processes - flow and non-flow, Control volume, Flow work and non-flow work, Steady flow energy equation, Unsteady flow systems and their analysis. **Second law:** Limitations of first law of thermodynamics, Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law and their equivalence, Carnot cycle, Carnot theorem, Thermodynamic temperature scale, Clausius inequality. Concept of entropy.

UNIT-3

Properties of steam:
Properties of steam, Phase transformation process and its graphical representation on P-V, T-V &T-s diagram, Mollier diagram and Steam Tables, Processes involving steam in closed and open systems.
Introduction to I.C. Engines: Two & four stoke S.I. and C.I. engines. Otto cycle, Diesel cycle, Dual cycle.

UNIT-4

Force systemand Analysis
Basic concept: Review of laws of motion, transfer of force to parallel position, resultant of planer force system, Free BodyDiagrams, Equilibrium. **Friction:**Introduction, Laws of Coulomb friction, Equilibrium of bodies involving dry fiction.
Structure Analysis
Beams: Introduction, Shear force and bending moment, Shear force and bending moment diagram for statically determinate and indeterminate beams.
Trusses: Introductio n, Simple Trusses, Determination of forces in simple truss members, Method of joints and Method of section.

UNIT-5

Stress and Strain Analysis
Simple stress and strain: Introduction, Normal shear stresses, Stress-strain diagrams for ductile and brittle materials, Elastic constants, One dimensional loading of members of varying cross section, Strain energy, Thermal stresses.
Compound stress and strains: Introduction, State of plane stress, Principal stress and strain, Mohr's circle for stress and strain.
Pure Bending of Beams: Introduction, Simple bending theory, Stress in beams of different cross sections.**Torsion:** Introduction, Torsion of Shafts of circular section, Torque and Twist, Shear stress due to Torque.

Reference:
1. Agarwal, Basic Mechanical Engineering, Wiley India
3.Holman, J.P. : Thermodynamics, Mc Graw Hill book Co. NY.
4. Singh Onkar, Bhavikatti S.S., Chandra Suresh : Introduction to Mechanical Engineering:
Thermodynamics, Mechanics and Strength ofMaterials, New Age International Publishers
5.Yadav R. : Thermodynamics and Heat Engines, Vol I & II (SI Edition) Central Publishing
House Allahabad.

Subject Name- Mechanical Engineering Lab

Subject Code-01BME202

Semester-1stSemester   **Credit Value- 2[P=2, T=0,L=0]**

A minimum of 10 experiments from the following :

1. Study of Steam engine and steam turbinemodels.
2. Study of 2-stroke and 4 -stroke I.C.E.models.
3. Study of Fiat engine and/ or Diesel engineprototype.
4. Study of a vapour compression Refrigeration unittutor/refrigerator.
5. Study of a window type airconditioner.
6. To conduct the tensile test on a UTM and determine ultimate 7. Tensile
strength, percentage elongation for a steelspecimen.
8. To conduct the compression test and determine the ultimate
compressive strength for aspecimen.
9. To conduct the Impact test (Izod / charpy) on the Impact testing
machine and to find the impactstrength.
10.To determine the value of acceleration due to gravity by Atwood's
Machineappratus.
11. To verify the principle of moment by Bell Crank LeverAppratus
12. To determine the moment of inertia of a flywheel apparatus about its axis of rotation
13. To verify Newton's second law o f motion by Fletcher's Trolley
apparatus
14. To find out coefficient of friction by combined inclined plane & friction
slideapparatus
15. To determine the velocity ratio, mechanical advantage & efficiency ofa single
purchase crab apparatus & draw graph between load vs effort, mechanical
advantage andefficiency.
16. To determine the velocity ratio, mechanical advantage & efficiency ofa double
purchase crabapparatus.

Subject Name-Fundamentals of Electronic Engineering
Subject Code-01 BME 105
Semester-1stSemester   Credit Value- 4[L=3, T=1,P=0]

UNIT-1
Semiconductor materials and properties
Group-IV materials, Covalent bond, electron-hole concepts Basic concepts of energy bands in materials, concepts of forbidden gap Intrinsic and extrinsic semiconductors, donors and acceptorsimpurities.

UNIT-2
Junction diode and diode applications
p-n junction, depletion layer, v- i characteristics, diode resistance, capacitance diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage).
Diode Applications
Rectifiers (half wave and full wave), calculation of transformer utilization factor and diode ratings, filter (C – filter), calculation of ripple factor and load regulation clipping circuits, clamping circuits, voltage multipliers.

UNIT-3
Breakdown diodes
breakdown mechanisms (zener and avalanche), breakdown characteristics, zener resistance, zener diode ratings, zener diode application as shuntregulator.

UNIT-4
Bipolar Junction Transistor
Basic construction, transistor action, CB, CE and CC configurations, input/output Characteristics, Concept of Biasing of transistors-fixed bias, emitter bias, potential divider bias.
TransistorAmplifier
Graphical analysis of CE amplifier, concept of voltage gain, current gain, h-parameter model (low frequency), computation of Ai, Av, Ri, $R_0$of single transistor CE and CC amplifier configurations.

UNIT-5
Field Effect Transistor
JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristics equation CG, CS and CD configurations, Introduction to self and fixedbiasing.
MOSFFT: depletion and enhancement type MOSFET-construction, operation and characteristics.
Computation of Av, Ri, Ro, of single FET amplifiers using all the three configurations.

Switching theory and logic design
Number systems, conversions of bases, Boolean algebra, logic gates, concept of universal gate, concept of K- Map.
Operational Amplifiers
Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders.
Books:

1. R. K. Singh & Lal Kishor, Basic Electronics Engineering, B S Publication,Hyderabad.
2. Gaikwad, Basic Electronics, WileyIndia
3. A Mottershead, ‗Electronic devices and circuits'. PHI,2000.
4. Morris Mano, ‗Digital Computer Design', PHI,2003.

Subject Name-Fundamentals of Electronic Lab
Subject Code-01BME203
Semester-1stSemester   Credit Value- 2[P=2, T=0,L=0]

1. Study of diodecharacteristics.

2. To study a half wave and full wave rectifiercircuit.

3. Determination of ripple factor of capacitive and non capacitive filter for HW andFW diode rectifier circuit.

4. Study of characteristics of Zener Diode as constantvoltage.

5. Verification of Application of Zener Diode as shuntregulator.

6. Study of Clipper and Clamper Circuit with differentwaveforms.

7. Determination of characteristics of BJT in CB and CEconfiguration.

8. Determination of characteristics of FET in CS and CDconfiguration.

9. Study of BJT as single stage amplifier and determination of Ai, Vi, Ri andRo.

10. Study of AND, NAND, OR, NOR and EXORgates.

11. Verification of Universal gates.

Subject Name-Engineering Drawing lab
Subject Code-01BME204
Semester-1ˢᵗSemester   **Credit Value- 2[P=2, T=0,L=0]**

1. Introduction
Graphics as a tool to communicate ideas, Lettering and' dimensioning, Construction of
geometrical figures like pentagon and hexagon.

2. OrthographicProjection
Principles of orthographic projections, Principal and auxiliary planes, First and Third angle
projections.Projection of points. Pictorial view.Projection of lines parallel to both the planes.
Parallel to one and inclined to other, Inclined to both the planes. Application to practical
problems.Projection of solid in simple position, Axis or slant edge inclined to one and parallel to
other plane,Solids lying on a face or generator on a plane.Sectioning of solids lying in various
positions, True shape of the section.Development of lateral surfaces, sheet metal drawing.

3. Isometric Projection
Principles of isometric projection, Isometric projection using box and offset methods.

II SEMESTER

BHAGWANT GLOBAL UNIVERSITY KOTDWAR

MECHANICAL ENGINEERING

B.Tech IstYear (Common to All B.Tech Courses)

Year: I, Semester-II

S.No.	Course Code	Subject	Periods			EVALUATION SCHEME			Subject Total	CREDT
						SESSIONAL EXAM		Ex. Exam.		
			L	T	P	Mid Term	Assign.			
1	02BME 101	Engineering Mathematics - II	3	1	0	15	25	60	100	4
2	02BME 102	Engineering. Physics	3	1	0	15	25	60	100	4
3	02BME 103	Advanced technical Commu.	3	0	0	15	25	60	100	3
* 4	02BME 104	Basic Electrical Engineering	3	1	0	15	25	60	100	4
* * 5	02BME 105	Fundamentals of computer prog.	3	1	0	15	25	60	100	4
* * 6	02BME 106	Environmental Studies	2	0	0	30	20	-	50	-
*	**Practicals**									
* * *						Internal		External		
* 1	02BME 201	Engineering Physics	0	0	2	30	20	50	100	2
* * 2	02BME 202	Basic Electrical Engineering	0	0	2	30	20	50	100	2
* * 3	02BME 203	FCP	0	0	2	30	20	50	100	2
* 4	02BME 204	Workshop Practice	0	0	2	30	20	50	100	2
5	02BME 301	General Proficiency	0	0	0	30	20	50	100	1
	TOTAL								1000	28

Subject Name- Engineering Mathematics-2

Subject Code-02BME101

Semester-2ⁿᵈ   Semester   Credit Value- 4[L=3, T=1,P=0]

Unit-1

Differential Equations

Ordinary differential equations of first order, exact differential equations, Linear differential Equations of first order, Linear differential equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing the dependent and independent Variables, Method of variation of parameters.

Unit-2

Laplace Transform

Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Laplace transform of periodic function, Unit step function, Convolution theorem, Applications to solve simple linear and simultaneous liner differential equations.

Unit-3 InfiniteSeries

Introduction, Sequences, Series: Convergence, Series of positive terms, Comparison tests, Integral tests, Comparison of ratio's, D'Alembert ratio test, Raabe's test, Cauchy root test, Alternating series: Leibnitz rule, Power series, Uniform convergence, Weierstress's M-test, Properties of uniformly convergent series.

Unit-4

Fourier Series and Partial Differential Equations

Periodic functions, Trigonometric series, Fourier series of periodic function, Euler's formula, Functions having arbitrary period, Change of intervals, Even and odd functions, half range sine And cosine series. Introduction to partial differential equations, Linear partial differential equations with constant coefficients of second order and their classifications: parabolic, hyperbolic and elliptic with illustrative examples.

Unit-5

Applications of Partial Differential equations

Method of separation of variables for solving partial differential equations, One dimensional wave equation, Laplace equation in two dimensions, Heat conduction equations of one dimension and two dimension.

Subject Name-Engineering Physics
Subject Code-02BME102
Semester-2ⁿᵈSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-I

Relativistic Mechanics:
Inertial and Non-inertial Frames, Postulates of Special Theory of Relativity , Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity. **Radiation:** Kirchhoff's Law, Stefan's law (only statement), Energy spectrum of Blackbody Radiation, Compton Effect.

UNIT-II

Interference: Coherent Sources, Conditions of Interference, Fresnel's Biprism Experiment, Displacement of Fringes, Interference in Thin Films – Wedge Shaped Film, Newton's Rings.
Diffraction: Single and n-Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Grating.

UNIT-III

Polarization: Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicole Prism, Production and Analysis of Plane, Circularly and Elliptically Polarized Light, Fresnel Theory, Optical Activity, Specific Rotation, Polari meter. **Laser:** Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.

UNIT-IV

Electromagnetic: Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Pointing Theorem. **Magnetic Properties of Materials:** Basic Concept of Para- , Dia and Ferro-Magnetism, Langevin's Theory of Diamagnetism, Phenomenon of Hysteresis and Its Applications

UNIT-V

Superconductivity:-
Essential properties of superconductors (zero resistivity), London equations, penetration depth and coherence length, Meissner effect, critical field , critical current Isotope effect, heat capacity, Type I and Type II superconductors, Characteristics of superconductors in superconducting state, applications of superconductors. **Wave Mechanics :** Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle, Schrödinger Wave Equation and Its Applications: Particle in a Box.

Reference Books:
1. Introduction to Special theory of Relativity Robert Resnick – WileyIndia

Subject Name- Advanced Technical Communication   Subject Code-02BME103

Semester-2ⁿᵈSemester   Credit Value- 3[L=3, T=0,P=0]

UNIT 1: TECHNICAL COMMUNICATION
 1. Introduction to technical communication, types of technical communication, historyof the development of technicalcommunication.
 2. Difference between general and technical communication, importance oftechnical communication.
 3. Characteristic features of technical communication. Elements of style intechnical communication.
 4. Process of preparing a technicaldocument.
 5. Elements, features and objectives of scientific articles, research papers, dissertationand thesis.

UNIT 2:-BUSINESS COMMUNICATION
 1. Importance and Features of Business Communication
 2. Business Correspondence – Principles, Features, Types, Format and layout of Business letter.
 3. Types of Business Correspondence – letters of Enquiry, Quotation, Order,Instructions, Sales, Credit, Complaint, Collectionetc.
 4. Some more types of Business Correspondence -- Notice, Agenda, Minutes, Memorandum.
 5. Job Application letters -- Covering letter, Resume, Bio-data andC.V.

UNIT 3:- TECHNICAL PROPOSAL and TECHNICAL REPORT
 1. Technical Proposal – Introduction, purpose, features, types, format, importance,process of preparation. Writing technicalproposals.
 2. Technical Report -- Features, Types, Style, Format, Relevance. WritingTechnical Reports.

UNIT 4:-LITERATURE
 1. Critical reading and thematic, value-based study of the Novella, **'Animal Farm'** by George Orwell.
 2. Critical review, study of theme, plot, symbolism, characterization, style of writingetc.

UNIT 5:- SOFT SKILLS
 This unit should be covered in classroom teaching as well as judicious use of language lab, (There should be optimum use of software's related to accent, presentation skills etc.)
 1. Kinesics, Para language,Proxemics.
 2. Presentation skills - Features, Types, Structure, Aids andImportance.
 3. Interpersonal communication skills – Role of Personality and its various attributes like EQ, attitude, motivation, stress management and accepting criticism in determining efficacy of interpersonalcommunication.
 4. Corporate communication skills – Role of business etiquette, conductingmeetings, managing conflict, negotiation, team spirit, decision-making, time management and

problem solvingskills.

5. Group Discussion skills - Features andImportance

6. Facing Interviews - InterviewTips.

Practice of Soft Skills using Language Laboratory

1. Practicing the following modules through self-learningsoftware:

a. Pronunciation: of consonants, vowels, syllables and individualwords

b. Word Stress: based on accentualpatterns

c. Rhythm in speech based on content words and strongwords

d. Intonation: rising, falling and rising-fallingtone

e. Pause groups

f. Presentationskills

2. Participating in MockInterviews

3. Participating in GroupDiscussions

4. Giving Presentations keeping in mind Kinesics, Para language, andProxemics

5. Participating in Role Play for enhancing interpersonal and corporatecommunication Skills

Suggested reference books

1. Kavita tyagi & padma misra, advance tech. Communication, phi, newdelhi

2. Gupta advanced technical communication, cambridge university press, n.Delhi

3. George orwell animal farm, penguin publishing company, n.Delhi

4. Sharma & mohan business correspondence and report writing, tmh, ndelhi.

5. Rubens science & technical writing, foundation books,cambridge, n.Delhi

6. Daniel riordan, raman & sharma technical communication, cengage learning, n. Delhi
Technical communication, oup, n.Delhi

7. Wallace, masters personalit y development, cengage learning, n.Delhi

8. Robert barrass students must write, foundationbooks, cambridge, n.Delhi

9. Bhaskar rao, successful career soft skills and business english, bs publications,hyderabad

10. Chakrawarthi: soft skills for professionals, wileyindia

Subject Name- Basic Electrical Engineering
Subject Code-02BME104
Semester-2ndSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-1

D.C. Network Theory :

Circuit theory concepts-Mesh and node analysis. Network Theorems- Super-position theorem. Thevenin's theorem, Norton's theorem, Maximum, Power Transfer theorem, Star Delta transformation.

Steady State Analysis of A.C. Circuits :

Sinusoidal and phasor representation of voltage and current: single phase A.C. circuit behavior of resistance, inductance and capacitance and their combination in series & parallel and power factor, series parallel resonance-band width and quality factor : magnetic circuit.

UNIT-2

Three Phase A.C. Circuits :

Star-Delta connections, line and phase voltage/current relations, three phase power and its measurement.

3. Measuring Instruments:

Construction and principle of operation of voltage and current measuring instruments; introduction to power and energy meters.

UNIT-3

Transformer :

Principle of operation, types of construction, phasor diagram, equivalent circuit, efficiency and voltage regulation of single phase transformer, O.C. and S.C. tests.

Unit-4

D.C. Machines

Principle of electromechanical energy conversion, types of d.c. machines, E.M.F. equation, Magnetization and load characteristics, losses and efficiency, Starter and speed control of d.c. motors, their applications.

Synchronous Machines: Principle of Operation of Alternator and synchronous motor.

UNIT-5

Three phase induction Motor

Principle of operation, types and methods of starting, slip-torque characteristics, applications.
Single
phase Motors : Principle of operation and methods of starting of induction motor, Stepper motor and Universal motor

References :
1. Dr. R. K. Singh and Dr. P.S. Subramanyam, Basic Electrical Engineering, BS Publication, Hyderabad.

Subject Name- Fundamentals of Computer & Programming
Subject Code-02BME105
Semester-2ndSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-I
Introduction to Computer Systems; Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions. Binary arithmetic, Floating point arithmetic, signed and unsigned numbers IEEE standards, CPU organization, ALU, registers, memory, the idea of program execution at micro level. Concept of computing, Contemporary Operating Systems such as DOS, Windows, UNIX etc. (only brief user level Description). Introduction to organization and architecture of mainframe, mini and micro systems.

UNIT-II
Concept of flow chart and algorithm; Algorithms to programs: specification, top-down development and stepwise refinement ,Introduction to the design and implementation of correct, efficient and maintainable programs, structured Programming, Use of high level programming language for the systematic development of programs, programmability and programming languages, Object codes, compilers. Introduction to the Editing tools such as vi or MS-VC editors.

UNIT-III
C: Data types, Identifiers, Storage class, Constant, Operators, expression, Statements, console I/O statements, Selection statements: if-else, switch, Iteration Statements: for, while, do-while, Jump statements: return, go to, break, continue, comments. Function, Call by value, Call by reference, arguments to main(), return statements, recursion, function prototypes, preprocessor directives.

UNIT-IV
Arrays:
Single dimensional arrays, two dimensional arrays, multidimensional arrays, variablelength arrays. Strings, array of strings. Structures: array of structures, passing structure to function, structure pointers, structure within structures. Unions, bit fields,enumerations.

UNIT-V
Pointers: pointer variables, pointer operator, pointer expression, array of pointers, multiple indirection, pointers to functions, dynamic allocation functions.
File I/O : Streams and files, file system basics, fread, fwrite, fseek, random access I/O, fprintf(), fscanf(), standard streams.

Subject Name- Environmental Studies
Subject Code-02BME301
Semester-2ndSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-1 NATURAL RESOURCES:

Renewable and Non-renewable Resources:

Natural resources and associated problems.

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

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

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

d) Food resources : World food problems, changes caused by agriculture andover-grazing, effects

of modern agriculture, fertilizer-pesticide problems, water logging, salinit y, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources,use of alternate energy sources. Casestudies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soilerosion anddesertification.

• Role of an individual in conservation of naturalresources.

• Equitable use of resources for sustainablelifestyles.

UNIT- 2 ECOSYSTEMS

• Concept of anecosystem.

• Structure and function of anecosystem.

• Producers, consumers anddecomposers.

• Energy flow in theecosystem.

• Ecologicalsuccession.

• Food chains, food webs and ecologicalpyramids.

• Introduction, types, characteristic features, structure and function of thefollowing ecosystems:-

a. Forestecosystem

b. Grasslandecosystem

c. Desertecosystem

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

UNIT- 3 BIODIVERSITY AND ITS CONSERVATION
• Introduction – Definition : genetic, species and ecosystemdiversity.
• Biogeographically classification ofIndia
• Value of biodiversity : consumptive use, productive use, social, ethical,aesthetic
and option values
• Biodiversit y at global, National and locallevels.
• Inida as a mega-diversit ynation
• Hot-sports ofbiodiversity.
• Threats to biodiversit y : habitat loss, poaching of wildlife, man-wildlifeconflicts.
• Endangered and endemic species ofIndia
• Conservation of biodiversity: In-situ and Ex-sit conservation ofbiodiversity.

UNIT- 4 ENVIRONMENTAL POLLUTION & SOCIAL ISSUES
• Definition
• Cause, effects and control measures of:-
a. Airpollution
b. Waterpollution
c. Soil pollution
d. Marinepollution
e. Noisepollution
f. Thermalpollution
g. Nuclearhazards
• Disaster management : floods, earthquake, cyclone andlandslides.
• From Unsustainable to Sustainable development
• Urban problems related toenergy
• Water conservation, rain water harvesting, watershedmanagement
• Environmental ethics : Issues and possiblesolutions.
• Climate change, global warming, acid rain, ozone layer depletion,nuclear
accidents and holocaust. Case Studies.
• Wastelandreclamation.
• Consumerism and wasteproducts.

REFERENCE BOOK
1. M Ajni Reddy, Text book of environmental Science, BS Publication,Hyderabad
2. Environmental Studies byDaniel, WileyIndia
3. Environmental Studies by Erach Bharucha, UniversityPress.
4. Fundamental of Ecology, E.P.Odum, Cengage Learning.
5. Environmental Science and Engineering byWright, PearsonPublication.
6. First Ecology by Beeby and Brennan, Oxford UniversityPress.
7. Environment Science byMiller, Cengage Learning, NewDelhi.
8. Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards Vol. 1 &
Vol. 2, Bharat Publication, NewDelhi.

Subject Name- Engineering Physics Lab
Subject Code-02BME201
Semester-2ndSemester   **Credit Value- 2[P=2, T=0,L=0]**

List of Experiments (At least ten)
1. To determine the wavelength of monochromatic light by Newton'sring.
2. To determine the wavelength of monochromatic light with the help of Fresnel'sbiprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shadepolarimeter.
5. To determine the wavelength of spectral lines using plane transmissiongrating.
6. To determine the specific resistance of the material of given wire using Carey Foster'sbridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of thecoil.
8. To verify Stefan's Law by electricalmethod.
9. To calibrate the given ammeter andvoltmeter.
10. To study the Hall effect and determine Hall coefficient, carnier density and mobility of a given semiconductor material using Hall-effect setup.
11. To determine energy bank gap of a given semiconductormaterial.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the givenspecimen.
14. To determine the ballistic constant of a ballisticgalvanometer.
15. To determine the viscosity of aliquid.
Note : Additional experiments may be added based on contents of syllabus.

Subject Name- Fundamentals of Electrical Engineering Lab
Subject Code-02BME202
Semester-2ndSemester   **Credit Value- 2[P=2, T=0,L=0]**

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1. Study of diode characteristics. Study of phenomenon of resonance in RLC seriescircuit.
2. Measurement of power in a three phase circuit by two wattmetermethod.
3. Measurement of efficiency of a single phase transformer by loadtest.
4. Determination of parameters and losses in a single phase transformer by OC and SCtest.
5. Study of characteristic of DCMotor.
6. Study of characteristic of ACMotor.
7. DC generatorcharacteristics.
8. 10. Speed control of dc shuntmotor.
9.   Study running and reversing of a three phase inductionmotor.
10. Study of a single phase energymeter.
11. Verification of NetworkTheorems

Subject Name- C Programming Lab
Subject Code-02BME203
Semester-2ndSemester   **Credit Value- 2[P=2, T=0,L=0]**

List of Experiments
1. Practice of all internal and External DOSCommands
2. Practice of all UNIX commands and write simple shellscript.
3. WAP to perform simple arithmetic operations using different datatypes.
4. WAP to swap two numbers without using thirdvariable.
5. to find out whether the given number is prime ornot.
6. WAP using conditional operator to determine whether a year is leap year ornot.
7. WAP to print the ASCII code and their equivalentcharacters.
8. WAP to print corresponding days of a week using switchcase.
9. WAP to print factorial of a number usingrecursion.
10. WAP to print Fibonacci series usingfunction.
11. WAP to print an array and find greatest element of thearray.
12. WAP to arrange elements of a given array in ascendingorder.
13. WAP for Matrix multiplication and find the inverse of resultantmatrix.
14. WAP to print name, price & no. of pages of 3 books usingstructures.
15. WAP to remove the trailing blanks in a string input by the user, and print theresulting string usingpointer.

Subject Name- Workshop Practice
Subject Code-02BME204
      Semester-2ndSemester   **Credit Value- 2[P=2, T=0,L=0]**

Carpentry Shop:

1. Study of tools and operation and carpentry joints.

2. Simple exercise using jack plain.

3. To prepare half- lap corner joint, mortise and tennon joints.

4. Simple exercise on woodworkinglathe.

Fitting Bench Working Shop :
1. Study of tools and operations
2. Simple exercises involving filling work.
3. Making perfect male-female joint
4. Simple exercise involving drilling/tapping/dieing.

Black Smithy Shop :
1. Study of tools and operations
2. Simple exercises based on black smithy operations such as upsetting, drawing down,
punching, bending, fullering &swaging.

Welding Shop :
1. Study of tools and operations .
2. Simple butt joint.
3. Lapjoint.
4. oxy acetylenewelding.

Sheet metal shop :
1.Study of tools and operations.
2. Making funnel complete with soldering.
3. Fabrication of tool box, tray, electrical panel boxetc

Machine Shop :
1. Study of tools and operations.
2. Plane turning.
3. Step turning.
4.Taper turning
5. Threading.
6. Single point cutting toolgrinding.

SECOND YEAR

(III SEMESTER)

(YEAR II, SEMESTER-III)

S.No.	SUBJECT CODE	SUBJECT NAME	PERIODS			Evaluation Scheme				Credit
						SESSIONAL EXAM.				
			L	T	P	Mid	Assign.	Ext.	Total	
	THEORY									
1.	03BME101	Engineering Mathematics –III	3	1	0	15	25	60	100	4
2.	03BME102	Materials Science	3	0	0	15	25	60	100	3
3.	03BME103	Applied Thermodynamics	3	1	0	15	25	60	100	4
4.	03BME104	Fluid Mechanics	3	1	0	15	25	60	100	4
5.	03BME105	Strength of Material	3	1	0	15	25	60	100	4
	PRACTICAL/TRAINING/PROJECT									
						Inter.		External		
6.	03BME201	Material Science & Testing Lab	0	0	2	30	20	50	100	2
7.	03BME202	Machine Drawing-I	0	0	2	30	20	50	100	2
8.	03BME203	Fluid Mechanics Lab	0	0	2	30	20	50	100	2
9.	03BME204	Applied Thermodynamics Lab	0	0	2	30	20	50	100	2
10.	03BME301	General Proficiency	0	0	0	30	20	50	100	1
		Total							1000	28

(YEAR II, SEMESTER-IV)

S. No.	Subject Code	SUBJECT NAME	PERIODS			Evaluation Scheme			Total	Credit
						SESSIONAL EXAM.				
			L	T	P	Mid	Assign.	External		
		THEORY								
1.	04BME101	Industrial Engineering	3	1	0	15	25	60	100	4
2.	04BME102	Kinematics of Machine	3	0	0	15	25	60	100	3
3.	04BME103	Manufacturing Science-I	3	1	0	15	25	60	100	4
4.	04BME104	Electrical Machines	3	1	0	15	25	60	100	4
5.	04BME105	Measurement, Metrology and Control	3	1	0	15	25	60	100	4
		PRACTICAL/TRAINING/PROJECT								
6.	04BME201	Manufacturing Science-I Lab	0	0	3	30	20	50	100	2
7.	04BME202	Measurement, Metrology and Control Lab	0	0	2	30	20	50	100	2
8.	04BME203	Machine Drawing-II	0	0	2	30	20	50	100	2
9.	04BME204	Electrical Machines Lab	0	0	3	30	20	50	100	2
10.	04BME301	General Proficiency	0	0	0	30	20	50	100	1
		Total							**1000**	**28**

NOTE: Practical summer training-I of 4-weeks after IV –semester will be evaluated in VII semester

Subject Name- Engineering Mathematics-3
Subject Code- 03BME101
Semester-3rdSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit - I : Integral Transforms

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

Z – transform and its application to solve difference equations.

Unit - II : Functions of a Complex Variable - I

Analytic functions, C-R equations and harmonic functions, Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Liouvilles theorem, Fundamental theorem of algebra.

Unit - III : Functions of a Complex Variable - II

Representation of a function by power series, Taylor's and Laurent's series, Singularities, zeroes and poles, Residue the orem, evaluation of real integrals of type $\int_0^{2\pi} f(\cos\theta, \sin\theta) \, d\theta$ and $\int_{-\infty}^{+\infty} f(x) \, dx$, Conformal mapping and bilinear transformations.

Unit - IV : Statistics and Probability

Moments, Moment generating functions, Skewness, Kurtosis,Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

Unit - V : Curve Fitting and Solution of Equations

Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations.

Subject Name- Material Science
Subject Code- 03BME102
Semester-3rdSemester   **Credit Value- 3[L=3, T=0,P=0]**

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, Non-destructive 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 behaviours and processing of plastics. Future of plastics.

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

Performance of materials in service: Brief theoretical consideration of Fracture,

Fatigue, and Corrosion anditscontrol.

References :
1.   *W.D. Callister, Jr, - Material Science & Engineering Addition-Wesly PublishingCo.*

2.   *Van Vlash - Elements of Material Science & Engineering John Wiley &Sons.*
3.   *V. Raghvan - Material Science, Pretice Hall ofIndia*
4.   *Narula - Material Science,TMH*
5.   *Srivastava, Srinivasan - Science of Materials EngineeringNewage.*
6.   *K.M. Gupta – MaterialScience.*

Subject Name- Applied Thermodynamics
Subject Code- 03BME103
Semester-3rdSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-I
Review of Thermodynamics : Brief review of basic laws of thermodynamics, Helmholtz &
Gibb's function, Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron
Equation, Joule -Thompson coefficient and Inversion curve. Coefficient of volume expansion,
Adiabatic & Isothermal compressibility. Availability & Irreversibility.   7
Unit-II
Properties of Steam and Boilers : Properties of steam. Use of stream table & Mollier Chart.
Steam generators-classifications. Working of fire-tube and water-tube boilers, boiler mountings &
accessories, Draught & its calculations, air pre heater, feed water heater, super heater. Boiler
efficiency, Equivalent evaporation. Boiler trial and heat balance.   6
Unit-III
Steam Engines : Rankine and modified Rankine cycles, working of stream engine Indicator
diagram.   4
Steam & Gas Nozzles : Flow through nozzle, variation of velocity, area and sp. Volume, nozzle
efficiency, Throat area. Super saturated flow.   4
Unit-IV
Vapour Power cycles: Effect of Pressure & temp. on Rankine cycle Reheat cycle, Regenerative
cycle, feed water heaters.
Steam Turbines : Classification, impulse and reaction turbines, Staging, Stage and overall
efficiency, re-heat factor, bleeding, comparison with steam engines. Governing of turbines.
Velocity diagram of simple & compound multistage impulse & reaction turbines & related
calculations work done efficiencies of reaction, impulse Reaction Turbines, state point locus,
Reheat factor.   6
Unit-V
Gas Turbine & Jet Propulsion: Gas turbine classification Brayton cycle, Principles of gas
turbine, Gas turbine cycles with intercooling, reheat & regeneration stage efficiency, polytropic
efficiency. Deviation of actual cycles from ideal cycles.   5
        Introduction to the principles of jet propulsion, Turbojet & turboprop engines & their
processes, Introduction toRocketEngine.   4

References :
1.   *Applied thermodynamics by Onkar Singh, New Age International (P) PublishersLtd.*
2.   *Thermal Engg. By P.L. Blallaney, KhannaPublisher*
3.   *Theory of Stream Turbine by W.J.Kearton*
4.   *Steam & Gas Turbine by R.Yadav, CPHAllahabad*
5.   *Thermal Engg. By R.K. Rajput, LaxmiPublication*
6.   *Turbine Compressons & Fans by S.M. Yahya,TMH*
7.   *Gas Turbine, by Ganeshan, Tata McGraHillPublishers.*
8.   *Heat Engines byb R. Yadav, CPHAllahabad.*
9.   *Engg. Thermodynamics byNag*
10.   *Engg. Thermodynamics by C.P.Arora..*
11.   *Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long manLtd.*

Subject Name- Fluid Mechanics
Subject Code- 03BME104
Semester-3rdSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT I:

Introduction: Fluids and continuum; Physical propertiesoffluids: Viscosity, Compressibility, Surface Tension, Capillarity, Vapour Pressure; Cavitation; Classification of fluids including rheologicalclassification.

Fluid Statics: Pascal's law; Pressure-density- height relationship; Measurement of pressure by Manometers and mechanical gauges; Pressure on plane and curved surfaces; The Hydrostatic law; Total Pressure and Centre of pressure; Buoyancy; Stability of immersed and floating bodies; Fluid masses subjected to uniform horizontal and vertical accelerations.

Dimensional Analysis: Units and Dimensions, Dimensional analysis, Rayleigh's method, Buckingham's ? theorem, Important dimensionless numbers used in fluid mechanics and their significance.

UNIT II:

Hydraulic Similitude and Model Studies: Model and prototype; Similitude; Geometric, Kinematic and Dynamic similarity; Model Laws; Un-distorted model studies.

Fluid Kinematics: Description of Fluid flow: Lagrangian and Eulerian approach; Types of fluid Flows: Steady and unsteady, Uniform and non-uniform, Laminar and turbulent flows, 1, 2 and 3-D flows; Stream lines, Path lines and Streak lines; Stream tube; Acceleration of a fluid particle along a straight and curved path; Differential and Integral form of Continuity equation; Rotation, Vorticity and Circulation; Elementary explanation of Stream function and Velocity potential; Flow net characteristics, uses and experimental and graphical methods of drawing.

Fluid Dynamics-I: Concept of control volume and control surface, Reynolds Transport Theorem, Introduction to Navier-Stokes Equations, Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Flow through orifices, Mouthpieces, Nozzles, Notches, Weirs, Sluice gates under free and submerged flow conditions; Free and Forced vortex motion.

UNIT III:

Fluid Dynamics-II: Impulse-Momentum Principle; Moment of momentum equation; Momentum equation application to stationary and moving vanes, pipe bends, ***Problems related to,*** combined application of energy and momentum equations, flow measurements, determination of coefficients of discharge, velocity and contraction and energy loss.

Laminar Flow: Reynolds Experiment**;** Equation of motion for laminar flow through pipes; Flow between parallel plates; Kinetic energy and Momentum correction factors; Stokes law; Flow through porous media; Darcy's Law; Fluidization; Measurement of viscosity; Transition from laminar to turbulentflow.

Turbulent Flow: Turbulence; Equation for turbulent flow; Reynolds stresses; Eddy viscosity; Mixing length concept and velocity distribution in turbulent flow; Working principle of Hot-wire anemometer and Laser Doppler anemometer (LDA).

UNIT IV:

Boundary Layer Analysis: Boundary layer thicknesses; Boundary layer over a flat plate; Laminar boundary layer; Application of Von-Karman Integral Momentum Equation; Turbulent boundary layer; Laminar sub- layer; Hydro-dynamically Smooth and rough boundaries; Local and average friction coefficient; Total drag; Boundary layer separation and itscontrol.

Flow Through Pipes: Nature of turbulent flow in pipes; Equation for velocity distribution over smooth and rough surfaces; Major and Minor energy losses; Resistance coefficient and its variation; Hydraulic gradient and total energy lines; Flow in sudden expansion, contraction, diffusers, bends, valves and siphons; Concept of equivalent length; Branched pipes; Pipes in series and parallel; Simple pipe networks.

Unit V:

Compressibility Effects in Pipe Flow: Transmission of pressure waves in rigid and elastic pipes; Water hammer; Analysis of simple surge tank excluding friction.

Ideal (Potential) Fluid Flow: Importance; Elementary concept of the uniform flow, the source flow, the sink flow and the free vortex flow.

Flow Past Submerged Bodies: Drag and lift, Types of drag force, Drag on sphere, Cylinder and airfoil; Circulation and Lift on a cylinder and airfoil; Magnus effect.

REFERENCES:
1. *R J Fox: Introduction to FluidMechanics*
2. *Hunter Rouse: Elementary Mechanics of Fluids, John Wiley and sons, Omc/1946.*
3. *L H Shames: Mechanics of Fluids, McGraw Hill, International studentedition.*
4. *Garde, R J and A G Mirajgaonkar: Engineering Fluid Mechanics (including Hydraulic machines), second ed., Nemchand and Bros, Roorkee,1983.*
5. *K L Kumar: Engineering FluidMechanics*
6. *Munson, Bruce R, Donald F Young and T H Okishi, Fundamentals of Fluid Mechanics, 2nd ed, wileyEastern.*
7. *V Gupta and S K Gupta, Fluid Mechanics and its Applications, Wiley easternltd.*
8. *Som and Biswas: Introduction to Fluid Mechanics and Machines,TMH.*
9. *R K Bansal: Fluid Mechanics and HydraulicMachines*
10. *Modi and Seth: Fluid Mechanics and FluidMachines*

Subject Name- Strength Of Materials
Subject Code- 03BME105
Semester-3rdSemester **Credit Value- 4[L=3, T=1,P=0]**

UNIT-I
Review: Review of simple and compound stresses, Mohr's Circle.
3-D Stress, Theory of failure, Castingliona's Theorem, Impact load: Three-dimensional state of stress & strain, equilibrium equations. Generalized Hook's Law. Theories of Failure. Castigliano's Theorem. Impact load & stresses.
Airy's Stress Fuction: Airy's stress function and its applications

UNIT –II

Stresses in Beams: Review of pure Bending**.** Direct and shear stresses in beams due to transverse and axial loads,compositebeams.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulys method, area moment method, fixed andcontinuousbeams.

Torsion: Review of Torsion, combined bending & torsion of solid & hollow shafts.

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, laminatedsprings.
Columns and Struts: Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions. Euler's theory and experimental results, Ranking Gardon Formulae, Examples of columns in mechanical equipments and machines.

UNIT-IV

Thin cylinders & spheres: Hoop and axial stresses and strain.Volumetricstrain.
Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, Compound cylinders. Stress due tointerferencefits.

UNIT-V

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.

Unsymmetrical Bending : Properties of beam cross-section, slope of beutral 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. 5

- ***Books:***

    1. *Strength of Materials byRyder*
    2. *Strength of Materials bySinger*
    3. *Strength of Materials by Timoshenko and Timoshenko & Ysung*
    4. *Engineering Mechanics of Solids byPopov*
    5. *Mechanics of Materials by BearJhonson*
    6. *Strength of Materials by R.K.Rajput*
    7. *Strength of Materials by Ramamrutham &Narain*
    8. *Advanced Mechanics of Solids by Kazami,TMH*

Subject Name- Material Science And Testing Lab
SubjectCode- 03BME201
Semester-3 Semester   **Credit Value- 2[L=0, T=0,P=2]**

A.   **Material Science Lab Experiments :** (at least 5 of thefollowing)
1. Making a plastic mould for small metallicspecimen.
2. Specimen preparation for micro structural examination-cutting, grinding, polishing,etching.
3. Grain Size determination of a givenspecimen.
4. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, cooperetc.)
5. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before andafter.
6. Material identification of say 50 common items kekpt in abox.
7. Faradays law of electrolysisexperiment.
8. Study of corrosion and itseffects.
9. Study of microstructure of welded component and HAZ. Macro & Micro examination.

B. Material Testing Lab Experiments : (at least 5 of thefollowing)
1. Strength testing of a given mild steel specimen on UTM with full details and s-e plot on themachine.
2. Other tests such as shear, bend tests onUTM.
3. Impact testing on impact testing machine like Charpy, Izod orboth.
4. Hardness testing of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index testing on spring testingmachine.
6. Fatigue testing on fatigue testingmachine.
7. Creep testing on creep testingmachine.
8. Deflection of beam experiment, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion testing of a rod on torsion testingmachine.
10. Study of non-destructive testing methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetranttests.

Subject Name- Machine Drawing-I
SubjectCode- 03BME202
Semester-3 Semester   **Credit Value- 2[L=0, T=0,P=2]**

MACHINE DRAWING-I

1. Introduction : Graphic language, Classification of drawings, Principles of drawing: IS codes for Machine drawing, Lines, Scales, Sections, Dimensioning, Standardabbreviations.
2. Orthographic Projections : Principles of first and third angle projections, drawing and sketching of machine elements in orthographic projections, spacing ofviews.
3. Screwed (Threaded) fastners: Introduction, Screw thread nomenclature, Forms of threads, Thread series, Thread designation. Representation of threads, Bolted joints, Locking arrangements for nuts, Foundationbolts.
4. Keys and Cotters : Keys, Cotterjoints.
5. Shaft couplings : Introduction, Rigid and flexiblecoupling.
6. Riveted Joints : Introduction, Rivets and riveting, Rivet heads, Classification of rivetedjoints.
7. Assembly drawing : Introduction, Engine parts, Stuffing boxetc.
8. Fee hand sketching : Introduction, Need for free hand sketching, Free hand of sketching of some threaded fasteners and simple machinecomponents.

References:
1. N. Siddeshwar, P.Kannaiah, V.V.S. Shastry : Machine drawing, TMH, New Delhi.
2. K.L. Narayana, P. Kannaiah, K. Venkat Reddy : Machine drawing, New Age Intemational Publications, 2^{nd}edition.
3. Engineering drawing practice for schools and colleges, SP46-1998(BIS)

Subject Name- Fluid Mechanics Lab

Subject Code- 03BME203
Semester-3rdSemester   **Credit Value- 2[L=0, T=0,P=2]**

1. To determine the metacentric height of a ship modelexperimentally.
2. To study the transition from laminar to turbulent flow and to determine the lower critical Reynoldsnumber.
3. To determine the coefficients of velocity, contraction and discharge of an orifice (or a mouth piece) of a given shape. To plot the flow net for a given model using the concept of electricalanalogy.
4. To find the velocity distribution in a pipe and hence to compute the discharge by integrating the velocity profileobtained.
5. To verify the Bernoulli'stheorem.
6. To calibrate an orifice meter and venturimeter and to study the variation of the coefficient of discharge with the Reynoldsnumber.
7. To calibrate and to determine the coefficient of discharge for rectangular and triangularnotches.
8. To verify Darcy's law and to find out the coefficient of permeability of the given medium.
9. To verify the momentumequation.
10. To study the boundary layer velocity profile and to determine boundary layer thickness and displacement thickness. Also to determine the exponent in the power law of velo citydistribution.
11. To study the variation of friction factor, 'f' for turbulent flow in smooth and rough commercialpipes.
12. To determine the loss coefficients for the various pipefittings.
13. To study the flow behaviour in a pipe bend and to calibrate the pip e bend for dischargemeasurement.

Subject Name- Applied Thermodynamics Lab Subject
Code- 03BME204
Semester-3rdSemester   **Credit Value- 2[L=0, T=0,P=2]**

1. Study of Fire Tubeboiler
2. Study of water Tubeboiler
3. Study & working ofRefrigerator
4. Study of velocity compounded steamturbine
5. Study of pressure compounded steamturbine
6. Study of impulse & Reactionturbine
7. Study of steam Enginemodel.
8. Study and working of two stroke petrolEngine
9. Study and working of Four stroke petrolEngine
10. Determination of Indicated H.P. of I.C. Engine by MorseTest
11. Study of Gas TurbineModel
12. Study & working of Airconditioner
13. Prepare the energy balance for Diesel/PetrolEngine
14. Study & working of two stroke DieselEngine
15. Study & working of four shope DieselEngine.
16. Study of Ignition system of I.C.Engine.
17. Study of Breaking system of anyvehicle.

IV SEMESTER

Subject Name- Industrial Engineering
Subject Code- 04BME101
Semester-4thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-I

1.Productivity: Introduction, definition, measurement, productivity index, ways to improve productivity, Types of ProductionSystem.

2. Work study : Meaning and benefits of work study, time & motion study. Micromotion study P.M.T.S. man machine Diagram flow chart. Motion economy, Method study, work measurement, work sampling, standardtime.

Unit-II

3. Plant layout and materials Handling : Plant location, type of layout, principles of facility layout principles of material handling, Material Handlingeqpts.

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

Unit-III

5. Managerial Economics : Introduction, Assumptions, Time Value of money, apprised, criteria step- in BEA, purpose, costs & overheads fixed & variable costs, margin of safety, Angle of incidence profit volumegraph.

6. Replacement Analysis : Depreciation causes, obsolescence, service life of assets, Replacement ofitems.

7. Maintenance Management : Maintenance Planning & Control, MaintenanceStrategy

Unit-IV

8. Inventory Control : Inventory, function, cost, deterministic models, Introduction to MRP, supply chainManagement

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

Unit-V

10. Indus trial Ownership : Proprietorship, partnership,Jointstock   & co-operative stores.2

11. Manpower Planning : Resources, Humanrelationship.

12. Organization : Principles of organization, Development of Organizational charts like line, staff, line and staff & Functionaltypes.

13. Job Evaluation & Merit rating : Job analysis, Job description job simplification and job evaluation methods & description, merit rating, wage incentiveplans.

References :
1. *Principles of management. An analysis of manageme ntfunctions-H.Koontz & C.O. Donnel. Tata McGrow-Hall Co.*
2. *Manufacturing Management-J Moore Prentice Hall Englewoon cliffs :Newjersey.*
3. *Modern production operations Management-Buffam E.S. Wileyeastern.*
4. *Industrial Engg. & Management O.P.Khanna.*

Subject Name- Kinematics of Machines
Subject Code- 04BME102
Semester-4thSemester   **Credit Value- 3[L=3, T=,P=0]**

UNIT I

Introduction
Links-types, K inematics 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.

Books and References:

1.   Theory of machines - ThomasBevan
2.   Theory of machines and mechanisms - Shigley
3.   Theory of machines and mechanisms -Ghosh & Mallik
4.   Theory of machines and mechanisms - Rao &Dukkipati
5.   Theory of Machines – R. K. Bansal
6.   Theory of Machines – V. P. Singh
7.   Theory of Machines – Malhotra &Gupta

Subject Name- Manufacturing Science-I
Subject Code- 04BME103
Semester-4ᵗʰSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-I Introduction :

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

Metal Forming Processes :

Elastic & plastic deformation, yield criteria. Hot working vs cold working. Load required to accomplish metal forming operation.

Analysis (equilibrium equation method) of forging process with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging

Unit-II

Metal Forming Processes (continued):

Analysis of Wire/strip drawing and max. reduction, Tube drawing, Extrusion and its application.

Condition for Rolling force and power in rolling. Rolling mills.

Design, lubrication and defects in metal forming processes.

Unit-III

Sheet Metal working :

Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs Piercing. Compound vs Progressive die. Flat- face vs Inclined-face punch and Load(capacity) needed.

Analysis of forming process like cup/deep drawing and bending.

Unit-IV

Unconventional Metal forming processes :

Unconventional metal forming processes such as explosive forming, electro-magnetic, electro-hydraulic forming.

Powder Metallurgy :

Powder metallurgy manufacturing process. The process, advantage and applications.

Jigs & Fixtures :

Locating & clamping devices/principle. Jigs and Fixtures and its applications.

Manufacturing of Plastic components :

Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives.

Unit-V

Casting (Foundry)

Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand. Elements of mould and design considerations, gating, riser, runnes, core. Solidification of casting, theory and analysis. Sand casting, defects & remedies and inspection. Cupola furnace.

Die Casting centrifugal casting. Investment casting etc.

Books :

1. *Manufacturing Science by Ghosh andMallik*
2. *Production Engg. Science by P.C.Pandey*
3. *Production Technology by R.K.Jain*
4. *Manufacturing Technology by P.N.Rao.*
5. *Materials and Manufacturing by PaulDegarmo.*

Subject Name- Electrical Machines
Subject Code- 04BME104
Semester-4thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit – I :

Transformers: Construction, polarity test, Sumpner's test, all day efficiency
Autotransformer: Volt-amp relation, efficiency, advantages & disadvantages and applications; Three-phase transformers: Connections, three-phase bank of single phase transformers, Scott connections; Instrument Transformers.

Unit – II :

D.C. Machines:
D.C.machine: Construction, emf and torque equations. Armature reaction, commutation, performance characteristics of motors and generators, starting of motors, speed control losses andefficiency.

Unit – III :

Three-Phase Induction Motor:
Construction, rotating magnetic field and principle of operation, of equivalent circuit, torque production, Torque-slip characteristics, speed control, starting of squirrel cage and slip ring induction motors.

Unit – IV:

Three-phase Synchronous Machines :
Alternator: Construction, emf equation & effects of pitch and distribution factors phasor diagram, armature reaction, Voltage regulation and its determination by synchronous impedance method, methods of synchronization
Synchronous motor: Principle of operat ion and starting torque and mechanical power developed, effect of excitation on line current, (v – curves)

Unit – V :

1. Fractional H.P.Motors:
Single phase induction motor: Construction, revolving field theory and principle of operation, equivalent circuit and starting methods. Two-phase servo - motor, stepper motor, and their applications.
2. Industrial Applications:
    Concept of braking in dc and ac motors, two quadrant and four quadrant operation of dc and three phase induction motors, industrial applications of dc and ac motors

REFERENCES:
1   Electric Machines by I J Nagrath & D P Kothari , Tata McGraw Hill ,1997
2   Electric Machines by Ashfaq Husain , Dhanpat Rai & Com. ,2005
3   Generalised Theory of Electrical Machines by Dr. P S Bimbhra ,1996
4   Irvin L.Kosow,"Electric Machinery and Transformers" Prentice Hall ofIndia.

Subject Name- Measurement, Metrology and Control
Subject Code- 04BME105
Semester-4thSemester **Credit Value- 4[L=3, T=1,P=0]**

Unit-I

I. MechanicalMeasurements

Introduction: 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 oferror, 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, pneumalic & hydraulic systems.

Temperature measurement :

By thermometers, bimetallic, thermocouples, thermistors and pyrometers.

Vibration:

Seismic instruments, vibration pick ups and decibel meters, vibrometers accelerometers.

Unit-III :

METROLOGY

II. Metrology and Inspection:

Standards of linear measurement, line and end standards. Limit, fits and tolerances. Interchangeability and standarisation.

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

Controls

Introduction: Concept of Automatic Controls – open loop & closed loop systems. Servomechanisms. Block diagrams, transfer functions.Applicationsof Laplace-Transform in control systems with simple examples /numericals.

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

References

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. *Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi,1994*
6. *Sirohi, "Mechanical Measurement" New AgePublishers*

Subject Name- Manufacturing Science-1 Lab
Subject Code- 04BME201
Semester-4thSemester   **Credit Value- 2[L=0, T=0, P=2]**

Experiments :

Say minimum 8 experiments out of following (or such experiment).

1.   Design of pattern for a desired casting (containinghole)
2.   Patternmaking
3.   Making a mould (with core) andcasting.
4.   Sand testings (at least one such as grain fineness numberdetermination)
5.   Injection moulding withplastics
6.   Forging hand forgingprocesses
7.   Forging - power hammer study &operation
8.   Tube bending with the use of sand and on tube bendingm/c.
9.   Press work experiment such as blanking/pievcing, washer, makingetc.
10.   Wire drawing/extrusion on softmaterial.
11.   Rolling-experiment.
12.   Bending & springback.
13.   Powder metallergyexperiment.
14.   Jigs & Fixtureexperiment.

Subject Name- Measurement, Metrology and Control lab
Subject Code- 04BME202
Semester-4thSemester   **Credit Value- 2[L=0, T=0,P=2]**

Experiments:

Say minimum 8 out of following (or such experiments)

1. Study & working of simple measuring instruments. Like vernier calipers, micrometer, tachometeretc.
2. Measurement of effective diameter of a screw thread using 3 wiremethod.
3. Measurement of angle using sinebar & slipgauges.
4. Study of limitgauges.
5. Study & angular measurement using levelprotector
6. Adjustment of spark plug gap using feelergauges.
7. Study of dial indicator & its constructionaldetails.
8. Use of dial indicator to check a shape runuse.
9. Study and understanding of limits, fits &tolerances
10. Pressure measuringexperiment
11. Temperature measurementexperiment
12. Strain gaugemeasurement
13. Speed measurement usingstroboscope
14. Flow measurementexperiment
15. Vibration/work measuringexperiment.
16. & 17. Expe riments on'Controls'

Subject Name- Machine Drawing –II Lab
Subject Code- 04BME203
Semester-4ᵗʰSemester   **Credit Value- 2[L=0, T=0,P=2]**

Review

Orthographic projection, missing lines, interpretation of views and sectioning.

Part and Assembly drawing

Introduction, assemblies drawing of stuffing box, steam engine cross head, air valve, late tailstock, gate valve, screw jack, connecting rods, spark plug, tool post, safety valves etc. Drawing exercises.

Specification of Materials :

Engineering materials, code designation of steels, copper and aluminum and its alloys.

Limits, Tolerance and fits :

Introduction, Limit systems, tolerance, fits Drawings and exercises

Surface Roughness :

Introduction, surface roughness, machining symbols, indication of surface roughness, drawing exercises

Production Drawing:

Introduction to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crankshaft, belt pulley, piston details etc. Idea about tooldrawing.

Computer Aided Drafting :

Introduction, input, output devices, introduction to drafting software like Auto CAD, basic commands and development of simple 2D and 3D drawings.

References :

1.   *Machine Drawing by Narayana, et. all, NewAge*
2.   *Production drawing by Narayana, et. all, NewAge*
3.   *Auto CAD 14 for Engineering Drawing by P. Nageswara Rao,TMH.*

Subject Name- Electrical Machines Laboratory
Subject Code- 04BME204
Semester-4thSemester   **Credit Value- 2[L=0, T=0,P=2]**

Note: Minimum nine experiments are to be performed from the following list.

1   To obtain magnetization characteristics of a dc shuntgenerator
2   To obtain load characteristics of a dc shuntgenerator
3   To obtain load characteristics of a dc seriesgenerator
4   To obtain load characteristics of a dc compound generator (a) cumulatively compounded (b) differentiallycompounded
5   To obtain speed – torque characteristics of a dc shuntmotor
6   To obtain efficiency & voltage regulation of a single phase transformer by Sumner's (back to back)test
7   To perform no load test & block rotor test on a three phase induction motor and determine parameters of equivalent circuit andefficiency
8   To perform no load test and blocked rotor test on a single phase induction motor and determineefficiency
9   To obtain variation of stator current with excitation current (V/curve) of a three phase synchronous motor at no load ½ load and fullload.
10   To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation by synchronous impedance method at a power factor of unity 0.8 lagging & 0.8leading
11   To study operation of a 2-phase ac servomotor and a steppermotor
12   To study parallel operation of three phasealternators

THIRD YEAR

(V SEMESTER)

Semester:V

S. No	Subject Code	Subject Name	Periods			Evaluation			Total	Credit
			L	T	P	Sessional				
						Mid	T A	External		
Theory										
1	05BME101	**Mechanical Vibrations**	3	1	0	15	25	60	100	4
2	05BME102	**Machine Design I**	3	1	0	15	25	60	100	4
3	05BME103	**Dynamics Of Machine**	3	1	0	15	25	60	100	4
4	05BME104	**Manufacturing Science II**	3	1	0	15	25	60	100	4
5	05BME105	**Heat and Mass Transfer**	3	1	0	15	25	60	100	4
6	05BME106	**Concepts of programming and OOPS**	2	1	0	15	25	60	100	3
Practical										
						Internal		Exter nal		
1	05BME201	**Theory of Machine Lab**	0	0	2	30	20	50	100	2
2	05BME202	**Heat and Mass Transfer**	0	0	2	30	20	50	100	2
3	05BME203	**Application of programming and OOPS Lab**	0	0	2	30	20	50	100	2
4	05BME301	**General Proficiency**	0	0	0	30	20	50	100	1
Total									**1000**	30

L- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

Semester-VI

S.No	Subject Code	Subject Name	Periods			Evaluation			Total	Credit
			L	T	P	Sessional		External		
						Mid	TA			
Theory										
1	06BTC101	Operation Research	3	1	0	15	25	60	100	4
2	06BTC102	IC Engine	3	1	0	15	25	60	100	4
3	06BTC103	Machine DesignII	3	1	0	15	25	60	100	4
4	06BTC104	Fluid Machinery	3	1	0	15	25	60	100	4
5	06BTC105	Refrigeration and Air Conditioning	3	1	0	15	25	60	100	4
6	06BTC106	Principle Of Management	2	1	0	15	25	60	100	3
Practical										
1	06BTC201	Machine Design II Lab	0	0	2	30	20	50	100	2
2	06BTC202	Fluid Machinary Lab	0	0	2	30	20	50	100	2
3	06BTC203	Refrigeration and Air Conditioning Lab	0	0	2	30	20	50	100	2
4	06BTC301	Seminar/General Proficency				30	20	50	100	1
Total									1000	30

L- Lecture, **T**- Tutorial, **P**- Practical, **CT**- Class Test comprising of two testes in a semester each of 15 Marks, **TA**- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10marks

MECHANICAL VIBRATIONS

UNIT- I

INTRODUCTION:

Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, fourieranalysis.

Single Degree Freedom System: Free vibration, Natural frequency, Equivalent Systems, Energy method for determining naturalfrequency, Response to aninitialdisturbance,

Torsional vibrations, Damped vibrations. Damping models – Structural, Coulomb and Viscous damping, Vibrations of system withviscous damping, Logarithmic decrement,Viscousdampers.

UNIT- II

Single Degree Freedom: Forced vibration, Harmonic Excitation with viscous damping, Steady state vibrations,

Forced vibrations with rotating and reciprocating unbalance,Support excitation,

Vibration isolation, Transmissibility, Vibration measuring instruments- Displacement, Velocity, Acceleration and Frequencymeasuringinstrument.

UNIT- III

Two Degree Freedom System: Introduction, Principal modes, Double pendulum, Torsional system with damping,

Coupled System, Undamped dynamic, vibration absorbers, Centrifugal pendulum absorber, Dry friction damper, Untunedviscousdamper.

UNIT- IV

Multidegree Freedom System: Exact Analysis Undamped free and forced vibrations of multidegree system,

Influence numbers, Reciprocal Theorem, Torsional vibration of multi rotor system, Vibration of geared system,

Principalcoordinates, Continuous systems- Longitudinal vibration of bars, Torsional vibrations ofCircular shafts, Lateral vibrationofbeams.

UNIT- V

Multidegree Freedom System: Numerical Analysis Rayleigh's, Dunkerley's, Holzer's and Stodola's

methods, Rayleigh –Ritzmethod.

Critical Speed of Shafts: Shafts with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

Reference Books :

1. Mechanical Vibration –Magreb, Cengage India, NewDelhi

2. Mechanical Vibration Practice with Basic Theory – V. RamaMurthy – NarosaPublishers

3. Machanical Vibrations – S.S. Rao,Pearson

4. Mechanical Vibration- Palm, Wiley India, NewDelhi

MACHINE DESIGN

UNIT-I

Introduction, Definition, Methods, standards in design & selection ofpreferredsize.

Selection of materials for static & fatigue loads, Materials for components subjected to creep, BIS system of designation of steels, steels, plastics & rubbers. AISI (American Iron & Steel Institution), ASTM rubbertestingmethods.

UNIT-II
Design against static load.
Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of Failure

Design against fluctuating load stress concentration, stress concentration factors, Fluctuating/alternting stresses, fatigue failure, endurance limit, design for finite & infinite life, Soderberg &Goodman criteria.

UNIT-III
Design Of Joints
Welded joint, screwed joints, ecentric loading of above joints, Joint design for fatigue loading.

Shaft, keys & coupling.
Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys & splines, rigid &flexiblecouplings.

UNIT-IV
Mechanical springs
Design of Helical and leaf springs, against static &fatigueloading.

Design analysis of Power Screws
Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack.

UNIT-V
Introduction to Product Development & Design Process
Definition of Design, Design Process, Need Analysis, Need based developments, Design by Evolution, Technology based developments, Examples. Case Studies. Brain-storming.

References
1. Design of Machine Elements : Bhandari,TMH
2. Machine design : Sharma & Aggarwal, Katsonspublications
3. Mechanical Design, Theory and Metholodogy, Waldraon, BSP,Hyderabad
4. M/C Design : Maleev &Hartman
5. Machine Design, Robert L Norton,Pearson
6. Machine Design –U C Jindal,Pearson

DYNAMICS OF MACHINES

UNIT-I

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

UNIT-II Balancing of machines:
Static and dynamic balancing, Balancing of rotating and reciprocating masses, Primary and secondary forcesand couples.

UNIT-III Friction:
Pivot and collar friction, Friction circle, Single plate, Multiplate and Cone clutches, Michelle & Kingsbury thrust bearing and Rolling contact bearing, Belts and pulleys, Flat and V-belts, Designandselection.

Brakes and Dynamometers (Mechanical Type):
External and internal shoe brakes, Band and Block brakes, Hydraulic brakes, Absorption andTransmissiondynamometers.

UNIT-IV
Governors:
Dead weight and spring loaded governors, Sensitivity, Stability, Hunting, Isochronisms, Effort and Power, Friction and Insensitivity, Introduction toinertiagovernors.

UNIT – V
Gyroscopic Motion:
Principles, Gyroscopic acceleration, gyroscopic couple and Reaction. Effect of Gyroscopic couple upon the stability of aero planes, ship, two &fourwheelers.

References
1.Theory of Machine: Thomas Bevan (Pearson)
2.Theory of Machine: S.S.Ratan (TMH)
3. Kinematics, Dynamics & Design of Machinery-Waldron(Pearson)

CONCEPTS OF PROGRAMMING AND OOPS

UNIT 1
UTILIZATION: Developer fundamentals such as editor, integrated programming environment, UNIX shell,modules,libraries.
PROGRAMMING FEATURES: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic I/O. **APPLICATIONS:** Sample problems in engineering, science, text processing, and numerical
methods.

UNIT2
PROBLEM SOLVING WITH ALGORITHMS- Programming styles – Coding Standards and Best practices - Introduction to C Programming, Testing and Debugging. Code reviews, System Development Methodologies – Software development Models, User interface Design
–
introduction – The process – Elements of UI design&reports.

UNIT3
OBJECTED ORIENTED CONCEPTS – object oriented programming, UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism, Object Oriented Design methodology - Common Base class,Alice Tool – Application of OOC using Alice tool. 4

UNIT4
RDBMS- DATA PROCESSING – the database technology – data models,ER modeling concept –notations – Extended ER features, Logical database design – normalization, SQL – DDL statements – DML statements – DCL statements, Writing Simple queries – SQL Tuning
techniques – Embedded SQL–OLTP

REFERENCES:

1.Computer Concepts and C Programming by Vikas Gupta, Wiley India

2.Introduction to Computers by Peter Norton,TMH

3. G. Dromey, How to Solve It by Computer, Pearson

4.Programming in ANSI C by Balaguruswamy, TMH

MANUFACTURING SCIENCE-II `

Unit-I

A Metal Cutting and Machine Tools

Metal Cutting-
Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability. Brief introduction to machine tool vibration and

surface finish. Economics ofmetalcutting.

Unit-II

Machine Tools
(i) Lathe : Principle, types, operations, Turret/capstan, semi/Automatic,Toollayout.
(ii) Shaper, slotter, planer : operations&drives.
(iii) Milling : Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required.
(iv) Drilling and boring : Drilling, boring, reaming tools. Geometry oftwistdrills.

Unit-III

Grinding & Super finishing
(v) Grinding : Grinding wheels, abrasive, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and Cylindrical grinding.Centerlessgrinding.
(vi) Super finishing : Honing,lapping, polishing.

Limits, Fits & Tolerance and Surface-roughness:
Introduction to Limits, Fits, Tolerances and IS standards,andsurface-roughness.

Unit-IV

B. Metal Joining (Welding)
Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding : Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic

hydrogen, submerged arc, electroslag, friction welding. Soldering &Brazing.

Thermodynamic and Metallurgical aspects in welding and weld,. Shrinkage/residual

stress in welds. Distortions & Defects in welds and remedies. Weld decayinHAZ.

Unit-V

C. Introduction to non conventional ManufacturingProcess
Benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding application such as LBW, USW, EBW, Plasma arc welding, Explosive welding. HERE-ExplosiveForming

Books

1. Modern Machining Processes by P.C. Pandey & H.S.Shan
2. Manufacturing science by Degarmo, WileyIndia
3. Manufacturing Technology Metal Cutting & Machine Tools by PN Rao,TMH
4. Manufacturing Process by Sontosh Bhatnagar, BSPHyderabad

HEAT & MASS TRANSFER

UNIT-1

Introduction to Heat Transfer:
Concepts of heat flows: conduction, convection and radiation; effect
Of temperature on thermal conductivity of materials; introduction to combined heat transfer
mechanism.

Conduction :
One-dimensional general differential heat conduction equation in the rectangular,initial and
boundaryconditions.

Steady State one-dimensional Heat conduction :
Composite Systems in rectangular, cylindrical and spherical coordinates with and without Energy
generation; thermal resistance concept; Analogy between heat and electricity flow; thermal contact
resistance;Overall Heat Transfer Coefficient,critical thickness of insulation.

UNIT-2
Types of fins, Fins of uniform cross-sectional area; errors of measurement of temperature in thermometer
wells.

Transient Conduction:
Transient heat conduction Lumped capacitance method, unsteady state heat conduction in one
dimension only,Heisler charts.

UNIT-3

Forced Convection:
Basic concepts; hydrodynamic boundary layer; thermal boundary layer, flow over a flat
plate; flow across a single cylinder and a sphere; flow inside ducts; empirical heat transfer
relations; relation between fluid friction and heat transfer; liquid metalheattransfer.

Natural Convection :
Physical mechanism of natural convection; buoyant force; empirical heat transfer
relations for natural convection over vertical planes and cylinders, horizontal plates and
Cylinders,andsphere.

UNIT-4

Thermal Radiation :
Basic radiation concepts; radiation properties of surfaces; black body radiation laws;
shape factor; black-body radiation exchange; Radiation exchange between non-blackbodies in
an enclosure; Infinite parallel Planes,radiationshields;

UNIT-5

Heat Exchanger :
Types of heat exchangers; fouling factors; overall heat transfer coefficient; logarithmic Mean temperature difference (LMTD) method; effectiveness-NTU method; compact heat Exchangers, Steam distribution systems.

Condensation And Boiling :
Introduction to condensation phenomena; heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes pool boiling,curve,forced convective boiling.

Introduction To Mass Transfer :
Introduction; Flick's law of diffusion; steady state equimolar counter diffusion; steady state diffusion though a stagnantgas film.

Books
1. Elements of Heat transfer by Cengel,TMH
2. Heat and mass transfer, M.Thirumaleswar, Pearson
3. Fundamentals of Heat & Mass Transfer by Incropera Wiley India
4. 4.Heat & Mass Transfer by Khurmi, Schand,NewDelhi

THEORY OF MACHINE LAB

Min. 5 out of following (or such) experiments to be done:

1. To Study various types of links, pairs, chain andmechanism.
2. To Study various types of gear- Helical, cross helical, worm, bevelgear.
3. To study the various types ofdynamometer.
4. Exp. onGovernor.
5. Exp. on critical speed of shaft (whirling of shaft)
6. Exp. onGyroscope
7. Exp. on Balancing (static &dynamic)
8. To study various types of Cam and followerarrangement.
9. Exp. on Gears (tooth profile, interferenceetc.)
10. Exp. on Geartrains.
11. To plot follower displacement v/s cam rotation for various cam followerarrangements.
12. Exp. on Vibration(spring)

HEAT & MASS TRANSFER–LAB

(min 8 experiment of the following orsuchexperiment)
1. Conduction - Composite wallexperiment
2. Conduction - Composite cylinderexperiment
3. Convection - Pool Boilingexperiment
4. Convection - Experiment on heat transfer from tube-naturalconvection.
5. Convection - Heat Pipeexperiment.
6. Convection - Heat transfer through fin-natural convection.
7. Convection - Heat transfer through tube/fin-forcedconvection.
8. Any experiment - Such as on Stefen's Law,
on radiation detrmination of emissivity,etc.
9. Any experiment - Such as on solar collector, etc. on
radiation
10. Heat exchanger - Parallel flowexperiment
11. Heat exchanger - Counter flowexperiment
12. Any other suitable exp such as on critical insultationthickness.
13. Conduction - Determination of thermal conductivity offluids.
14. Conduction - Thermal Contact ResistanceEffect.

VI SEMESTER

OPERATIONS RESEARCH

Unit 1: Introduction:
Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods.

Linear Programming Problems:
The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases.

Unit 2: Transportation Problem:
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods,
Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation
problems.
Assignment Problem: Formulation, unbalanced assignment problem,travelingproblem.

Unit 3: Game Theory:
Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game),dominanceproperty.

Unit 4: Queuing Theory:
Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzingof M/M/ 1 and M/M/Cqueuingmodel.

Unit 5: PERT-CPM Techniques:
Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing ofsimplenetworks.

Reference :
1. Taha H. A. - Operations Research ,Pearson
2. Operations Research: Principles and practice: Ravindran, Phillips & Solberg, Wiley Indialtd
3. AM Natarajan, P.Balasubramani , ATamilaravari "Operation research" Pearson2005
4. Introductionto operation research: Theory and Applications, Springer BSP,Hyderabad
5.S D Sharma-Operations Research, KedarnathRamnath

IC ENGINES

Unit-1

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

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

Unit–2

SI Engines:
Carburetion, Mixture requirements, Carburetor types Theory ofcarburetor,MPFI. Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design forSIengines.

I gnition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, battery and its types, Charging and discharging of batteries

Unit–3 CI Engine:
Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors,Injectiontimings.
Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CIengines.

Scave nging in 2 Stroke engines, pollution andit'scontrol.

Unit-4

Engine Cooling: Different cooling systems, Cooling Towers, Radiators and cooling fans.

Lubrication: Engine friction, Lubrication principal, Type of lubrication ,Lubrication oils,Crankcaseventilation.

Supercharging: Supercharging, Types ofsupercharging.

Testing and Performance: Performance parameters, Basic measurements, , Testing of SI andCIengines.

Unit-5

Compressors:
Classification, Reciprocating compressors, Single and multi stage, Intercooling,
Volumetricefficiency.

Rotary compressors, Classification, Centrifugal compressor, Elementary theory ,Vector
Diagram efficiencies, Elementary analysis ofaxialcompressors.

BOOKS:
I.C. Engines by Ganeshan ,TMH
I C Engines by Ferguson, Wiley India
A Course in International Combustion Engines, by Mathur & Sharma, Dhanpat Rai &
Sons. Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications
Czechoslovakia . I.C Engine Analysis & Practice by E.FObert.
I.C Engine, by Ganeshan, TMH
I.C Engine, by R. Yadav, Central Publishing House, Allahabad

MACHINE DESIGN-II

UNIT I

Spur Gears Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of geartooth, Failure of gear tooth, Design of spur gears, AGMA andIndian standards.

Helical Gears Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design ofhelicalgears.

Worm Gears Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of wormgearing

UNIT II

Sliding Contact Bearing Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing, **5**

Rolling Contact Bearing Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting ofbearing.

UNIT III

IC ENGINE PARTS

Selection of type of IC engine, General design considerations, Design of Cylinder and cylinder head; Design of piston, piston ring and gudgeon pin; Design of connecting rod; Design of centre crankshaft **6**

References:

1. Mechanical Engineering Design – Joseph E. Shigely, McGraw HillPublications

2. Design of Machine Memebers-Alex Valance and VI Doughtie, McGraw HillCo.

3. Machine design-M.F. Spott, Prentice HallIndia

4. Machine Design-Maleev and Hartman,CBS

5. Machine design -Black & Adams, Mc GrawHill

6. Machine Design-Sharma and Agrawal, S.K. Katara &Sons

7. Design of Machine Elements-V.B. Bhandari, Tata McGraw HillCo.

FLUID MACHINERY

UNIT-I

Introduction:
Classification of Fluid Mechanics, Application of momentum and momentum equation to flow through hydraulic machinery, Euler'sfundamentalequation.

Impact of jet:
Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), effect of inclination of jet withthesurface.

Hydraulic Turbines:
Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing ofPeltonwheel.

UNIT-II

Reaction Turbines:
Fransis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, cavitation in turbines, principles of similarity, unit and specific speed, performance characteristics, selection ofwaterturbines.

UNIT-III

Centrifugal Pumps:
Classifications of centrifugal pumps, vector diagram, work done by impellor, efficiencies of centrifugal pumps, specific speed, model testing, cavitation and separation, performance characteristics.

UNIT-IV

Positive Displacement Pumps:
Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration, work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps,performancecharacteristics.

UNIT-V

Other Machines:
Hydraulic accumulator, Intensifier, Hydraulic press, Lift and Cranes, theory of hydraulic coupling and torque converters,performancecharacteristics.

Water Lifting Devices: Hydraulic ram, Jet pumps, Airlift pumps**,** water distribution systems.

References:
Fluid Mechanics and Hydraulic Machines by S C Gupta,

Pearson Fundmanetals of Fluid Mechanics by Munson, Pearson
Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
Hydraulic Machines: Theory & Design, V.P.Vasandhani, Khanna Pub.
Hydraulic Machines by R K Rajput, S.Chand & co Ltd.
Hydraulic Machines by D S Kumar

REFRIGERATION & AIR CONDITIONING

Unit-1

Refrigeration:
Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature(DART).

Unit-2

Vapour Compression System:
Single stage system, Analysis of vapour compression cycle, use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Different configuration of multistage system, Cascade system. **8**

Unit-3

Vapour Absorption system;
Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Ammonia – Water vapour absorption system,Lithium-Bromide water vapour absorptionsystem,Comparison.

Refrigerants:
Classification, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFCfreerefrigerants.

Unit-4

Air Conditioning:
Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body Effective temperature and comfort chart, Cooling and heating load calculations, Infiltration & ventilation, Internal hear gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dewpoint(ADP).

Unit-5

Refrigeration Equipment & Application:
Elementary knowledge of refrigeration & air conditioning equipments e.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, cold storage, Refrigerates Freezers, Icc plant, Water coolers, Elementaryknowledgeoftransmissionanddistributionofairthroughductsandfans,Basic

difference between comfort and industrialairconditioning.

Books:
Refrigeration and Air conditioning by C.P Arora.TMH
Refrigeration and Air conditioning by Arora & Domkundwar.Dhanpat Rai
Refrigeration and Air conditioning by stoecker & Jones.
Refrigeration and Air conditioning by Roy J. Dossat.Pearson
Heating Ventilating and Air conditioning by Mcquiston
Thermal Environment Engg. by Kuhen, Ramsey & Thelked. Central Book

Agency. ASHRAE Handbooks

PRINCIPLES OF MANAGEMENT

UNIT1
INTRODUCTION TO MANAGEMENT: Theories of management: Traditional behavioral,

contingency and systems approach. Organization asasystem.

UNIT 2
MANAGEMENT INFORMATION: Interaction with external environment. Managerial decision makingand MIS.

UNIT 3
PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS: design of organization structure; job design and enrichment; job evaluation andmeritrating.

UNIT 4
MOTIVATION AND PRODUCTIVITY: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques.Casestudies.

TEXT BOOK:
1.Schermerhorn,; Management and Organisational Behaviour essentials, WileyIndia
2. Koontz: Essentials of Management, PHILearning.
3. Hirschey: Managerial Economics, CengageLearning.
4.A V Rau: Management Science, BSP, Hyderabad
5.Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6.Stephan R Robbins Fundamental of Management, Pearson

FLUID MACHINERY LAB

(Say min 8 experiments from following or such experiment)
1. Impact of Jetexperiment.
2. Turbine exp. on Peltonwheel.
3. Turbine exp. on Francisturbine.
4. Tubrine exp. on Kaplanturbine.
5. Exp. on Reciprocating pump.
6. Exp. on centrifugalpump.
7. Exp. on HydraulicJack/Press
8. Exp. on HydraulicBrake
9. Exp. on HydraulicRam
10. Study through first visit of any pumpingstation/plant
11. Study through second visit of any pumpingstation/plant.
12. Any other suitable experiment/test rig such as comparision & performance of different typesof
pumps and turbines.

REFRIGERATION & AIR CONDITIONING   **L**
LAB

Say min 8 out of following

1.Experiment on refrigeration test ring and calculation of various proformance parameters.
2. To study different types of expansion devices used in refrigreationsystem.
3. To study different types of evaporators used in refrigerationsystems.
4. To study basic components of air-conditioningsystem.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. To study airwashers
7. Study of window airconditioner.
8. Study & determination of volumetric efficiency ofcompressor.
9. Visit of a central air conditioningplant.
10. Visit of coldstorage.

FOURTH YEAR

(VII SEMESTER)

VII SEMESTER

S. No	Subject Code	Subject Name	PERIOD			EVALUATION SCHEME				CREDIT
			L	T	P	SESSIONAL EXAM			TOTAL	
						MID	TA	EXTE.		
1	07BME101	CAD/CAM	3	1	0	15	25	60	100	4
2	07BME102	Experimental Stress Analysis	3	1	0	15	25	60	100	4
3		Elective I	3	1	0	15	25	60	100	4
4		Elective II	3	1	0	15	25	60	100	4
5.		Open Elective	3	1	0	15	25	60	100	4
Practical /Training/Project										
6	07BME201	CAD/CAM	0	0	2	30	20	50	100	2
7	07BME202	Industrial Training Report	0	0	2	30	20	50	100	2
8	07BME203	Project	0	0	3	30	20	50	100	3
9	07BME204	Seminar	0	0	2	30	20	50	100	2
10	07BME301	General Proficiency				30	20	50	100	1
Total									1000	30

Seminar will be on any technical topic and internal evaluation will be done through a presentation

Subject Name- CAD/CAM
Subject Code- 07BME101
Semester-7ᵗʰSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT I :

Cad Tools: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, Review of C, C++, statements such as if else for while & switch, functions, pointer-notations, structure & class, concept of OOP.
Geometric modeling: Output primitives- Bresenham's line drawing and Mid-point circle algorithms. Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves.

UNIT II:

Surface Modeling: Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.
Parametric Representation of Synthetic Surfaces – Hermit Bicubic surface, Bezier surface, B-Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).
Geometricmodelling-3d : Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).

UNIT III :

Cad/Cam Exchange : Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.
Design Applications : Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.
Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.
Introduction to CAD/CAE, Element of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance &necessity.
Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/ Displacement Matrix, One/Two Dimensional bar & beam element (as spring system) analysis.

UNIT – IV:

Features of NC Machines- Difference between ordinary and NC machine tools. Methods for improving Accuracy and Productivity.
NC Part Programming- Manual (word address format) programming. Examples Drilling and Milling.

UNIT – V:

System Devices- Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa.
Interpolators- Principle, Digital Differential Analyzers. Linear interpolator, circulator Interpolator and its software interpolator.

Control of NC Systems- Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control

Books/References

1. *Computer Graphics by Hearn & Baker (Pearson / Prenticehall)*
2. *Computer Aided Design by R.K.Srivastava.*
3. *Computer Graphics –Theory & Practice- Foley, Van Dam, Feiner, (PearsonEducation)*
4. *CAD/CAM Theory and Practice – Ibrahim Zeid (Mc Graw HillInternational)*
5. *Computer Aided Analysis & Design of Machine Elements (Rao &Dukkipati)*
6. *Mathematical Elements for Computer Graphics – Rogers & Adams (Mc Graw Hill)*
7. *C AD/CAM – Groover & Zimmers (Prentice Hall of India PvtLtd)*
8. *Computer Oriented Numerical Methods – Rajaraman (PrenticeHall)*
9. *FEM – SS.Rao.*
10. *Computer control of Manufacturing systems byKoren*

Subject Name- CAD/CAM Lab
Subject Code- 07BME201
Semester-7thSemester   **Credit Value- 2[L=0, T=0,P=2]**

Say 10 experiments (6 from CAD experiments, 4 from CAM experiment)
A. CADExperiments-
1. Line drawing or Circle drawing algorithm experiment: writing the program and running it oncomputer.
2. Transformations algorithm experiment for translation/rotation/scaling: writing program and running it on computer.
3. Design problem experiment: writing the program for design of machine element or other system and running it oncomputer.
4. Optimization problem experiment: writing a program for optimizing a function and running it oncomputer.
5. Auto CAD experiment: understanding and use of Auto CADcommands.
6. Writing a small program for FEM for 2 spring system and running it. Or using a FEMpackage.
7. Use of Graphic software standards packages e.g. GKs/PHICS/GLetc.
8. Use of pro Engineer/Ideasetc.
B. CAMexperiments-
1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NCmachine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NCmachine
3. Experiment on Robots and itprograms
4. Experiment on Transfer line/Materialhandling.
5. Experiment on difference between ordinary machine and NC machine, study orretrofitting.
6. Experiment on study of system devices such as motors and feedbackdevices.
7. Experiment on Mechatronics &controls.

Subject Name- Experimental Stress Analysis
Subject Code- 07BME102
Semester-7ᵗʰSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT I:
Elementary Elasticity:
Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Co-ordinate System, Special States of Stress.
Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State ofStress.

UNIT II
Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid-Method of StrainAnalysis.
Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

UNIT III
Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.
Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null Balance Bridges.
Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, Plane Shear-Gage.

UNIT IV
Theory of Photo elasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polari scope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polari scope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirror.

UNIT V
Two Dimensional Photo elasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photo elasticity.

Text Books:

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student Edition, McGraw-Hill BookCompany.
2. Experiment Stress Analysis by Dr. Sadhu Singh, KhannaPublishers.

LIST OF ELECTIVES

Elective-I

07BME-103.1 Computer Integrated
Manufacturing
07BME-103.2 Mechanical Vibrations
07BME-103.3 Management Information System
07BME-103.4 Non conventional energy
resources
 07BME-103.5 Advanced Engineering Material

Elective-II

07BME104.1 Optimization Techniques in Engineering
07BME104.2 Advanced Welding Processes
07BME104.3 Six Sigma Methods & Applications
07BME104.4 Non Destructive Testing
07BME104.5 Hydraulic & Pneumatic Systems

Subject Name- Computer Integrated Manufacturing
Subject Code- 07BME103.1
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT 1:
Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

UNIT 2:
Computer Aided Design (CAD): CAD hardware and software; product modeling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre.

UNIT 3:
Computer Aided Manufacturing (CAM): Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP); computer aided production scheduling; computer aided inspection planning; computer aided inventory planning; flexible manufacturing system (FMS); concept of flexible manufacturing.

UNIT 4:
Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting.

UNIT 5:
Management Information Systems (MIS), Various CIM systems – examples.

References :

1. *CAD, CAM, CIM by P.Radhakrishnan and S.Subramanyan, New Age InternationalPublishers.*
2. *Computer Integrated Manufacturing by Paul G. Rankey, PrenticeHall.*
3. *Computer Integrated Manufacturing by Harrington J. Jr., Industrial Press, Inc., NewYork.*
4. *Computer Integrated Manufacturing by K.Rathmill and P.Macconal, IFSPublications.*
5. *Automation, Production Systems and Computer Integrated Manufacturing by M. P.Groover*

Subject -Mechanical Vibration
Subject Code- 07BME103.2
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT- I
INTRODUCTION: Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, fourier analysis.
Single Degree Freedom System:
Free vibration, Natural frequency, Equivalent Systems, Energy method for determining natural frequency, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Damping models – Structural, Coulomb and Viscous damping, Vibrations of system with viscous damping, Logarithmic decrement, Viscous dampers.

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

UNIT- III
Two Degree Freedom System:
Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled System, Undamped dynamic, vibration absorbers, Centrifugal pendulum absorber, Dry friction damper, Untuned viscous damper.

UNIT- IV
Multi degree Freedom System: Exact Analysis
Undamped free and forced vibrations of multidegree system, Influence numbers, Reciprocal Theorem, Torsional vibration of multi rotor system, Vibration of geared system, Principal coordinates, Continuous systems- Longitudinal vibration of bars, Torsional vibrations of Circular shafts, Lateral vibration ofbeams.

UNIT- V
Multi degree Freedom System: Numerical Analysis
Rayleigh's, Dunkerley's, Holzer's and Stodola's methods, Rayleigh – Ritz method. **5**
Critical Speed of Shafts:
Shafts with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

Reference :
1. Mechanical Vibration – P. Srinivasan –TMH
2. Mechanical Vibration – G. K. Grover – Jain Bros. Roorkee.
3. Mechanical Vibration –W.T. Thomson
4. Mechanical Vibration – Theory & Application – Tse, Morse &Hinkle
5. Introduction Course on Theory and Practice of Mech. Vibration – J.S. Rao & K. Gupta, New Age Publishers.

Subject Name- Management Information System
Subject Code- 07BME103.3
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-I
Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, Various channels of information & MIS.

Unit-II
Foundation of Information System : Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS-dataflow diagram, flow chart etc.

Unit-III
Business application of information technology, electronic commerce, Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage.

Unit-IV
Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

Unit-V
Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, Procurement Management System Object Oriented modeling case studies.

Books
1. *O.Brian, "Introduction to Information System", Mc-Graw Hill.*
2.*O.Brian, "Management Information System", TMH.*
*3.**Alter, "Information Systems : A Management Perspective", Addison Wesley. Arora&*
*4.**Bhatia, "Information Systems for Managers",Excel*
*5.**Bansal, "Information System Analysis & Design",TMH.*

Subject Name- Non-Conventional Energy Resources
Subject Code- 07BME103.4
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-1
Indian and global energy sources, Energy exploited Energy planning, Energy consumption and GDP, Energy demand analysis, National energy plan. Introduction to various sources of non conventional energies.
UNIT-2
Solarenergy:
Solar radiations and its geometry:
Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, flux on a plane surface, latitude, expression for angle between, incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length. Solar collectors, Flat plat, Concentric collectors, Cylindrical collectors. Solar energy storage.
UNIT-3
Wind energy:
Properties of wind, Availability of wind energy in India, wind Velocity, wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill,
Geothermal energy:
Principal of working, types of geothermal station with schematic representation,
UNIT-4
Tidal power:
Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems.
Hydrogen Energy:
Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel.
UNIT-5
Electrical energy conservation in building lighting, heating, ventilating and air conditioning, power factor improvement in power systems, Energy audit of Combustion process, Boilers, Turbines, compressors, Pumps, Heat exchangers, Condensers, Use of industrial, wastes.

BOOKS :

1.Energy Management and condevtion, by Clive Beggs, Butterwoth- Heinemann Elsevier Science.
2.Optimising Energy Efficiency in the Industry, By Rajan, Tata Mc Graw Hill Publishers. Guide to
energy Management , By C.L Capehart, Fairmont Press.
3.Renewable Energy Sources and their Environment Impact, by Abbasi & Abbasi, Prentice Hall ofIndia.
4.Environmental Risks and Hazards by Cutter, Prentice Hall ofIndia.
5.Bansal Keemann, Meliss," Renewable energy soucesa and conversion technology", Tata Mc GrawHill.

Subject - Advance Engineering Materials
Subject Code- 07BME103.5
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

UNIT-I

Ferrous Materials, their Properties and Applications:
Plain carbon steels, their properties and application: plain carbon steels, effects of alloying elements in plain carbon steels. Alloy steels, tools steels, stainless steels, low and high temperature resisting steels, high strength steels, selections, specifications, form and availability of steel. Cast irons-white, grey, modular malleable and alloy cast irons. Recognized patterns of distribution of graphite flakes in grey cast iron.

UNIT-II
Heat Treatment of Steels
TTT diagrams, annealing, normalizing, hardening and tempering of steel. Austempering and martempering of steel. Hardenibility, Journing end quench test. Grauisis and its determination. Effect of graion the properties of steel.
Surface hardening of steel :
Carbonising nitriding carbonitriding cyniding, flues and inducation hardenirng microscopic determination of case depth and depth of hardening.

Unit-III
Nonferrous materials, their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials – soputionising and precipitations hardening.

Unit-IV
Composite
Polymer – polymer, metal-metal, ceramic –ceramic, ceramic-polymer, metal-ceramic, metal polymer composites. Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites.

UNIT-V
Elasiomers And Masullaneous
Types, properties and identifications of different types of rubbers vulcanisation, fabrication and forming techniques of rubber. Introduction of plastics and ceramics – types, application and process. Smart materials-introduction and types. Selection of materials and factors effecting deflection, Selection process and systematic evaluation.

Subject - Optimization Techniques In Engineering
Subject Code- 07BME104.1
Semester-7th Semester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-I
Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Unit-II
Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method, Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn –Tucker Sufficient Conditions.

Unit-III
Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg-Marquartd, Extensions of LP to Mixed Integer Linear Programming (MILP), Non-Linear Programming, The Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization, SQP Implementation, Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, Singular Based Optimization, On-Line Real-Time Optimization, Optimization in Econometrics Approaches – Blue.

Unit-IV
Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Mehtod and the Runge-Kutta Method for Ordinary Differential Equations, Gaussian Quardative Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions, Jacobi's Iteration Method.

Unit-V
Optimization in Operation Research: Dynamic Programming, Transportation – Linear Optimization Simplex and Hitchcock Algorithms, Algorithms, Minimax and Maximum Algorithm, Discrete Simulation, Integer Programming – Cutting Plane Methods, Separable Programming, Stochastic Programming, Goal Programming, Integer Linear Programming, Pure and Mixed Strategy in theory of Games, Transshipment Problems, Heuristic Methods.

Books.
1. Winston W L: Operations Research: Applications andAlgorithms
2. Rao S.S., Optimization: Theory andApplications.
3. Walsh G R: M methods ofOptimization.
4. Williams H.P.: Model Building in Mathematics Programming.
5. Williams H.P.: Model Solving in Mathematics Programming
6. G.L. Nemhauser and L.A. Wolsey: Intger and CombinationalOptimization.
7. R.G. Parker and R.L. Rardin:DiscreteOptimization.

Subject Name- Advanced Welding Technology
Subject Code- 07BME104.2
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-I
Introduction : Importance and application of welding, classification of welding process. Selection of welding process.
Review of conventional welding process : Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, Stainless steel & Maurer/Schacfflar Diagram. Soldering & Brazing.

Unit-II
Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic weldingetc.

Unit-III
Advanced welding Techniques (continued) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding / Metalizing, Hard facing.

Unit-IV
Weld Design : Welding machines/equipments and its characteristics. Weld defects and distortion and its remedies, Inspection/testing of welds, Macrostructure & microstructure of welds, HAZ, Weld Design, Welding of pipe-lines and pressure vessels. Life predication.

Unit-V
Thermal and Metallurgical consideration.: Thermal considerations for welding, temperature distribution, Analytical analysis, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

Books
Welding Hand Book

Subject - Six Sigma Methods & Application
Subject Code- 07BME104.3
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-1:
Quality Perception : Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.
Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.
Probability Distribution : Normal, Binomial, Poisson Distribution

Unit-2:
Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Zscore,
Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, GreenBelts.

Unit-3:
Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

Unit-4:
Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

Unit-5:
Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

References:
1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower PublishingCo.
2. Six Sigma for managers, Greg Brue,TMH
3. What is Six Sigma, Pete Pande,TMH
4. The Six Sigma Way, Peter S. Pande, TMH Team Fieldbook
5. The Six Sigma way, Peter S. Pande,TMH

Subject Name- Non Destructive testing
Subject Code- 07BME104.4
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-1:
Introduction:
Scope and advantages of N.D.T. some common NDT methods used since ages - visual inspection, Ringing test, and chalk – test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects.

Unit-2:
Common NDT methods
Dye – penetrant tests – principle, scope, equipment and techniques. Zyglo testing. Magnetic Particle Tests-Scope of test, Principle equipment and technique. DC And AC magnetization, use of day and wet powders magnaglow testing. Interpretations of results.

Unit-3:
Radiographic Methods
X-ray radiography – principle, equipment and methodology. Interpretation of radiographs, Limitations Gamma ray radiography. Principle, equipment, source of radioactive material and technique. Precautions against radiation hazards, Advantage over x-ray radiographymethods.

Unit-4:
Ultrasonic Testing Methods
Introduction Principle of Operation – piezoelectricity. Ultrasonic probes, cathode ray oscilloscope techniques and advantages limitation and typical applications.

Unit-5:
Testing of castings, forgings & weldments
Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples. Case studies. Sample-testing in the lab.
[This course to be offered where NDT laboratory facilities are available]

Subject - Hydraulic & Pneumatic Systems
Subject Code- 07BME-104.5
Semester-7thSemester   **Credit Value- 4[L=3, T=1,P=0]**

Unit-1:
Fluid Power : Hydraulic and pneumatic power : advantages and applications, Basic concepts and definitions, Desirable properties and types of power transmitting fluid.

Unit-2:
Hydraulic & Pneumatic Circuits, Hybrid Circuits and Servo Mechanisms : Pumps, compressors, hydraulic & air motors, linear & rotational actuators, accumulators and pressure intensifiers, Flow direction, non-return and pressure control valves, filters, piping, servo and cartridge valves, hydraulic fuses, pressure and temperature switches – Characteristics and symbols of the components, Hydraulic, pneumatic, hydro-pneumatic, electro-hydraulic and electro-pneumatic circuits and servomechanisms.\

Unit-3:
Design Analysis and Control of Fluid Powered Systems : Design and construction of simple and compound circuits, linear and rotary motion (speed, position and direction) control, consideration of inertia and compressibility effect; pressure, friction and energy losses, linearized analysis of servo mechanisms, controlling load sensitivity and stability, Fluid logic and electrical controls for fluid power circuits.

Unit-4:
Applications of Fluid Powered Circuits : Various circuits for automobiles, machine tools, material handling equipment, robots etc.

Reference Books :

1. *Fluid power - ByAnthonyEsposito   PrenticeHall*
2 *Hydraulics & Pneumatics By-Andrew parr   Jaico publications*
3. *Oil Hydraulics : Principles&Maintanence   -By   Majumdar S.R.*
4. *Pneumatic andHydraulicsystem   - ByW.Boltan   B/H Butterworth, Heinemam*
5. *Pneumatic systems : Principles and maintenance -By Majumdar S.R. Tata Mc Graw -Hill*

VIII SEMESTER

VIII SEMESTER

S. No	Subject Code	Subject Name	PERIODS			EVALUATION SCHEME				CREDIT
			L	T	P	SESSIONAL EXAM			TOTAL	
						Mid	TA	EXT.		
1	08BME101	Power plant	3	1	0	15	25	60	100	4
2	08BME102	Automobile Engg.	3	1	0	15	25	60	100	4
3		Elective III	3	1	0	15	25	60	100	4
4		Elective IV	3	1	0	15	25	60	100	4
PRACTICAL/TRAINING/PROJECT										
6	08BME201	Automobile Engineering lab	0	0	2	30	20	50	100	4
7	08BME201	Project	0	0	2	100	100	200	400	5
9	08BME301	General Proficiency				30	20	50	100	1
Total									1000	30

08BME101
POWER PLANT ENGINEERING

Unit-I
Introduction

Power and energy, sources of energy, review of thermodynamic cycles related topower plants, fuels and combustion,calculations.

Variable Load problem

Industrial production and power generation compared, ideal and realised load curves, terms and factors. Effect of variable load on power plan operation, methods of meeting the variable load problem.

Power plant economics and selection

Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

Unit-II
Steam power plant

Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizes and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, reheating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency.

Unit-III
Diesel power plant

General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance.

Gas turbine power plant

Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants.

Unit-IV
Nuclear power plant

Principles of nuclear energy, basic components of nuclear reactions, nuclear power station.

Hydro electric station

Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.

Unit-V

Nuclear fuels in fission and fusion reactors, Types of nuclear reactors, Fissile and fertile materials, Neutron chain reaction in fission reactors, Neutron flux, Concept of criticality for bare homogeneous reactors, Coolants, moderators, Control and structural materials. Heat generations and steady state temperature distribution in fuel elements, Heat removal.

Books:

1. Nuclear Reactor Engineering By S. Glastone and A .Sesonske.

2. Basic Nuclear Engineering, by K.S.Ram.

3. Introduction to Nuclear Engineering, by J.Rlamarsh.

4. "Power Plant Engineering" F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras.

5. "Power Plant Engineering" Mahesh Verma, Metropolitan Book Company Pvt. Ltd. New Delhi.

6. "Power Plant Technology" El-Vakil, McGrawHill.

7. Power Plant Engineering by P.K. Nag, Tata McGrawHill.

8. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, CentralPub.House.

08BME102
AUTOMOBILE ENGINEERING

Unit-I

INTRODUCTION: Classification of automobile, Parts of an automobile, Description of an automobile, performance of automobile, engine cycle-energy balance, terms connected with I.C. Engines, Detonation, performance number, tractive efforts.

FUEL-SUPPLY SYSTEM:

S.I. ENGINE: Carburetion & carburetors, Induction system, factor influencing carburetion, Mixture requirement, Distribution, Complete carburetor, theory of simple carburetor.

C.I. ENGINE: Functional requirements of an injection system, Fuel pump and fuel injector (Atomizer), Types of nozzles and fuel spray patterns, troubleshooting of a fuel system & carburetor, Turbo Charger (Function and benefits).

Unit II

ENGINE FRICTION, LUBRICATION & COOLING SYSTEM:

Determination of engine friction, Lubrication, lubrication system, Crankcase ventilation, Necessity of engine cooling, Areas of heat flow in engines, gas temperature variation, heat transfer, temperature distribution & temp. profiles, cooling air and water requirements, cooling systems, troubleshooting of cooling system, gear box (Problems).

Unit III

CHASSIS: Introduction. Classification of chassis, Frame.

SUSPENSION: Introduction, requirements of suspension system,springs,

damper. **WHEELS**: Introduction, Requirement, types ofwheels.

TYRES: Introduction, requirements, types of tyre, tyre construction-cross ply, radial ply, belted bias, tyre materials tyre shape, tread patterns, tyre markings, tyre inflation pressure, causes of wear, factors affecting tyre life, wheel balancing, wheel alignments.

Unit IV

STEERING AND GEARS: Purpose, function, requirements, general arrangements of steering systems, steering gears, steering ratio, reversibility, steering geometry, under steering, over steering, steering arms, Drag link, power steering, adjusting of steering geometry, steering troubleshooting. Requirements. Clutches. Toque converters. Over drive and free wheel,

Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle,

FRONT AXLE: Introduction, construction, types of front axles, stub axles.

BRAKING SYSTEM: Necessity, functions, requirements, classification of brakes, Mechanical brakes, hydraulics brakes, power brakes, brake effectiveness, brake shoe holding down arrangements, brake tester, brake service, troubleshooting chart of hydraulic brakes system, air brakes & Brake shoes & drums.

UNIT V

AUTOMOTIVE ELECTRICAL SYSTEM: Introduction, main parts of

vehicles. **STARTING SYSTEM:** Introduction, battery, starting motor.

IGNITION SYSTEM: Introduction, purpose, requirements, coil ignition system, firing order, ignition timing, spark plugs, troubleshooting.

CHARCHING SYSTEM: Introduction. Dynamo, alternators.

LIGHTING: introduction, main circuits, lighting system.

Maintenance system: Preventive maintenance, break down maintenance, and over hauling system.

References-
1. Automotive Engineering-Hietner
2. Automobile Engineering - KripalSingh.
3. Automobile Engineering -Narang.
4. Automotive Mechanics-Crouse

5.

08BME201
AUTOMOBILE ENGG. -LAB

Say any 8 study & exp. from the following or suchexperiments)
1. Study & experiment on brakingsystem.
2. Study & experiment on fuel supplysystem.
3. Study & experiment on ignitionsystem.
4. Study & experiment on steeringsystem.
5. Study & experiment on transmissionsystem.
6. Study & experiment on suspensionsystem.
7. Study safety aspect of automobiledesign.
8. Study & experiment on Lighting or lubricationsystem.
9. Study & experiment on lubrication and coolingsystem.
10. Comparative study features of common small cars (such as fiat, Ambassador, Maruti, Matiz, Santro,Indica and its variations) available inIndia.
11. Comparative study & technical features of common scooters & motorcycles available in India. Casestudy/termpaper.
12. Comparative Study & Technical features of common heavy vehicles available in India. Case study/termpaper.
13. Engine tuning and carburator servicingexperiment.
14. Experiment & study of MPFIsystem.
15. on fuel consumptionmeasurement.
16. Review experiment on IC Engines & moderntrends.
17. Visit of an Automobilefactory.
18. Study & experiment of main gear box and differential gearbox.

Elective-III

08BME103.1 Total Quality Management (TQM)
08BME103.2 Advanced Fluid Mechanics
08BME103.3 Mechatronics
08BME103.4 Unconventional Manufacturing Processes 08BTC103.5 Finite Element Method

Elective-IV

08BME104.1 Maintenance & safety engg.

08BME104.2 Experimental stress analysis

 08BME104.3 Thermal Turbo Machines

08BME104.4 Robotics and automation

08BME104.5 Machine Tool Design

08BME103.1
TOTAL QUALITY MANAGEMENT (TQM)

Unit-I

Quality Concepts

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type.

Control on PurchasedProduct

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurementprocedure.

Manufacturing Quality

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

Unit-II

Quality Management

Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

Human Factor in Quality

Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and correctivemethods.

Unit-III Control

Charts

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Charts

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis ofC-chart.

Unit-IV

Defects Diagnosis and Prevention

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Unit-V
IS0-9000 and its concept of Quality Management:
ISO 9000 series, Taguchi method, JIT in some details

References:
1. Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990..
2. Greg Bounds. "Beyond Total Quality Management". McGraw Hill,1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill1992.

08BME103.2
ADVANCED FLUID MECHANICS

UNIT-I
Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in Cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress.

UNIT-II
Non-viscous incompressible flow- Equation of continuity, Euler's equation of motion, Bernoulli's equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of source-sink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoil.

UNIT-III
Boundary layer Concept-Introduction to boundary layer formation, Novier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poisseuille flow, Plane Couette flow, Hydrodynamic theory of lubrication.

UNIT-IV
Compressible flow- Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables.

UNIT-V
Flow with normal shock waves- Development of shock wave, rarefaction wave, governing equations, Prandtle-Meyer relation. Thermodynamic properties across shock. Wind tunnels.
Flow in constant area duct with friction-Fanno curves, Fanno flow equations, Solution of fanno flow equations. Variation of flow properties. Tables & charts for Fanno flow.
Flow in constant area duct with heat transfer- Rayleigh line, Fundamental equations, Rayleigh flow relation, Variation of flow properties. Tables & Charts for Rayleighflow

Books:
1. Fluid Mechanics byWhite.
2. Fluid Mechanics byStreeter
3. Fluid Mechanics by Som &Biswas
4. Fluid Mechanics by K.L.Kumar
5. Fluid Mechanics by A.K.Jain
6. Fundamentals of Compressible flow by S.M.Yahya
7. Gas Dynamics by Z.Hussain
8. Viscous fluid flow bywhite
9. Computational Fluid Dynamics byAnderson

08BME103.3

MECHATRONICS

1 Review of Microprocessors and Micro Controllers: Concepts, Binary numbers to hexadecimal details, information on flipflops, gates, registers, counters, memory, polling and interrupts etc. Architecture, instruction set for 8085, 8051 and assembly level language. Difference between microprocessors and micro controllers. Introduction to programming. Signal and Data Processing: Concepts and principles, analogue signal conditioning, signal level changes, linearization, conversion, filtering. Impedance matching passive circuits. Specifications and circuits in instrumentation. Digital signalconditioning.

2 Ladder Diagram Fundamentals:Basic Components and their symbols, Fundamentals of ladder diagrams, Machine Control Terminology. The Programmable Logic Controller : A Brief History, PLC configurations, System Block Diagrams, Update Solve the ladder – Update, Update, Solve theLadder

3 Fundamentals of PLC Programming: Physical Components Vs Program, components, Lighting Control Example, Internal Relays, Disagreement Circuit, Majority Circuit, Oscillator, Holding contacts, Always ON and Always OFF Contacts, Ladder Diagram Having more than one rung. Programming On/Off Inputs, to produce on – off outputs : Introduction, PLC input instructions, outputs : Coils, Indicators and others, Operational procedures, Contact and Coil Input output programming Examples, Fail Safe Circuits, Industrial ProcessExamples.

4 Creating Ladder Diagrams from Process Control Descriptions:Introductions, Ladder Diagrams, Sequence Listings. Large Process Ladder diagram Constructions, Flowcharting as programming Method. Introduction to Robotics: Elementary treatment on anatomy, drives, transmission and end effectors ofRobotics

5 Material Handling: Generations Considerations, Applications in material transfer and loading unloading Assembly and Inspections : Assembly and robot assembly automations, Parts presentations methods., Assembly ope4rations, Assembly syst4m configurations inspe4ction automation. Introduction to Nano-technology.

Reference Books:

1 "Programmable Logic Controller – Principles and Applications" 5/e, J. W. Webb, R.A. Reis; Prentice Hall of India Ltd. ISBN81-203-2308-4

2 "Industrial Robotics – Technology, Programming and Applications"; M. P. Groover,M. Weiss, R. N. Nagel, N. G. Ordey; McGraw Hill International Editions, Industrial Engineering Series, ISBN0-0-100442-4

3 "Programmable Logic Controller – Programming methods and Applications"Hackworth John R. and Hackworth Frederick D. Jr.; Pearson Education LCE, ISBN81-297-0340-8.

4 Introduction to 8085 –Gaonkar

5 Process control and instrumentation – Johnson C.D.

6 Introduction to PLC – Gary Dumming – Delmar

Pub. 7 Various PLC manufacturerscatalogue

8 Programmable Logic Controller – FESTO Pneumatics, - Bangalore

08BME103.4
UNCONVENTIONAL
MANUFACTURING PROCESSES

Unit-I

Introduction: Limitations of conventional manufacturing processes, need of unconventional manufacturing processes and its classification.

Unit-II

Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machiningetc.

Unit-III

Principle and working and application of unconventional machining processes such as laser beam machining, Electron beam machining, Ultrasonic machining etc.

Unit-IV

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metallising, Plasma are welding/cutting etc.

Unit-V

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

Books
1. Modern Machining Processes – P.C.Pandey
2. Unconventional Machining – V.K.Jain

08BME103.5
FINITE ELEMENTMETHOD

UNIT I

Introduction to Finite Difference Method and Finite Element Method, Advantages and disadvantages

UNIT II

Mathematical formulation of FEM, Variation and Weighted residual approaches, Shape functions, Natural co-ordinate system, Element and global stiffness matrix, Boundary conditions, Errors, Convergence and patch test, Higher order elements.

UNIT III

Application to plane stress and plane strain problems, Axi-symmetric and 3D bodies, Plate bending problems with isotropic and anisotropic materials, Structural stability, Other applications e.g., Heat conduction and fluid flow problems.

UNIT IV

Idealisation of stiffness of beam elements in beam-slab problems, Applications of the method to materially non-linear problems, Organisation of the Finite Element programmes, Data preparation and mesh generation through computer

graphics, Numerical techniques, 3D problems.

UNIT V

FEM, an essential component of CAD, Use of commercial FEM packages, Finite element solution of existing complete designs, Comparison with conventional analysis.

Books:

1. The Finite Element Method O.C. Zienkiewicz and R.L. Taylor McGrawHill

2. An Introduction to Finite Element Method J. N. Reddy McGrawHill

3. Finite Element Procedure in Engineering Analysis K.J. Bathe McGrawHill

4. Finite Element Analysis C.S. Krishnamoorthy Tata McGrawHill

5. Concepts and Application of Finite Element Analysis R.D. Cook, D.S. Malcus and M.E. Plesha JohnWiley

6. Introduction to Finite Elements in Engineering T.R Chandraguptaand

A.D. Belegundu Prentice Hall India

7. Finite Element and Approximation O.C. Zenkiewicy & Morgan-

08BME104.1

MAINTENANCE& SAFETY ENGINEERING

Unit-I

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability

Unit-II

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

Unit-III

Replacement planning maintain or replace decision, replacement of items that deteriorate identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning

Unit-IV

SAFETY IN ENGINEERING INDUSTRY:

Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps .general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents.

Unit-V

Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.

Books:

1) Industrial Safety Handbook : WilliamHandley

2) Introduction to Safety Engineering : David S Gloss & MiriamGayleWardle

3) Industrial Safety : Roland PBlake

4) Industrial Hazard & Safety Handbook : Ralph King & JohnMagid

5) Occupational Safety Management & Engg. : WilliHammer

6) Recognition of Health Hazards in Industry : William ABurgess

08BME104.2

EXPERIMENTAL STRESS ANALYSIS

UNIT I

Elementary Elasticity:

Stress: Introduction, Stress Equations of Equilibrium, Laws of Stress Transformations, principal Stresses, Two-Dimensional State of Stress, Stresses Relative to Principal Co-ordinate System, Special States of Stress.

Strain: Introduction, Displacement and Strain, Strain Transformation Equation, Principal Strains, Compatibility, Volume Dilation, Stress Strain Relations, Strain Transformation Equations and Stress Strain Relations for Two-Dimensional State of Stress.

UNIT II

Strain Measurements: Introduction, Properties of Strain Gage Systems, Types of Strain Gages, Grid-Method of StrainAnalysis.

Brittle Coating Method: Coating Stresses, Failure Theories, Brittle Coating Crack Patterns, Resin and Ceramic Based Brittle Coating, Test Procedure, Analysis of Brittle Coating Data.

UNIT III

Electrical Resistance Strain Gages: Introduction, Strain Sensitivity in Alloys, Strain Gage Adhesives, Gage Sensitivity and Gage Factor.

Strain Gage Circuit: Potentiometer and its Application, Wheat-Stone Bridge, Bridge Sensitivity, Null BalanceBridges.

Analysis of Strain Gage Data: Three Element Rectangular Rosette, Delta Rosette, Stress Gage, PlaneShear-Gage.

UNIT IV

Theory of Photoelasticity: Introduction, Temporary Double Refraction, Stress Optic Law, Relative Retardation, Stressed Model in Plane Polariscope, Effect of Principal Directions, Effect of Principal Stress Difference, Stressed Model in Circular Polariscope, Light and Dark Field arrangements, Tardy Compensation, Fringe Sharpening and Multiplication by Partial Mirrors.

UNIT V

Two Dimensional Photoelasticity : Introduction, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, Calibration Methods, Separation Methods, Shear Difference Method, Electrical Analogy Method, Oblique Incidence Method, Materials for Two-Dimensional Photoelasticity.

Text Books:

1. Experiment Stress Analysis by James W. Dally and William F. Riley, International Student Edition, McGraw-Hill BookCompany.

2. Experiment Stress Analysis by Dr. Sadhu Singh, KhannaPublishers.

08BME104.3
THERMAL TURBO MACHINES

UNIT-I

Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam & gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler's equation, Velocity diagrams for axial & radial turbo machinery and pumps. Definition of various efficiencies, Introduction to blowers, pumps, compressors, steam & gas turbines turbojet.

UNIT-II

Centrifugal compressors- Principle of operation, work done and pressure rise, Diffuser, state losses, ship factors, Performance, characteristics.

Axial flow compressor- basic operation, Elementary theory, Factors affecting stage pressure ratio, Blockage in compressor annulus, Degree of reaction, 3-D flow, Design process, blade design, calculation of stage performance. Supersonic & transonic stages, Performance.

UNIT-III

Axial flow turbines-Elementary theory of axial flow turbine, Vortex theory, Choice of blade profile, pitch and chord, Estimation of stage performance.

UNIT-IV

Steam turbines- Constructional details, working of steam turbine.

Pumps : Pumps, main components, indicator diagram and modification due to piston acceleration, performance and characteristics, axial flow pumps.

Radial flow turbines: Single velocity triangle Enthalpy- Entropy diagram, State losses, performance, Characteristics.

UNIT-V

Gas Turbine Starting & Control Systems: Starting ignition system, combustion system types, safety limits & control.

Turbine Blade coding: Cooling techniques, types

Mechanical Design consideration: Overall design choices, Material selection, Design with traditional materials.

Books-
1. Gas turbine theory : Gohen & Rogers, Addison Weslay LongmanLtd.
2. Design of high efficiency turbomachinery and gas turbines, David Gordon Wilson,
Theodosios Korakianitis, Prentice HallInternational.
3. Turbomachinery : S.M.Yahya.
4. Turbine, Compressors and Fans, S.M. Yahya, Tata Mc GrawHill.
5. Gas Turbine- Ganeshan, Tata Mc GrawHill

08BME104.4

ROBOTICS AND AUTOMATION

1. Introduction : Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrialrobot.
2. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, designconsideration.
3. Robot Motion Analysis & Control : Introduction to manipulator kinematics, robot dynamics, manipulator dynamics, robot control, taskplanning.
4. Sensors : Transducers and sensors, sensors in robotics, tedile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torquesensors.
5. Machine Vision: Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system roboticapplications.
6. Programming : Basics of robot programming, languages, commands, communications and dataprocessing.
7. Applications : Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Futureapplications.
8. Introduction to design of robot in specificapplications.
9. Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation,Automated flow lines. Automation formachining operations Design and fabrication considerations.Analysis of multi stationassembly.
10. Automated Material Handling: components, operation, types, design of automatedguided vehicles and applications.
11. Automated storage / retrieval systems - types, basic components and applications.
12. Group Technology: Part families, part classification and coding, machine Celldesign, Benefits.
13. Computer Aided Process Planning, benefits andlimitations.
14. Automated Inspection And Testing: Automated inspection principles and methods sensors techniques for automated inspection-techniques for automated inspection-contact and non-contact inspection methods-in process gauging, CMM's, construction, types, inspection probes, types, and applications. Machine vision, LASER Micrometer and optical inspection methods.

Reference Books:
1. *Industrial Robotics (Technology, Programming and applications) – Mc Graw HillEditions*
2. *Robotics – An introduction - Douglas R. Malcolm. Jr -- Delmar PublisherInc*
3. *Robot technology fundamentals - Saures G. Keramas - Delmarpublishers*
4. *Fundamentals of robotics – analysis & control - Robert J. Schilling – (PHI)edition*
5. *Robotics - Control, sensing, vision and Intelligence -K.S. Fy., R.C. gonzaler, C.S.G.Lee -- Mc Graw Hill editions*

6. *Robotics Technology and flexible Automation – S.R. Deb - Tata Mc. GrawHill*

08BME104.5

MACHINE TOOL DESIGN

UNIT-IV ARRAYS

Introduction: Developments is machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis.

UNIT-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, Selection of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools.

Unit-III

Regulation of Speed and Feed rates : Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.

Unit-IV

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design.

Design of guide ways and power screws: Basic guide way profiles, Designing guide way for stiffness a wear resistance, hydrostatic and antifriction grand ways. Design of sliding friction power Screws. Design of spindlier & spindle supports.

Layout of bearings, selection of bearings for machine tools

Unit-V

Dynamics of machine tools: General procedure for assessing the dynamic stability of cutting process, closed loop system, chatter in machine tools.

Control Systems : Functions, requirements & types of machine tool controls, controls for speed & feed change. Automatic and manual Controls. Basics of numerical controls. Machine tooltesting.

Books :
   1. *Machine Tools Design & Numerical Controls –N.K. Mehta, T.M.H. NewDelhi.*
   2. *Design of Machine Tools – S.K. Basu AlliedPublishers.*
   3. *Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book*

List of Open Electives to be Offered by the Mechanical Engineering

OME-001 Optimization Techniques in Engineering

OME-002 Robotics and automation

OME-003 Advanced Engineering Materials

OME-004 Computer Integrated Manufacturing

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