B.E AUTOMOBILE ENGINEERING
SYLLABI
2017
(REGULAR PROGRAMME)

Faculty of Engineering

KARPAGAM ACADEMY OF HIGHER EDUCATION

Karpagam Academy of Higher Education

(Established Under Section 3 of UGC Act 1956)

Eachanari Post, COIMBATORE-641021, INDIA

17BECC101 ENGLISH FOR ENGINEERS 3 0 0 3

OBJECTIVES:

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional communication to meet the growing demand in the field of Global communication.
2. To help students acquire their ability to speak effectively in real life situations.
3. To inculcate the habit of reading and to develop their effective reading skills.
4. To ensure that students use dictionary to improve their active and passive vocabulary.
5. To enable students to improve their lexical, grammatical and communicative competence.
6. To study formal context

INTENDED OUTCOMES:

Students undergoing this course will be able to

1. Use English language for communication: verbal & non –verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Gain confidence in using English language in real life situations.
4. Improve word power: lexical, grammatical and communication competence.
5. To guide the students to write business letters and other forms of technical writing.
6. To remember students to prepare for oral communication in formal contexts.

Unit- I LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing)

(9)

Listening –Types of listening- Listening to class reading - Video tapes/ Audio tapes. **Speaking** – Introduction on self. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative. **Writing** – Formal and Informal letters- Letters to the Editor.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Tenses -Articles. **Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

Unit – II LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing)

(8)

Listening – Understanding the passage in English –Pronunciation practice. **Speaking** – Asking and answering questions. **Reading** – Critical reading – Finding key information in a given text (Skimming - Scanning). **Writing**– Coherence and cohesion in writing – Short paragraph writing – Writing short messages.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

WH questions –Yes/No Question - Subject Verb agreement. **Vocabulary** – Compound Nouns/Adjectives – Irregular verbs.

Unit - III LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing)

(8)

Listening – Listening for specific task – fill in the gaps. **Speaking** – Phonemes – Syllables – Role play – Conversation Practice. **Reading** –comprehension passages based on general topics or matters of current affairs. **Writing** - Autobiographical writing & Biographical writing.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Preposition – Infinitive & Gerund. **Vocabulary** – Foreign words used in English – British and American usage.

Unit- IV LSRW SKILLS & GRAMMAR, CAREER ORIENTED

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing)

(10)

Listening – Responding to questions – Reading in class for complete understanding and for better pronunciation. **Speaking** – Debate- Presentations in seminars. **Reading** – Making inference from the reading passage – Predicting the

content of reading passages. **Writing** - Interpreting visual materials (tables, graphs, charts, etc) & Instruction writing.
Grammar & Vocabulary (Function Grammar & Technical Vocabulary)
Parts of Speech , Sentence pattern – Voice (active and passive voice). **Vocabulary** – One word substitution.

Unit- V LSRW SKILLS & GRAMMAR, FIELD WORK
Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) **(10)**

Listening –Distinction between native and Indian English (Speeches by TED and Kalam). **Speaking**- Extempore talk – Just-a-minute talk. **Reading**-Reading strategies–Intensive reading – Text analysis. **Writing** - Creative writing – Writing circulars and notices – Writing proposal.
Grammar & Vocabulary (Function Grammar & Technical Vocabulary)
Direct and Indirect speech – Conditional sentences - Auxiliary verbs. **Vocabulary** – Abbreviations & Acronyms.

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

Total-45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Sangeeta Sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP, New Delhi.	2015

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2009
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006

WEBSITES:

www.learnerstv.com – Listening/ Speaking/ Presentation
www.usingenglish.com – Writing/ Grammar
www.englishclub.com – Vocabulary Enrichment/ Speaking
www.ispeakyouspeak.blogspot.com – Vocabulary Enrichment/ Speaking
www.teachertube.com – Writing Technically
www.Dictionary.com – Semantic / Grammar

17BECC102 ENGINEERING MATHEMATICS I 3 2 0 4

Course Objectives:

- To understand geometrical aspects of curvature and elegant application of differential calculus and improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives and vector calculus.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations and partial differential equations.
- To introduce sequence and series which is central to many applications in engineering.
- To study the algebraic manipulation

Course Outcomes:

The student will be able to

- The student will be able to Apply advanced matrix knowledge to Engineering problems.
- Improve their ability in solving geometrical applications of differential calculus Problems.
- Solve engineering problems involving hyperbolic functions, Beta and Gamma functions.
- Expose the concept of sequences and series.
- To analyze and evaluate the accuracy of solution for ordinary differential equations
- To understand the difference of beta and gamma functions in control engineering

UNIT I MATRICES (12)

Review of Matrix Algebra - Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonal reduction.

UNIT II DIFFERENTIAL CALCULUS (12)

Limits, Continuity (Concepts only)- Differentiation- Differentiation Techniques: standard formulae, product rule, quotient rule, chain rule, method of substitution, implicit functions and successive differentiation.

UNIT III GEOMETRICAL APPLICATIONSOF DIFFERENTIAL CALCULUS (12)

Curvature – centre, radius and circle of curvature in Cartesian co- ordinates –Evolutes– Envelope –Evolute as envelope of normals.

UNIT IV DIFFERENTIAL EQUATIONS (12)

Introduction to Ordinary differential equations: Linear ordinary differential equations of second and higher order with constant coefficients.

Introduction to Partial differential equations: Linear Partial differential equations of second and higher order with constant coefficients.

UNIT V VECTOR DIFFERENTIATION (12)

Vectors-Differentiation of vectors – scalar and vector point functions –vector operator – vector operator applied to scalar point functions: Gradient; vector operator applied to vector point functions: Divergence and curl; Physical interpretation of divergence and curl, solenoidal and irrotational vectors.

Total: 60

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hemamalini. P.T	Engineering Mathematics	McGraw Hill Education (India) Private Limited, New Delhi.	2014
2	Sundaram, V. Lakhminarayan,K.A. &Balasubramanian,R.	Engineering Mathematics for first year.	Vikas Publishing Home, New Delhi.	2006
3	Bali, N.P. & Manish Goyal	A Text Book of Engineering Mathematics	Laxmi Publications Pvt. Ltd., New Delhi.	2014

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Grewel . B. S.	Higher Engineering Mathematics	Khanna Publications, New Delhi.	2014
2	BhaskarRao. P. B, Sri Ramachary SKVS, BhujangaRao. M	Engineering Mathematics I	BS Publications, India.	2010
3	Ramana. B.V	Higher Engineering Mathematics	Tata McGraw Hill Publishing Company, New Delhi.	2007
4	ShahnazBathul	Text book of Engineering Mathematics(Special Functions and Complex Variables)	PHI Publications, New Delhi.	2009
5	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEBSITES:

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants
4. www. Intmath.com/calculus/calculus-intro.php

17BEPH103 ENGINEERING PHYSICS 3 0 0 3 100

Course Objectives:

- To enhance the fundamental knowledge in Physics and its applications relevant to various branches of Engineering and Technology
- To study the elastic nature of materials.
- To know the characteristics of laser.
- To study optical fiber process.
- To study thermal properties of materials through various methods.
- To study the quantum mechanics.

Course Outcomes:

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

- Understand the elastic nature of materials.
- Infer the characteristics of laser for various engineering applications.
- Extend the knowledge on optical fiber for communication purposes.
- Illustrate the thermal properties of materials through various methods.
- Develop the idea of quantum mechanics through applications.
- Identify the different atomic arrangements of crystals and its defects.

UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS (9)

Three types of modulus of elasticity – basic definitions, relation connecting the moduli (Derivation), Poisson‟s ratio- Torsional pendulum- bending of beams- bending moment – uniform and non uniform bending Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

UNIT II LASER AND FIBER OPTICS (9)

Introduction – emission and absorption process- Einstein‟s coefficients derivation. Types of LASER -CO_2, Semiconductor LASER- Applications of LASER in industry and medicine.
Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle –derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram)

UNIT III QUANTUM PHYSICS (9)

Introduction to quantum theory – Black body radiation - dual nature of matter and radiation – de Broglie wavelength, uncertainty principle –Schrödinger‟s wave equation – time dependent and time independent equations – particle in one dimensional box- physical significance of wave function, scanning electron microscope

UNIT IV CRYSTAL PHYSICS (9)

Lattice – unit cell – Bravais lattice – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures, crystal defects –

point, line and surface defects

UNIT V ULTRASONICS AND NUCLEAR PHYSICS (9)

Production of ultrasonics by piezoelectric method –Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications – Sonogram. Introduction – basics about nuclear fission and fusion, Radiation detectors– semi conductor detector. Reactors – essentials of nuclear reactor- power reactor.

Total- 45

TEXT BOOK:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ganesan.S and Baskar.T	Engineering Physics I	GEMS Publisher, Coimbatore-641 001	2015

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Serway and Jewett	Physics for Scientists and Engineers with Modern Physics	Thomson Brooks/Cole, Indian reprint, New Delhi	2010
2	Gaur, R.K. and Gupta, S.C	Engineering Physics	Dhanpat Rai Publications,New Delhi.	2011
3	M.N. Avadhanulu and PG Kshirsagar	A Text book of Engineering Physics	S.Chand and company, Ltd., New Delhi	2011
4	D.C. Ghosh, N.C. Ghosh, P.K. Haldar	Engineering Physics	University Science, New Delhi	2011
5	P. Khare, A. Swarup	Engineering Physics: Fundamentals and Modern Applications	Jones & Bartlett Learning	2009

WEBSITES:

- www.nptel.ac.in
- www.physicsclassroom.com
- www. oyc.yale.edu
- www.physics.org

17BECH103 ENGINEERING CHEMISTRY 3 0 0 3 100

Course Objectives:

- To understand about the water technology.
- To get the information on electrochemical cell.
- To get the knowledge of batteries and its types
- To study about the corrosion and protective coatings.
- To gain knowledge on adsorption phenomena.
- To get the knowledge of fuels and combustion

Course Outcomes:

At the end of this course, students will be able to

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalise bulk properties and processes using thermodynamic considerations.
5. List major chemical reactions that are used in the synthesis of molecules.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I WATER TECHNOLOGY (9)

Sources-Characteristics – Specification for drinking water, BIS &WHO-Alkalinity – Types of alkalinity and determination(No problems) – Hardness – Types and estimation by EDTA method (No problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination - Reverse osmosis.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES (9)

Electrochemical cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox - Fe^{2+} vs dichromate) –Electrolytic conductance-application (conductometric titration)-Batteries- Primary batteries-Leclanche cell- Secondary batteries- Lead acid battery. An introduction to Fuel Cell- H_2-O_2 Fuel Cell.

UNIT III FUELS AND COMBUSTION (9)

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method - Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking - Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, Combustion of fuel-Introduction-GCV-NCV- Problems on Calculation of GCV & NCV - Flue gas analysis.

UNIT IV CORROSION SCIENCE (9)

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions –Inorganic coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hot dipping.

UNIT V SURFACE CHEMISTRY AND PHASE RULE (9)

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm-Role of adsorbents in industries (catalysis and water softening).
Phase Rule: Definition -Phase diagrams – one component water system, two component Ag-Pbsystem.

Total: 45

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Vairam.S	Engineering Chemistry	Gems Publishers, Coimbatore.	2014
2.	Dr.Ravikrishnan.A	Engineering Chemistry I & II	Sri Krishna Hi tech Publishing Company (P) Ltd., Chennai.	2012

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Raman Sivakumar	Engineering Chemistry I &II	McGraw-Hill Publishing Co.Ltd., 3rd Reprint NewDelhi.	2013
2.	Kuriakose. J.C. and Rajaram	Chemistry in Engineering and Technology. Vol. I & II 5th edition.	Tata McGraw Hill Publishing Company, New Delhi.	2010
3.	Jain, P.C. and Monika Jain	Engineering Chemistry.	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.	2009
4.	Dara.S.S	Text book of Engineering Chemistry.	S.Chand&Co.Ltd., New Delhi	2008
5.	Sharma.B. K	Engineering Chemistry	Krishna Prakasam Media (P) Ltd., Meerut	2001

WEBSITES:

1.http://www.studynotes.ie/leaving-cert/chemistry/
2. http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html
3.http://www.learnerstv.com/Free-chemistry-Video-lectures-ltv044-Page1.htm
4. http://ocw.mit.edu/courses/#chemistry
5. http://www.chem.qmul.ac.uk/surfaces/sec

17BEAE104 BASIC AUTOMOBILE ENGINEERING 3 0 0 3 100

OBJECTIVES:

- To learn the fundamental principles, construction of automotive petrol and diesel engines.
- To understand the basics of Steering System, Brakes and Suspension System.
- To enable the students to grasp latest developments in Automotive Electronics.
- To learn the fundamental principles petrol and diesel engines.
- To learn the construction of automotive petrol and diesel engines.

COURSE OUTCOMES:

UNIT I BASICSOFAUTOMOBILE ENGINEERING

Introduction to an Automobile–History of the automobiles-Classification of automobile-

- Demonstrate the operating principles and constructional details of various automobile components.
- Explain the function and working of components in transmission and drive lines.
- Identify and explain the types of steering system.
- Identify and explain the types of suspension system.
- Classify and describe the types of wheels, tyres and brakes of automobiles.
- Discuss the current and future trends in the automobiles.

Layout of an automobile Chassis- Classification of vehicles -Major components and their functions-

UNIT II AUTOMOTIVE ENGINES

Classification of Engines based on operation and construction-Constructional details of four stroke petrol engine and working principle-Constructional details of two stroke engine and operation, Comparison of four stroke and two stroke engine operation- Diesel Engine Construction and Operation

UNIT III AUTOMOTIVE TRANSMISSION

Requirements of transmission system. Different types of clutches, principle, Construction-Different types of gear boxes–operation-Differential and Propeller Shaft

UNIT IV STEERINGAND SUSPENSION SYSTEM

Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Different types of steering gear boxes. Steering linkages

UNIT V SUSPENSION AND BRAKING SYSTEMS

Need of suspension system - Types of suspension - Suspension springs - of leaf, coil and torsion bar springs-Drum Brakes and Disc Brakes-Construction and Operation-Brake actuating systems

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OFTHEBOOK	PUBLISHER	YEAROF PUBLICATION
1.	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2012
2	WilliamCrouse, Donald Anglin	Automotive Mechanics **Edition 10**	McGrawHill Education (India)Private Limited	**2010**

REFERENCES:

SL.NO.	AUTHOR(S)	TITLE OFTHEBOOK	PUBLISHER	YEAROF PUBLICATION
1.	Tim Gilles	Automotive Chassis-Brakes, Steeringand Suspension	Thomson DelmarLearning	2005
2.	LjuboVlacic, Michael Sarenand Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001

17BEAE105 ENGINEERING MECHANICS 3 2 0 4 100

COURSE OBJECTIVES:

- To familiarise the basic concepts and force systems in a real-world environment.
- To impart knowledge on the equilibrium of rigid bodies.
- To learn the concept of centroid, centre of gravity and moments of inertia.
- To understand the rectilinear motion and curvilinear motion.
- To enrich the understanding of dynamic forces exerted in rigid body
- To provide knowledge on the friction.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Determine the resultant force and moment for a given system of forces.
- Analyse the plane trusses having different types of supports and determine the forces in each member.
- Identify the location of centroid, centre of gravity and calculate the moment of inertia for different sections.
- Apply the equations of motion of particles to calculate displacement, velocity and acceleration.
- Calculate dynamic forces exerted in rigid body
- Determine the friction and its effects by using the laws of friction.

UNIT I STATICS OF PARTICLES

Forces – system of forces - concurrent forces in plane and space- resultant - problems involving the equilibrium of a particle-free body diagram-equilibrium of particle in space.

UNIT II STATICS OF RIGID BODIES IN TWO DIMENSIONS

Rigid bodies-two dimensional structure-moment of force about an axis-moment of a couple-equivalent system of coplanar forces-Rigid body in equilibrium-problems involving equilibrium of rigid body-types of supports-reactions of beams and frames.

APPLICATION OF STATICS: Roof trusses-Method of joints, method of sections and Tension coefficient method.

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA

Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

UNIT IV KINEMATICS OF PARTICLES

Introduction-plane, rectilinear motion - time dependent motion-rectangular coordinates-projectile motion.

IMPULSE AND MOMENTUM: Concept of conservation of momentum- Impulse-Momentum principle-Impact-Direct central impact-oblique central impact.

UNIT V FRICTION

Laws of friction-coefficient of friction-problems involving dry friction- wedge and ladder friction.

KINETICS OF PARTICLES: Equation of motion-rectilinear motion-Newton‟s II law – D‟Alembert‟s principle- Energy - potential energy-kinetic energy-conservation of energy-work done by a force - work energy method.

TEXT BOOKS:

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Beer F P. and Johnson E R	Vector Mechanics for Engineers-Statics and Dynamics	Tata McGraw–Hill , New Delhi	2006
2.	Rajasekaran S and Sankarasubramanian G	Engineering Mechanics-Statics and Dynamics	Vikas Publishing House Pvt. Ltd., New Delhi	2006

REFERENCE BOOKS:

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bansal R K	Engineering Mechanics	Laxmi Publications Pvt. Ltd., New Delhi	2006
2.	Bhavikatti S S.	Engineering Mechanics	New Age International Pvt. Ltd., New Delhi	2003
3.	Young D H. and S Timashenko	Engineering Mechanics	Tata McGraw–Hill , New Delhi	1980
4.	Jivan Khachane and Ruchi Shrivastava	Engineering Mechanics	ANE Books, New Delhi.	2006

WEB REFERENCE:

www.learnerstv.com/Free-Engineering-Video-lectures-ltv320
emweb.unl.edu/
www.nptel.iitm.ac.in/courses/...mechanics/ui/TableofConte
nts.html www.jncasr.ac.in/emumain.php
web.mit.edu/emech/dontindex-build/index.html

17BEPH111 ENGINEERING PHYSICS LABORATORY 0 0 4 2

Course Objective

- To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
- To study the concept of semiconductor and conductivity.
- To learn the properties of materials.
- To learn the device for determine the wavelength and velocity of sound
- To study the viscosity of liquids
- To learn the bandgap of semiconductor

Course Outcome

- Familiarize the properties of material and basic concepts in physics.
- Get experience in laser wavelngth experimenattion
- Get practical exposure to analyse the velocity of sound
- Get knowledge in bandgap and wavelengh determination
- Acquire knowledge about different bendings
- Practical knowledge in therml conductivity of wire and its thickness

LIST OF EXPERIMENTS – PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of Young‟s modulus of the material – Non uniform bending (or) Uniform bending.
4. Determination of Viscosity of liquid – Poiseuille‟s method.
5. Spectrometer Dispersive power of a prism.
6. Torsional pendulum – Determination of Rigidity modulus.
7. Particle size determination using Diode Laser
8. Determination of Laser parameters – Wavelength, and angle of divergence.
9. Determination of acceptance angle in an optical fiber.
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Wheatstone Bridge

17BECH111 ENGINEERING CHEMISTRY LABORATORY 0 0 4 2

Course Objective

- To learn the basic concepts in chemical terms relevant to different branches of Engineering and Technology.
- To study the concept of alkalinity of water sample.
- To study the hardness and chloride in water by experimental methods
- To learn the ferric ion by spectrophotometry
- To study the PH Titration
- To study the molecular weight and degree of polymerization using viscometry

Course Outcome

1.Familiarize the properties of material and basic concepts in chemistry
2.Get experience in argentometric method experimentation
3.Get practical exposure to analyse the water sample
4.Get knowledge in spectrophotometry
5.Acquire knowledge about different crystal formation in water
6.Practical knowledge in determine the chemical oxygen demand

LIST OF EXPERIMENTS – CHEMISTRY

1. Estimation of alkalinityof Water sample.
2. Estimation of hardness of Water byEDTA
3. Estimation of chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Conductometric Titration (Simple acidbase).
6. Conductometric Titration (Mixture of weak and strong acids).
7. Conduct metric Titration using $BaCl_2$ vs Na_2SO_4.
8. pH Titration (acid & base).
9. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$).
10. Estimation of Ferric ion bySpectrophotometry.
11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
12. Determination of molecular weight and degree of polymerization using Viscometry.
13. Determination of chemical oxygendemand.

17BEAE112 ENGINEERING WORKSHOP PRACTICE 0 0 4 2 100

COURSE OBJECTIVES:

- To provide hands-on training for the fabrication of components using carpentry and welding equipment/tools.
- To gain the skills for making fitting joints and household pipeline connections using suitable tools.
- To develop the skills for preparing the green sand mould.
- To present the skills for making the simple household electrical connection.
- To develop the skills for making wood/metal models using suitable tools.

COURSE OUTCOMES:

- Fabricate simple components using carpentry and welding equipment/tools.
- Make fitting joints and household pipeline connections using suitable tools.
- Prepare green sand mould using suitable tools.
- Make simple household electrical connections using suitable tools.
- Make simple models using wood and metal.
- Make simple plumbing work

PART – A (CIVIL & MECHANICAL)

i. WELDING

i. Preparation of arc welding of butt joints, lap joints and tee joints.

ii. BASIC MACHINING

i. Simple Turning and Taper turning
ii. Drilling and Tapping
iii. Sheet Metal Work
iv. Model making – Trays, funnels, etc.

iii. DEMONSTRATION ON

i. Smithy operations
ii. Foundry operations
iii. Plumbing Works
iv. Carpentary Works

PART –B (ELECTRICAL & ELECTRONICS)

i. ELECTRICAL ENGINEERING

i. Study of electrical symbols and electrical equipments.
ii. Construct the wiring diagram for Stair case wiring.
iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energy meter.
iv. Measurement of electrical quantities – voltage, current, power & power factor in R load.
v. Measurement of energy using single phase energy meter.

ii. ELECTRONICS ENGINEERING

i. Study of Electronic components– Resistor (color coding), capacitors and inductors.
ii. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
iii. Study of logic gates AND, OR, NOT, NOR and NAND.

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Jeyachandran, K. and Balasubramanian, S	A Premier on Engineering Practices Laboratory	Anuradha Publications, Kumbakonam	2007
2	Jeyapoovan, T., Saravanapandian, M	Engineering Practices Lab Manual	VikasPuplishing House Pvt. Ltd, Chennai	2006
3	Bawa, H.S	Workshop Practice	Tata McGraw – Hill Publishing Company Limited, New Delhi	2007

17BEAE113 ENGINEERING GRAPHICS 2 0 2 3 100

COURSE OBJECTIVES:

- To learn conventions and use of drawing tools in making engineering drawings.
- To impart knowledge on orthographic projection.
- To draw orthographic projections of points, line and plane surfaces.
- To draw orthographic projections of solids.
- To impart the basic concepts of isometric projections through simple examples.
- To impart knowledge of the CAD software

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Recognise the conventions and apply dimensioning concepts while drafting simple objects.
- Draw freehand sketching of multiple views from pictorial views of objects.
- Draw the orthographic projection of points, line and plane surfaces.
- Draw the orthographic projection of solids.
- Draw the isometric projection of the given objects.
- Demonstrate knowledge of the CAD software

UNIT I INTRODUCTION

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

UNIT II SCALES AND PLANE CURVES

SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

UNIT III FREE HAND SKETCHING

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT IV PROJECTION OF POINTS, LINES AND PLANE SURFACES

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT V PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

Introduction to Drafting Software/Package (Not for Exam)

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

S. NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Venugopal K and Prabhu Raja V	Engineering Graphics	New Age International Publishers	2007
2	VTU	A Primer on Computer Aided Engineering Drawing	Belgaum	2006

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Kumar M S	Engineering Graphics	D D Publications, Chennai	2007
2	Bureau of Indian Standards	Engineering Drawing Practices for Schools and Colleges SP 46-2003	BIS, New Delhi	2003
3	Luzadder W J	Fundamentals of Engineering Drawing	Prentice Hall Book Co., New York	1998

17BECC151 **YOGA** **1 0 0 - 100**

OBJECTIVE:

Yoga Education Helps To Develop The Self Discipline, Self Control, Awareness, Concentration And Higher Level Of Consciousness.

AIM : To Enable The Student To Have Physical Health And Mental Health.

UNIT- I

Introduction To Yoga- Meaning Of Yoga – Concept Of Yoga- Aim And Objectives Of Yoga – History Of Yoga - Systems Of Yoga.- Stages (Or) Limbs Of Yoga

UNIT- II

Asanas-Surya Namashkar- Thdasana- Veerabadhra Asana- Trikonasana- Utkatasana- Ardha Chakrasana- Ardha Kati Chakrasana- Thandasana- Gomugasana- Padmasana- Vajrasana- Paschimottasana- Matsyendrasana-Bavana Mukthasana- Supta Padhangusthasana- Sethubhandhasana- Navasana- Ardha Bavanamukthasana- Mathasyasana- Naukasana- Bujangasana- Salabasana- Makkarasana-Dhanurasana.

UNIT- III

Advance Asanas- Sirasasana- Garudasana- Natrajasana- Rajakoptasana- Chakrasana- Kukutasana- Virikshasana- Sarvagasana- Halasana-. Mayurasana .

UNIT- IV

Pranayama- Meaning- Types Of Pranayama- Bhastrika- Bhramari- Udgeeth- Kabalbhati- Bahya- Anulom Vilom- Pranay Pranayama- Benefits Of Pranayama. Neti - Jala Neti , Sutra Neti, Nouli- Three Types, Douthy-Three Types

UNIT- V

Mudras- Uses Of Mudras- Gyan- Shoonya- Apaan- Prana- Vayu- Prithvi- Linga- Apana- Adi Mudra- - Agni Mudra- Surya Mudra- Varuna- Hakini Mudra.

REFERENCES:

S.No	Author Name	Title Of Book	Publisher	Year of Publication
1.	Dr.K.Chandrasekaran	Sound Health Through Yoga	Prem Kalyan	2009
2.	B.K.S.Iyangar	Light On Pranayama	Crossroad Centuary	2013
3.	Thirumular	Thirumandhiram	Sriramakrishna Math	2016

17BECC201A **BUSINESS COMMUNICATION** **3 0 0 3 100**

Course Objectives:

- To help students comprehend the role of listening skills in effective communication.
- To familiarize students with verbal and non-verbal communication.
- To expose students to neutral accent.
- To develop emotional intelligence skills in them for enhancing their self-esteem.
- To assist them in setting goals and developing positive attitude.
- To enable students to acquire decision making skills, problem solving skills and assertive skills.

Course Outcomes:

Students undergoing this course will be able to

- Design and deliver a persuasive presentation that convinces the audience of the topic‟s relevance and overcomes resistance, using appropriate visual support and adhering to a specified time limit.
- Use a strategic communication model and critical thinking to identify **Course Objectives**, analyze audiences, and choose the most effective structure and
- Use a strategic communicationstyle for delivering strategically sound written and spoken messages.
- Practice principles of effective business writing and document design in all written documents.
- Build an understanding of different organizational cultures, business practices, and social norms to communicate more effectively in domestic and cross-cultural business contexts.
- Develop their soft skills and inter personal skills, which will make the transition from college to workplace smoother and help them excel in their job.

UNIT I **(8)**

What is Business Communication? - Types of Communication – Formal and informal communication – Process of Communication- modes of Communication – Barriers to communication.

UNIT II **(10)**

Written Business Communication – Style- word-usage- organization of Ideas – mechanics of writing and fill up of forms - Cover Letter- Letter for Job Application- Letter of Complaint - Memos - Resumes - Email- Reports Revising and proofreading- Advertising slogans- jargons- Description of Graphics and visual aids - interpretation of graphs using expressions of comparison and contrast .

UNIT III **(9)**

Reading and Understanding the news articles - Oral Business Communication - First Impressions

- Attire – Effective Presentation strategies- Nuances of delivery – Controlling nervousness and stage fright- Visual aids Presentations- Capturing Audience - Tone - Behavior - Telephone

Etiquette- Non - verbal communication - Eye contact - Facial expressions - Posture - Gestures - Body language – Etiquette- Organization of presentation – brain storming- Negotiations.

UNIT - IV **(9)**

Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting- Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

UNIT - V **(10)**

Intrapersonal skills - Self-analysis - Thought process – Interpersonal skills - Confidence building -Resolving conflicts- Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Communicating via e-mail. Ethical perspectives and their implications for responsible communication - Proposal Presentation

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Meenakshi Raman ; Prakash Singh	Business Communication	Oxford University Press	2012

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Murthy, G .R. K.	Soft Skills for Success**.**	The ICFAI University Press, Hyderabad.	2008
2	Jagadeesan, G &Santanakrishnan,R.	Soft Skills Development:Training and Evaluation.	The ICFAI University Press, Hyderabad.	2008
3	Sherfield, Robert M., Rhonda J. Montgomery, & Patricia G. Moody	Developing Soft Skills.	Pearson Education, New Delhi.	2005

WEBSITES

http://tribehr.com/social-hr-software/talent-management/skills-tracking
www.ispeakyouspeak.blogspot.com
https://alison.com/subjects/6/Personal-Development-Soft-Skills
www.learning-development.hr.toolbox.com
http://www.niit.com/solution/soft-skill-training
http://mybcommlab.com

17BECC201B **TECHNICAL ENGLISH** **3 0 0 3**

Course Objectives:

1. To motivate learners to acquire listening & speaking skills in both formal and informal context.
2. To focus on question forms & to make them understand the importance of using question tags and also the functional use of transformation of sentences.
3. To improve their reading habit and to train them in critical and analytical reading.
4. To equip them to write for academic as well as work place context.
5. To enable students to face interviews.
6. To study the receptive and productive skills

Course Outcomes:

Students undergoing this course will be able to

- Acquire second language: speaking convincingly, expressing their opinions clearly, negotiating and arguing using appropriate communicative strategies.
- Enhance them reading texts critically and analytically.
- Develop writing effectively and persuasively
- Producing different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Enrich the ability to face interviews with confidence.
- Ensure the good communication with the society.

UNIT-1 LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening - Difference between Hearing & Listening –Listening to informal conversation. **Speaking** - Spoken structures on different situations - Introduction, Greeting, Comments on topics like Films, Games etc, Excuse, Request, Agreement, Disagreement, etc., **Reading** – Extensive and Intensive reading. **Writing** – Report writing - Writing a covering letter. **Grammar & Vocabulary(Function Grammar & Technical Vocabulary**)

Regular & Irregular verbs - Kinds of sentences - Question tags. Homonyms and Homophones.

UNIT-II LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening – Note Taking- Improving grasping ability. **Speaking** – Welcome address - Vote of thanks - Master of ceremony. **Reading** – Active and Passive reading - R e a d i n g for vocabulary-

Reading for a purpose. **Writing** - Writing a review (Film review) - Summary of a story.**Grammar & Vocabulary (Function Grammar & Technical Vocabulary**)

Modal verbs – Conjunction - Expression of cause and effect.Phrasal verbs - Idioms.

UNIT – III LSRW SKILLS & GRAMMAR

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening - Barriers to listening (Physical, Psychological, Linguistic & Cultural). **Speaking** – Stress, Pause and Intonation. **Reading** – Rapid reading – Skimming, Scanning and Surveying. (SQ3R)**Writing** - Essay writing -Minutes of meeting - Agenda

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Active and Passive voice - Purpose expression. Same words used as noun and verb - Often misspelt and confused words.

UNIT-IV LSRW SKILLS & GRAMMAR, CAREERORIENTED

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening – Listening to telephone conversation - Viewing model interviews. **Speaking** – Group Discussion - Correlation between verbal & non - verbal communication. **Reading** – Reading comprehension (short & long text) - Reading job advertisements and profile of a company. **Writing** – Checklist preparation.

Grammar & Vocabulary (Function Grammar & Technical Vocabulary)

Grammar - Numerical expressions – Collocations. Singular and Plural (Nouns)

UNIT- V LSRW SKILLS & GRAMMAR, FIELD WORK

Receptive Skills (Listening, Reading and Scanning) & Productive Skills (Writing, Speaking and Representing) (9)

Listening – Types of listening- Improving listening comprehension**. Speaking** - Oral presentation - Vocal communication techniques - Voice, quality, volume, pitch etc., **Reading** - Note making - Making notes from books/ any forms of writing materials. **Writing** - Describing process & products - Recommendation writing – Short essays writing-

Grammar&Vocabulary (Function Grammar & Technical Vocabulary)

Transformation of sentences (Simple, Compound & Complex).Collection of Technical Vocabularies with their meanings.

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

Total-45

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Sangeeta Sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP, New Delhi.	2015

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2008
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006

WEBSITES :

www.learnerstv.com – Listening/ Speaking/ Presentation
www.usingenglish.com – Writing/ Grammar
www.englishclub.com – Vocabulary Enrichment/ Speaking
www.ispeakyouspeak.blogspot.com – Vocabulary Enrichment/ Speaking
www.teachertube.com – Writing Technically
www.Dictionary.com – Semantic / Grammar

17BECC202 ENGINEERING MATHEMATICS II 3 2 0 4 100

Course Objectives:

1. To have knowledge in integral calculus and Vector calculus
2. To expose the concept of Analytical function and Complex integration.
3. The syllabus is designed to develop the use of integrals techniques which is needed by Engineers for practical applications.
4. It aims to equip the students in integration to solve engineering problems
5. To learn Basic concepts of multiple and vector integrals.
6. To study complex integration

Course Outcomes:

The student will be able to

1. Solve problems in Fluid Dynamics, Theory of Elasticity, Heat and Mass Transfer etc.
2. Find the areas and volumes using Multiple Integrals
3. Improve their ability in Vector calculus
4. Expose to the concept of Analytical function.
5. Apply Complex integration in their Engineering problems
6. Analysis the real time application of it.

UNIT I INTEGRAL CALCULUS (12)

Definite and indefinite integrals – Substitution rule – Techniques of integration – Integration by parts - Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions – Improper Integrals.

UNIT II MULTIPLE INTEGRALS (12)

Double integral – Cartesian coordinates – Polar coordinates – Area as double integrals- Change the order of integration – Triple integration in Cartesian co-ordinates.

UNIT III VECTOR INTEGRATION (12)

Integration of vectors –line integral- surface integral- volume integral- Green‟s theorem - Gauss divergence theorem and Stoke‟s theorems (Statement Only), hemisphere and rectangular parallelopipeds problems.

UNIT IV ANALYTIC FUNCTIONS (12)

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z and bilinear transformation.

UNIT V COMPLEX INTEGRATION (12)

Complex Integration - Cauchy‟s integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy‟s residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi-circle (excluding poles

on the real axis).

Total : 60

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hemamalini. P.T	Engineering Mathematics I & II	McGraw-Hill Education Pvt.Ltd, New Delhi	2014
2	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2014

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Erwin Kreyszig	Advanced Engineering Mathematics.	John Wiley & Sons. Singapore	2011
2	Venkataraman, M. K.	Engineering Mathematics.	The National Publishing Company, Chennai	2005
3	Narayanan. S, Manicavachagampillay.T.K and Ramaniah.G	Advanced Mathematics for Engineering Students.	Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai.	2002
4	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEBSITES:

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.sosmath.com/diffeq/laplace/basic/basic.html
4. www.mathworld.wolframe.com

17BEPH203 ENGINEERING PHYSICS 3 0 0 3 100

Course Objectives:

- To become familiarize on the fundamentals of matter.
- To extend the deep understanding of elastic nature of material.
- To divulge knowledge on the basics of laser and optical fiber with appropriate applications.
- To disseminate the fundamentals of quantum physics and their applications in modern equipments.
- To inculcate the characteristics of electronic materials through basics.
- To study the basics atomic arrangements of crystals

Course Outcomes

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

- Understand the elastic nature of materials.
- Infer the characteristics of laser for various engineering applications.
- Extend the knowledge on optical fiber for communication purposes.
- Illustrate the thermal properties of materials through various methods.
- Develop the idea of quantum mechanics through applications.
- Identify the different atomic arrangements of crystals and its defects.

UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS (9)

Three types of modulus of elasticity – basic definitions, relation connecting the modulii (Derivation), Poisson‟s ratio- Torsional pendulum- bending of beams- bending moment – uniform and non uniform bending

Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

UNIT II LASER AND FIBER OPTICS (9)

Introduction – emission and absorption process- Einstein‟s coefficients derivation. Types of LASER -CO_2, Semiconductor LASER- Applications of LASER in industry and medicine.

Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle –derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram)

UNIT III QUANTUM PHYSICS (9)

Introduction to quantum theory – Black body radiation - dual nature of matter and radiation – de Broglie wavelength, uncertainty principle –Schrödinger‟s wave equation – time dependent and time independent equations – particle in one dimensional box- physical significance of wave function, scanning electron microscope

UNIT IV CRYSTAL PHYSICS (9)

Lattice – unit cell – Bravais lattice – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures, crystal defects – point, line and surface defects

UNIT V ULTRASONICS AND NUCLEAR PHYSICS (9)

Production of ultrasonics by piezoelectric method –Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications – Sonogram. Introduction – basics about nuclear fission and fusion, Radiation detectors– semi conductor detector. Reactors – essentials of nuclear reactor- power reactor.

Total- 45

TEXT BOOKS:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ganesan.S and Baskar.T	Engineering Physics I	GEMS Publisher, Coimbatore-641 001	2015

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Serway and Jewett	Physics for Scientists and Engineers with Modern Physics	Thomson Brooks/Cole, Indian reprint, New Delhi	2010
2	Gaur, R.K. and Gupta, S.C	Engineering Physics	Dhanpat Rai Publications,New Delhi.	2011
3	M.N. Avadhanulu and PG Kshirsagar	A Text book of Engineering Physics	S.Chand and company, Ltd., New Delhi	2011
4	D.C. Ghosh, N.C. Ghosh, P.K. Haldar	Engineering Physics	University Science, New Delhi	2011
5	P. Khare, A. Swarup	Engineering Physics: Fundamentals and Modern Applications	Jones & Bartlett Learning	2009

WEBSITES:

- www.nptel.ac.in
- www.physicsclassroom.com
- www. oyc.yale.edu
- www.physics.org

17BECH203 ENGINEERING CHEMISTRY 3 0 0 3 100

COURSE OBJECTIVES:

- To understand about the water technology.
- To get the information on electrochemical cells, batteries, fuels and combustion.
- To study about the corrosion and protective coatings.
- To gain knowledge on adsorption phenomena.
- To study the basics of Periodic properties, Intermolecular forces
- To comprehend the basic organic chemistry and to synthesis simple drug.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Analyse microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces.
- Rationalise periodic properties such as ionization potential, oxidation states and electronegativity.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise bulk properties and processes using thermodynamic considerations.
- List major chemical reactions that are used in the synthesis of molecules.
- Integrate the chemical principles in the projects undertaken in the field of engineering and technology.

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UNIT I WATER TECHNOLOGY (9)

Sources-Characteristics – Specification for drinking water, BIS &WHO-Alkalinity – Types of alkalinity and determination(No problems) – Hardness – Types and estimation by EDTA method (No problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination - Reverse osmosis.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES (9)

Electrochemical cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox - Fe^{2+}vs dichromate) –Electrolytic conductance-application (conductometric titration)-Batteries- Primary batteries-Leclanche cell- Secondary batteries- Lead acid battery. An introduction to Fuel Cell- H_2-O_2 Fuel Cell.

UNIT III FUELS AND COMBUSTION (9)

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method - Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking - Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, Combustion of fuel-Introduction-GCV-NCV- Problems on Calculation of GCV & NCV - Flue gas analysis.

UNIT IV CORROSION SCIENCE (9)

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions –Inorganic coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hot dipping.

UNIT V SURFACE CHEMISTRY AND PHASE RULE (9)

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm-Role of adsorbents in industries (catalysis and water softening).
Phase Rule: Definition -Phase diagrams – one component water system, two component Ag-Pb system.

Total: 45

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Vairam.S	Engineering Chemistry	Gems Publishers, Coimbatore.	2014
2.	Dr.Ravikrishnan.A	Engineering Chemistry I & II	Sri Krishna Hi tech Publishing Company (P) Ltd., Chennai.	2012

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Raman Sivakumar	Engineering Chemistry I &II	McGraw-Hill Publishing Co.Ltd., 3rd Reprint NewDelhi.	2013
2.	Kuriakose. J.C. and Rajaram	Chemistry in Engineering and Technology. Vol. I & II 5th edition.	Tata McGraw Hill Publishing Company, New Delhi.	2010
3.	Jain, P.C. and Monika Jain	Engineering Chemistry.	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.	2009
4.	Dara.S.S	Text book of Engineering Chemistry.	S.Chand & Co.Ltd., New Delhi	2008
5.	Sharma.B. K	Engineering Chemistry	Krishna Prakasam Media (P) Ltd., Meerut	2001

WEBSITES:

1.http://www.studynotes.ie/leaving-cert/chemistry/
2. http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html
3.http://www.learnerstv.com/Free-chemistry-Video-lectures-ltv044-Page1.htm
4. http://ocw.mit.edu/courses/#chemistry
5. http://www.chem.qmul.ac.uk/surfaces/sec

17BECC204 ENVIRONMENTAL SCIENCES 3 0 0 3

Course Objectives:

- To give a comprehensive insight into natural resources, ecosystem and biodiversity.
- To educate the ways and means of the environment
- To protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.
- To create the awareness about environmental problems among people.
- To motivate public to participate in environment protection and improvement.

Course Outcomes (COs)

Upon completion of the course the students will be able to

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES (9)

Definition, Scope and Importance – Need for public awareness –Forest resources: Use and over- exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources- role of an individual in conservation of natural resources.

UNI II ECOSYSTEM (9)

Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere- Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, Food web and Ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

UNIT III BIODIVERSITY (9)

Introduction to biodiversity, Definition- Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic

Species of India – Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION (9)

Definition – causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-causes, effects and control measures of urban and industrial wastes– Role of an individual in prevention of pollution–Disaster m a n a g e m e n t -earthquake, tsunami, cyclone and landslides.

UNIT V SOCIAL ISSUES AND ENVIRONMENT (9)

From Unsustainable to Sustainable development, Urban problems related to energy sources, Water conservation, Rain water harvesting and Watershed management, Resettlement and rehabilitation of people, its problems and concerns, Environmental ethics- Issues and possible solutions- Climate change- Green house effect and Global warming, Acid rain, Ozone layer depletion, Wasteland reclamation- Environment Protection Act- Human Rights- Value education, Role of Information Technology in Environment and Human health- Population growth, Variation of population among nations-Population explosion.

Total: 45

TEXT BOOKS:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. Ravikrishnan, A	Environmental Science	Sri Krishna Hi tech Publishing Company Private Ltd., Chennai	2012
2.	Anubhakaushik C.P. Kaushik	Environmental Science and Engineering	New Age International (P) Ltd., New Delhi.	2010

REFERENCES:

S.No.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William P.Cunningham	Principles of Environmental Science	Tata Mc Graw -Hill Publishing Company, New Delhi.	2008
2.	Linda D. Williams	Environmental Science Demystified	Tata Mc Graw -Hill Publishing Company Ltd., New Delhi.	2005
3.	BharuchaErach	Environmental Science Demystified	Mapin Publishing (P) Ltd., Ahmedabad.	2005
4.	Tyler Miller G. Jr	Environmental Science	Thomson & Thomson Publishers, New Delhi.	2004
5.	Trivedi, R.K. and Goel, P.K	Introduction to Air Pollution	Techno-Science Publications, Jaipur.	2003

WEBSITES:

1. http://people.eku.edu/ritchisong/envscinotes1.html
2.http://nptel.ac.in/courses.php?disciplineId=120
3.www.newagepublishers.com/samplechapter/001281.
4.www.unesco.org/ext/field/beijing/scienceb.htm,www.infinitepower.org/education.htm
5. http://www.sciencedaily.com/news/top/environment/

17BEAE205 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING **3 0 0 3 100**

Course Objectives

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working ofvarious Electrical Machines.
3. To understand the concepts of AC and DC currents.
4. To know about various measuring instruments.
5. To understand the basic concepts in semiconductor devices.
6. To understand the basic concepts of digital electronics

Course Outcomes

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

- Understand the basic knowledge about the Electric circuits.
- Infer the characteristics of various Electrical Machines.
- Extend the knowledge on concepts of AC and DC currents.
- Understand the various measuring instruments.
- Develop the idea of semiconductor devices.
- Understand the basic knowledge about digital electronics

UNIT I ELECTRICAL CIRCUITS

Ohms Law – Kirchoff's Laws – Steady State Solution of DCCircuits – Introduction to AC Circuits Waveforms and RMSValue – Power and Power factor – Single Phase andThree Phase balanced Circuits.

UNIT II ELECTRICAL MACHINES

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single PhaseTransformer, single phase induction Motor.

UNIT III MEASURINGINSTRUMENTS Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Wattmeters and Energy meters.

UNIT IV SEMICONDUCTOR DEVICESAND APPLICATIONS

Characteristics of PN Junction Diode–Zener Effect–Zener Diode and its Characteristics–Half wave and Fullwave Rectifiers–Voltage Regulation. Bipolar Junction Transistor–CB, CE, CC Configurations and Characteristics

UNIT V DIGITAL ELECTRONICS

Number systems – binary codes-logic gates-Boolean algebra, laws& theorems-simplification of Boolean expression-implementation of Boolean expressions using logic gates-standard forms of Boolean expression.

TEXT BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OFTHEBOOK	PUBLISHER	YEAROF PUBLICATION
1	Mittle, V.M	Basic Electrical Engineering	**Tata McGraw Hill Edition 3, New Delhi**	**2006**
2	SedhaR.S	Applied Electronics	**S. Chand &Co**	**2008**

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OFTHEBOOK	PUBLISHER	YEAROF PUBLICATION
1	Muthusubramania n R, and Muraleedharan K A	Basic Electrical, Electronics and Computer Engineering	Tata McGraw Hill, Second Edition	2006
2	Nagsarkar TK and SukhijaM S	Basics ofElectrical Engineering	Oxford press	2005
3	Mahmood Nahvi and JosephA. Edminister	Electric Circuits	Schaum"Outline **Series, McGraw Hill**	**2011**
4	Premkumar N	Basic Electrical Engineering	AnuradhaPublishers	2003

17BEPH211 ENGINEERING PHYSICS LABORATORY 0 0 4 2 100

Course Objective

- To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
- To study the concept of semiconductor and conductivity.
- To learn the properties of materials.
- To learn the device for determine the wavelength and velocity of sound
- To study the viscosity of liquids
- To learn the bandgap of semiconductor

Course Outcome

- Familiarize the properties of material and basic concepts in physics.
- Get experience in laser wavelngth experimenattion
- Get practical exposure to analyse the velocity of sound
- Get knowledge in bandgap and wavelengh determination
- Acquire knowledge about different bendings
- Practical knowledge in therml conductivity of wire and its thickness

LIST OF EXPERIMENTS – PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
2. Determination of wavelength of mercury spectrum – spectrometer grating.
3. Determination of Young‟s modulus of the material – Non uniform bending (or) Uniform bending.
4. Determination of Viscosity of liquid – Poiseuille‟s method.
5. Spectrometer Dispersive power of a prism.
6. Torsional pendulum – Determination of Rigidity modulus.
7. Particle size determination using Diode Laser
8. Determination of Laser parameters – Wavelength, and angle of divergence.
9. Determination of acceptance angle in an optical fiber.
10. Determination of thickness of a thin wire – Air wedge method
11. Determination of Band Gap of a semiconductor material.
12. Determination of Specific resistance of a given coil of wire – Wheatstone Bridge

17BECH211 ENGINEERING CHEMISTRY LABORATORY 0 0 4 2 100

Course Objective

- To learn the basic concepts in chemical terms relevant to different branches of Engineering and Technology.
- To study the concept of alkalinity of water sample.
- To study the hardness and chloride in water by experimental methods
- To learn the ferric ion by spectrophotometry
- To study the PH Titration
- To study the molecular weight and degree of polymerization using viscometry

Course Outcome

1.Familiarize the properties of material and basic concepts in chemistry
2.Get experience in argentometric method experimentation
3.Get practical exposure to analyse the water sample
4.Get knowledge in spectrophotometry
5.Acquire knowledge about different crystal formation in water
6.Practical knowledge in determine the chemical oxygen demand

LIST OF EXPERIMENTS – CHEMISTRY

1. Estimation of alkalinityof Water sample.
2. Estimation of hardness of Water byEDTA
3. Estimation of chloride in Water sample (Argentometric method)
4. Determination of corrosion rate by weight loss method.
5. Conductometric Titration (Simple acidbase).
6. Conductometric Titration (Mixture of weak and strong acids).
7. Conduct metric Titration using $BaCl_2$ vs Na_2SO_4.
8. pH Titration (acid & base).
9. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$).
10. Estimation of Ferric ion bySpectrophotometry.
11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
12. Determination of molecular weight and degree of polymerization using Viscometry.
13. Determination of chemical oxygendemand.

17BEAE212 **COMPUTER PRACTICE AND PROGRAMMING LABORATORY** **1 0 4 3 100**

COURSE OBJECTIVES:

- Identify and understand the working of key components of a computer program.
- Identify and understand the various kinds of keywords and different data types of C programming
- Understand, analyze and implement software development tools using algorithm
- Understand, analyze and implement software development tools using linux
- Acquire and analyse the roots of equations
- Study, analyze and understand logical structure of a computer program, and different construct to develop a program in "C" language

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Formulate simple algorithms for arithmetic and logical problems.
- Translate the algorithms to programs (in C language).
- Test and execute the programs and correct syntax and logical errors.
- Implement conditional branching, iteration and recursion.
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

THEORY:

What is computer- Computer Components- What is C- C Character set- Constants, Variables and Keywords-General form of C Program - Relational and Logical Operators - Selection Structures- If and nested if - Switch Case - Loops-Definition and types- Functions- Arrays- Introduction to Strings-Pointers.

PRACTICALS:

1. Working with word Processing, Spreadsheet and presentation software in Linux

2. Programming in Scratch:
   Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming

3. C Programming:
   Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and function, implementation of pointers.

REFERENCES:

1. E. Balagurusamy, " Computing Fundamentals and C Programming", TMH Education, 5th Edition, 2014
2. YashavantKanetkar, " Let us C", BPB Publications, 13th Edition, 2013

17BEAE213 MACHINE DRAWING 1 0 2 2 100

COURSE OBJECTIVES:

- To explain the surfaces for sheet metal working applications.
- To Understand the representation of details in machine drawing.
- To introduce tolerances and fits of machine elements.
- To equip them with skills to Construct an assembly drawing using part drawings of machine components.
- To equip them with skills to Construct an assembly drawing of machine components using 2D drafting.
- To Understand various Cam Profile

COURSE OUTCOMES:

- Draw the surfaces for sheet metal working applications.
- Understand the representation of details in machine drawing.
- Represent tolerances and fits of machine elements.
- Construct an assembly drawing using part drawings of machine components.
- Construct an assembly drawing of machine components using 2D drafting
- Understand the various Cam Profile

UNIT I CONVENTIONS

Importance of sectional views, Code of practice for engineering drawing, drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

UNIT II ASSEMBLY CONCEPTS AND DRAWING PRACTICE

Methods and concepts of assemblies-assembly requirements, Bill of materials. Methods of assembly-bolts, nuts, studs, screws and pins.Methods of arresting motion of a member in an assembly. Drawing Practice of flange coupling, universal coupling, oldhams coupling, swivel bearing, stuffing box, knuckle joint, C clamp, plummer block, screw jack, simple drill jig.

UNIT III FITS AND TOLERANCES

Limits, fits and tolerances-need, types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances. Geometric tolerance-uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings. Surface finish symbols- methods of indicating the surface roughness.

UNIT IV SOLID MODELING

Modelling of flange coupling, universal coupling, oldhams coupling, swivel bearing, stuffing box, knuckle joint, C clamp, plummer block, screw jack, simple drill jig.

UNIT V CAM PROFILE

Classifications, displacement diagrams-parabolic, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife - edged, roller, mushroom, flat type, derivatives of follower motion, pressure angle and undercutting.

TEXT BOOKS:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Gopalakrishna K R	Machine Drawing Seventeenth Edition	Subhas Stores, Bangalore	2003
2.	Narayana K L, Kannaiah P, Venkata Reddy K	Machine Drawing	New Age International	2006

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Varghese P I and John K C	Machine Drawing	Jovast Publishers, Thrissur	2007
2.	BIS	SP:46-2003	Engineering Drawing Practice for Schools and Colleges, New Delhi	2003
3.	ASME Y 14.5M-1994	Dimensioning and Tolerancing	ASME, New York	1995

17BEAE251 **BUSINESS PLAN** **1 0 0 - 100**

Course Objectives

- To explain relevance of Ethics while taking business decisions.
- To get knowledge of Entrepreneurship
- To get knowledge of business plan process
- To get knowledge of business plan components
- To learn about management and organization
- To study about government policy

Course Outcomes

- To develop a business plan connected with ethics.
- To become Entrepreneur
- To analysis business plan process
- To analysis business plan components
- To build up management and organization plan
- To implement government policy

Unit I

Entrepreneurship – Types- Entrepreneurial Competencies -Business Plan – Meaning - Basic parameters - Project parameters - Factors of successful business - Term Loans and Working Capital Management.

Unit II

Business Plan Process - Sources of Information – Online Resources - Offline Resources - Sources of Market Research - Benefits of market study - Coverage of market study.

Unit III

Business Plan components - Company description - Industry Analysis - Target Market - Competition - Strategic position - Risk assessment - Technology plan - Management and Organization – Government policy

Reference books

1. Rhonda Abrams " The Successful business Plan Secret $ Strategies " Prentice Hall
2. Rhonda Abrams “The business plan in a day" Prentice Hall.
3. Business plan preparation - Entrepreneurship Development Institute of India

17BEAE301 METHODS OF APPLIED MATHEMATICS 3 2 0 4 100

Course Objectives:

- To hone the analytical skills in the minds of Engineers.
- To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyze Engineering problems.
- To study the fourier series
- To study the basic principles of different transforms.
- To study the application of PDE
- To study the difference equations

Course Outcomes:

Upon Completion of this course the students will be ableto:

1. Explain the fundamental concepts of probability and standard distributions which can describe real life phenomenon.
2. Explain the basic concepts of one- and two-dimensional random variables and their applications in engineering.
3. Apply the concept of testing of hypothesis for small and large samples in real life problems.
4. Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
5. Discuss the notion of sampling distributions and statistical techniques used in engineering and management problems.
6. Discuss about the techniques in quality control that model engineering problems

UNIT- I LAPLACE TRANSFORM (13)

Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and final value theorems. Inverse Laplace transforms – Convolution theorem (statement only) – Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms – Transform of periodic functions.

UNIT- II FOURIER SERIES (12)

Dirichlet‟s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval‟s identity – Harmonic Analysis.

UNIT -III FOURIER TRANSFORM (12)

Fourier integral theorem (Statement Only) – Fourier transform pair –Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval‟s identity – Relation between Fourier and Laplace transforms

UNIT- IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12)

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded)

UNIT- V Z -TRANSFORM AND DIFFERENCE EQUATIONS (11)

Z-transform - Elementary properties – Inverse Z- transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

Total : 60

TEXT BOOKS:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2013
2	Erwin Kreyszig	Advanced Engineering Mathematics.	Wiley India (P) Ltd, New Delhi.	2014

REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venkateswarlu S	Engineering Mathematics, Vol I	Anuratha Agencies and Publishers, Kumbakonam.	2007
2	Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G	Advanced Mathematics for Engineering Students. Volumes II and III,	Viswanathan S Printers and Publishers Pvt. Ltd. Chennai.	2002
3	Bali N P., Manish Goyal	A text book of Engineering Mathematics	Laxmi Publications Pvt. Ltd., New Delhi	2006
4	Ramana B V	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Co. Ltd. New Delhi.	2008

WEBSITES:

1. www.sosmath.com
2. http://mathworld.wolfram.com/FourierSeries.html
3. www. nptel.ac.in

17BEAE302 MECHANICS OF SOLIDS 3 2 0 4 100

COURSE OBJECTIVES:

- To study and estimate the mechanical properties of materials and their deformations under different loading conditions.
- To gain knowledge on the shear force and bending stress distribution in different beams under various loads.
- To impart knowledge on finding slope and deflection of beams and buckling of columns for various boundary conditions.
- To learn deformation of the shaft under torsion and deflection of closed helical springs.
- To acquire knowledge on the two-dimensional stress systems and stresses in thin cylinders and spherical shells.
- To introduce the concepts of Mohr's circle

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Evaluate the stresses and strains in simple and composite structures subjected to axial loads.
- Examine the shear force, bending moment and shear stress of various beams under different loading conditions.
- Examine the stresses induced in the shaft and closed coil helical springs subjected to torsion.
- Evaluate the slope and deflection of beams and buckling loads of columns with different boundary conditions.
- Examine the stresses in two-dimensional systems and thin cylinders.
- Familiar with construction of Mohr's circle

UNIT I STRESS AND STRAIN

Stress and strain at a point-Tension, Compression, Shear Stress-hookes‟s Law-Relationship among elastic constants-Stress Strain Diagram for Steels- Ultimate and Yield Stress- Factor of Safety-Thermal stresses-Thin Cylinders and Shells-Strain Energy due to Axial force-Resilience- Stresses due to impact

UNIT II SHEAR AND BENDING IN BEAMS

Beams and Bending-Types of loads, supports-Shear Force and Bending Moment-Diagrams for statically determinate beam with concentrated load, uniformly distributed load- Uniformly varying load. Theory of simple bending-Analysis of Beams for Stresses-Stress Distribution at a cross section due to bending moment and shear force for cantilever, simply supported and overhanging beams with different loading conditions-Flitched beams

UNIT III DEFLECTION

Double Integration Method-Macaulay‟s Method-Area moment method-conjugate beam method for computation of slopes and deflections of determinant beams.

UNIT IV TORSION

Torsion of Circular and Hollow Shafts- Elastic Theory of Torsion-Stresses and Deflection in Circular Solid and Hollow shafts-combined bending moment and torsion of shafts- strain energy due to torsion- Modulus of rupture-Power transmitted to shaft- Shaft in series and parallel-

Closed and Open coiled helical springs-leaf Springs-Springs in series and parallel

UNIT V COMPLEX STRESSES AND PLANE TRUSSES

2D State of Stress-2D Normal and Shear Stresses on any plane-Principal Stresses and Principal Planes-Mohr‟s circle-Plane trusses-Analysis of plane trusses-method of joints-method of sections

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Popov .E.P	Engineering Mechanics of Solids	Prentice-Hall of India,New Delhi	1998
2.	Punmia .B.C, Ashok Kumar Jain and Arun Kumar Jain	Strength of Materials and Theory of Structures-Vol.2	Laxmi Publications, New Delhi	2005
3.	Ferdinand Beer, E. Russell Johnston Jr., John DeWolf and David Mazurek	Mechanics of Materials,7th Edition	McGraw-Hill Book Co, New Delhi.	2014

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William Nash,Merle Potter	Theory and problems in Strength of Materials Schaum Outline Series	McGraw-Hill Book Co,New York.	2011
2.	Kazimi S.M.A	Solid Mechanics	Tata McGraw-Hill Publishing Co., New Delhi.	2001
3.	Ryder G.H	Strength of Materials	Macmillan India Ltd, New Delhi	2002
4	Timoshenko.S.P.	Elements of Strength of Materials‟,5th Edition	East West,India	2003

17BEAE303 APPLIED THERMODYNAMICS 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on the fundamentals of thermodynamics, zeroth law, first law and second law of thermodynamics.
- To study the thermodynamic properties of pure substances and its phase change processes.
- To learn the gas power cycles and properties of gas mixtures.
- To acquaint the student with the concepts of air standard performance of heat engines.
- To familiarise the concept of psychrometry and its applications.
- To provide knowledge on the working principle and performance of air compressors and refrigeration systems.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Apply the first law of thermodynamics to closed and open systems.
- Solve the problems related to cycles and cyclic devices using the second law of thermodynamics.
- Determine the thermodynamic properties of pure substances and its phase change processes.
- Evaluate the air standard performance of heat engines.
- Solve the psychrometric problems in various applications.
- Calculate the performance of air compressors and refrigeration systems.

UNIT I BASIC CONCEPTS AND LAWS OFTHERMODYNAMICS

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Zeroth law of thermodynamics - First law of thermodynamics – application to closed and open systems, steady flow process with reference to various thermal equipments. Second law of thermodynamics-Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability.

UNIT II PROPERTIES OF PURE SUBSTANCE AND IDEAL & REAL GASES

Properties of steam, Pure substance, phase, phase change process, property diagrams, PVT surface. Gas mixtures- properties of ideal and real gases, equation of state, Avagadro‟s law, Vander Waal‟s equation of states, compressibility and its chart. Dalton‟s law of partial pressure, exact differentials, T-D, relations, Maxwell relations, Clausius Clapeyroni equations, Joule Thomson Coefficient

UNIT III GAS POWER CYCLES

Air standard cycles-Otto-Diesel-Dual-Work output, Efficiency and MEP calculations – Comparison of the cycles with respect to compression ratio, heat addition, heat rejection, peak pressure, temperature and work output , Simple Brayton cycle

UNIT IV PSYCHROMETRY

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric process- sensible and latent heat exchange processes.

UNIT V RECIPROCATING AIR COMPRESSORS &REFRIGEREATION CYCLES

Single acting and double acting air compressors, work required, effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, two stage compression, condition for minimum work.

Fundamentals of refrigeration, C.O.P., reversed carnot cycle, simple vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.Thermoelectric cooling and chip cooling.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Nag.P.K	Engineering Thermodynamics-5th Edition	McGraw-Hill Education (India) Private Limited	2013
2.	Rathakrishnan.E	Fundamentals of Engineering Thermodynamics	Prentice-Hall of India, New Delhi	2006
3.	Rajput.R.K	Applied Thermodynamics	Laxmi Publishing Co., New Delhi	2009

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Arora.C.P	Thermodynamics	Tata McGraw-Hill, New Delhi.	2003
2.	Nag.P.K	Basic and applied Thermodynamics	McGraw –Hill Education (India) Private Limited	2010

16BEAE304 AUTOMOTIVE ENGINES 3 0 0 3 100

COURSE OBJECTIVES:

- To impart basic knowledge on the construction and operation of two-stroke and four-stroke engines.
- To study various components of the fuel feed system.
- To learn the combustion process and types of combustion chambers.
- To provide knowledge on the supercharging, turbocharging and engine testing.
- To familiarise the types of cooling and lubrication systems.
- To provide knowledge on modern engine technologies

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Differentiate the construction and operation of two-stroke and four-stroke engines.
- Name and explain various components of the fuel feed system.
- Discuss the combustion process and combustion chambers.
- List and describe the different methods of supercharging and turbocharging.
- Explain the importance of cooling system.
- Explain the importance of lubrication system.

UNIT I ENGINE CONSTRUCTION AND OPERATION

Constructional details of four stroke SI and CI engine, working principle, air standard Otto cycle, Diesel and Dual Cycles actual indicator diagram, two stroke engine construction and operation, comparison of four stroke and two stroke engine, firing order and its significance. Port Timing, Valve Timing of petrol and diesel engines.

UNIT II FUEL FEED SYSTEM

Carburettor working principle, requirements of an automotive carburettor, starting, idling, acceleration and normal circuits of carburettors. Compensation, maximum power devices, constant choke and constant vacuum carburettors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI) - Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and common rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

UNIT III COOLING AND LUBRICATION SYSTEMS

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, forced circulation system, pressure cooling system. Lubrication system; Mist, Dry sump and wet sump lubrication system, properties of lubricants.

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS

Combustion in SI engine; stages of combustion, flame propagation, Delay period, Uncontrolled

combustion, Effect of Delay period, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on knock, knock rating. Combustion chambers; different types, Combustion in CI Engines, Direct and indirect injection combustion chambers for CI engines. Importance of Swirl, squish and turbulence. Factors considering combustion chamber design.

UNIT V SUPERCHARGING, TURBOCHARGING AND ENGINE TESTING

Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls - wastegate, variable geometry, variable nozzle types. Dynamometers, indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards-Morse Test

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2012
2.	Mathur .M.L and R.P.Sharma	A course in internal combustion engines	Dhanpat Raj & Sons Publications, New Delhi	2001
3.	Heinz Heisler	Advanced Engine Technology	Butterworth-Heinemann	2005

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John B. Heywood	Internal Combustion Engine Fundamental	McGraw-Hill Education(India) Private Limited.	2011
2.	Heldt.P.M	High Speed Combustion Engines: Design, Production, Test	Oxford & IBH Publishing Company	1965
3.	Obert.E.F	Internal Combustion Engines Analysis and Practice	International Text Books Co., Scrantron, Pennsylvania	1988
4.	William H.Crouse	Automotive Engines	McGraw-Hill Publishers.	2006
5.	Ellinger.H.E	Automotive Engines	Prentice Hall Publishers.	1992
6.	Pulkrabek	Engineering Fundamentals of the Internal Combustion Engines	Practice Hall of India.	2003

17BEAE305 ENGINEERING METROLOGY AND MEASUREMENT TECHNIQUES 3 0 0 3 100

COURSE OBJECTIVES:

- To familiarise the concepts of measurement and characteristics of instruments.
- To learn the procedure for various linear and angular measurements.
- To provide knowledge on the measurement of gear and thread terminologies using suitable instruments.
- To expose the procedure to measure the mechanical parameters using suitable instruments.
- To study the use of laser and advances in metrology for linear geometric dimensions.
- To impart knowledge on digital devices and computer aided inspection devices

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the basic concept of measurement and characteristics of measuring instruments.
- Practice the appropriate linear and angular dimensions using precision measuring instruments.
- Examine the major terminologies for the gear and screw thread measurement.
- Explain the suitable type of instrument used to measure the mechanical parameters.
- Apply the advanced techniques in metrology to calculate the geometric dimensions.
- Practice the digital devices and computer aided inspection devices

UNIT I CONCEPT OF MEASUREMENT

General concept – Generalised measurement system-Units and standards-measuring instruments-sensitivity, readability, range of accuracy, precision-static and dynamic response-repeatability- systematic and random errors-correction, calibration, interchangeability.

UNIT II LINEAR AND ANGULAR MEASUREMENT

Definition of metrology-Linear measuring instruments: Vernier, micrometer, intervalmeasurement, Slip gauges and classification, interferometry, optical flats, limit gauges - Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements:-Sine bar, optical bevel protractor, angle Decker – Taper measurements.

UNIT III FORM MEASUREMENT

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY

Precision instruments based on laser-Principles- laser interferometer-application in linear,angular measurements and machine tool metrology Coordinate measuring machine (CMM) - Constructional features – types, applications – digital devices- computer aided inspection.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Flow measurement: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, pressure thermometers, thermocouples, electrical resistance thermistor.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Jain.R .K	Engineering Metrology	Khanna Publishers, New Delhi	1994
2.	Alan S. Morris,	The Essence of Measurement	Prentice Hall of India	1997

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Gupta.S.K	Engineering Metrology	Dhanpat rai Publications, New Delhi	1984
2.	Jayal.A.K,	Instrumentation and Mechanical Measurements	Galgotia Publications	2000
3.	Beckwith.T.G and Lewis Buck.N	Mechanical Measurements	Addison Wesley	1991
4.	Donald D.Eckman	Industrial Instrumentation	Wiley Eastern	1985

WEB REFERENCES

www.engr-metr.com
www.exactmetrology.com

17BEAE306 **ENGINEERING MATERIALS AND METALLURGY** **3 0 0 3 100**

COURSE OBJECTIVES:

- To provide knowledge on physical metallurgy of metals through the study of phase diagrams.
- To study the properties and applications of various metals and alloys used in engineering industries.
- To expose the various heat treatment processes of steels.
- To impart knowledge of the mechanical properties evaluation and testing methods of engineering materials.
- To introduce fundamentals of composites
- To provide fundamental knowledge of composites and their applications.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the phase diagrams of different engineering materials.
- Recognise the properties and applications of various metals and alloys.
- Identify the appropriate heat treatment processes for the given applications.
- Test the mechanical properties of the given materials for real-time applications.
- Understand the fundamentals of composites
- Identify the appropriate composites for applications in the automotive industry.

Review (Not for Exam):
Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSITITUION OF ALLOYS AND PHASE DIAGRAMS
Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron – Iron carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNIT II FERROUS AND NON FERROUS METALS
Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA - maraging steels – Gray, White malleable, spheroidal -Graphite - alloy castirons. Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys.

UNIT III MECHANICAL PROPERTIES AND TESTING
Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creeptest.

UNIT IV HEAT TREATMENT

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

UNIT V INTRODUCTION TO COMPOSITES

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites in Automobiles

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Kenneth G.Budinski and Michael K.Budinski	Engineering Materials",4th Indian Reprint	Prentice-Hall of India Private Limited.	2014
2.	Raghavan.V	Materials Science and Engineering	Prentice Hall of India Pvt. Ltd	1999

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William D.Callister Jr	Materials Science and Engineering an Introduction", Sixth edition	John Wiley and Sons Inc, New York	2004
2.	Sydney H.Avner	Introduction to Physical Metallurgy	Tata McGraw-Hill Publishing Co. Ltd, New Delhi.	2008

WEBREFERENCE

www.nptel.iitm.ac.in

17BEAE311 **AUTOMOTIVE ENGINE PARTS AND MEASUREMENTS LABORATORY** **0 0 3 2 100**

COURSE OBJECTIVES:

1. To provide knowledge on Dismantling and Assembly of petrol engine.
2. To study the fuel systems in Automobiles.
3. To expose the various system components.
4. To impart knowledge on Calibration of Vernier / Micrometer / Dial Gauge
5. To introduce various measurement techniques
6. To provide fundamental knowledge of Displacement, Force and Vibration.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

1. Dismantle and Assembly petrol engine.
2. Recognize the fuel systems in Automobiles.
3. Identify the appropriate system components.
4. Test the dimensions using Vernier / Micrometer / Dial Gauge.
5. Understand the measurement techniques
6. Obtain knowledge on measurement of displacement, Force and Vibration Displacement, Force and Vibration.

1. Dismantling and Assembly of petrol engine.
2. Study of 4 cylinder diesel engine
3. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI & CRDI
4. Study of ignition system components – coil, magneto and electronic ignition systems.
5. Study of engine cooling system and lubrication system components
6. Ovality and taper measurement of cylinder bore, crankshaft and comparison with standard specifications
7. Calibration of Vernier / Micrometer / Dial Gauge
8. Checking Dimensions of part using slip gauges
9. Measurements of Gear Tooth Dimensions
10. Measurement of straightness, flatness and thread parameters
11. Measurement of Displacement, Force and Vibration

16BEAE312 COMPUTER AIDED MACHINE DRAWING LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

- To understand and interpret drawings of machine components.
- To acquire the ability in designing and making the assembly drawing of various components.
- To expose students to drawing of sleeve and cotter joint.
- To expose students to knuckle joint, gib and cotter joint
- To provide an overview of drawing of universal coupling, screw jack.
- To make the student acquire sound knowledge of piston and connecting rod

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Sketch the detailed drawing of sleeve and cotter joint.
- Sketch the detailed drawing of knuckle joint
- Sketch the detailed drawing of gib and cotter joint.
- Sketch the detailed drawing of universal coupling.
- Sketch the detailed drawing of screw jack.
- Create the assembly drawing of piston and connecting rod

1. Modeling of solid blocks
2. Modeling of V- Block , L- Block with rib
3. Modeling of blocks with holes
4. Modeling with square cut and U cut
5. Modeling of pistons and connecting rods
6. Assembly drawing of screw jack
7. Assembly drawing of Universal coupling
8. Assembly drawing of flanged coupling
9. Assembly drawing of knuckle joint
10. Modeling of valves
11. Modeling of crank shaft
12. Modeling of bumper
13. Modeling of frame assembly

17BEAE313 FLUID MECHANICS AND STRENGTH OF MATERIALS LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

- To demonstrate the principles of fluid mechanics.
- To measure the energy losses in a pipe flow.
- To perform a characteristic study on non-positive and positive displacement pumps.
- To know the tensile and shear strength of materials.
- To study the hardness and impact strength of materials.
- To give exposure to compression strength of helical springs

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Calculate the rate of fluid flow and coefficient of discharge in fluid flow devices.
- Measure the losses associated in a pipe flow.
- Evaluate the performance of non-positive and positive displacement pumps.
- Measure the tensile and shear strength of materials.
- Evaluate the hardness and impact strength of materials.
- Evaluate the compression strength of helical springs

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Venturi and Orifice meter.
2. Calculation of the rate of flow using Roto meter.
4. Determination of friction factor of given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submersible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Tensile test on metals-stress strain characteristics, ductility, resilience, toughness.
9. Hardness test on metals-Brinell, Vicker and Rockwell Hardness tests.
10. Impact test on metals-Charpy, Izod impact tests.
11. Shear test on metals-direct shear strength, single shear, double shear.
12. Tests on helical springs-compression, tension springs-load deformation characteristics, stiffness, shear stress , modulus of rigidity, energy.
13. Torsion test on beams-torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
14. Microscopic examination of i) Hardened samples ii) Tempered samples

17BEAE314 **COURSE ORIENTED PROJECT-I** **1 0 0 1 100**

The objective of this project is to provide opportunity for the students to implement their skills acquired and design projects based on courses in the third semester

The students in convenient groups of not more than 3 members have to take up a project work in any subject of their choice in the third semester. Every project work shall have a guide who is the member of the faculty of the institution.

- Identify a problem and develop the solutions.
- Identify, formulate and analyse problems and justify solutions using scientific knowledge.
- Apply technical ideas, strategies and methodologies.
- Design and conduct experiments, as well as analyse and interpret data.
- Familiar with cost-effectiveness analysis.
- Prepare technical report and oral presentations.

COURSE OUTCOMES:

17BEAE351 **SOFT SKILLS** **1 0 0 - 100**

INTENDED OBJECTIVE

- To elevate the students into productivity powerhouses who can employ life skills to better their performances

COURSE OUTCOMES

- Demonstrate the adequate soft skills required for the workplace.
- Express the presentation skills
- Express the views in group discussions with confidence.
- Demonstrate the appropriate interview skills.
- Manage time effectively.
- Explain the stress management

UNIT I

Overview to communication, self Introduction, Presentation on their own topic, Extempore, Group Activity

UNIT II

Group Discussion, Do's and Don‟‟ts of Group Discussion, Body language, Grooming and Resume, Resume correction

UNIT III

Introduction to HRM – Questions - Do's and Don‟‟t's - Interview - Mock GD - Stress Management

UNIT IV

Personality Development - Presentation skills, Interpersonal skills, Critical thinking, Confidence building and Stress management.

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Barun K Mitra	Personality Development and Soft Skills	Oxford University Press-New Delhi	2012
2	Rajiv K. Mishra	Personality Development	Rupa& Co.	2012

17BEAE401 THEORY OF MACHINES 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on the concept and kinematic analysis of simple mechanisms.
- To introduce the concept of friction drives in kinematic of machines.
- To calculate the speed ratio of various types of the gear train and construct the cam profile for the various types of follower motion.
- To provide knowledge on balancing of rotating and reciprocating masses.
- To learn the concept of free, forced and damped vibrations.
- To provide knowledge on torsional vibration of shaft

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Identify the simple mechanisms based on a given application, and find velocity and acceleration of simple mechanisms.
- Estimate the amount of power transmitted by drive.
- Calculate the speed ratio of various types of the gear train and construct the cam profile for the various types of follower motion.
- Estimate the balancing mass for rotating and reciprocating masses by using the force and couple polygon.
- Evaluate the natural frequency of a single degrees of freedom system subjected to free and forced vibrations.
- Compute the torsional vibration of shaft

UNIT I MECHANISMS

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom - Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

UNIT II FRICTION

Types of friction -Friction in screw and nut – Screw jack - Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT III GEARING AND CAMS

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicylic gear trains - Determination of speed and torque- Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions.

UNIT IV BALANCING

Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method. Governors and Gyroscopic effects.

UNIT V VIBRATION

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Rattan.S.S	Theory of Machines	Tata McGraw–Hill Publishing Co, New Delhi.	2014
2.	Ballaney.P.L	Theory of Machines	Khanna Publishers, New	2002
			Delhi.	
3.	Bansal.R.K.	Theory of Machines	Laxmi Publications (P) Ltd., New Delhi	2012

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Rao, V and Dukkipati, R.V	Mechanism and Machine Theory	Wiley Eastern Ltd, Second Edition	2005
2.	Malhotra, D.R and Gupta, H.C.	The Theory of Machines	Satya Prakasam, Tech. India Publications.	1989
3.	Gosh, A. and Mallick, A.K.	Theory of Machines and Mechanisms	Affiliated East West Press.	1989
4.	Shigley, J.E. and Uicker, J.J	Theory of Machines and Mechanisms	McGraw-Hill.	1986

17BEAE402 FLUID MECHANICS AND HEAT TRANSFER 3 2 0 4 100

COURSE OBJECTIVES:

- To study the fluid laws
- To make the students conversant on properties and measurements.
- To expose the various fluid flow measuring devices and calculate the flow losses in pipes.
- To impart knowledge on various types of pumps and hydraulic turbines.
- To impart knowledge of the conduction heat transfer mechanisms.
- To learn the principles of convection and radiation.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Estimate the flow properties and pressure head using fundamental laws of fluid mechanics.
- Evaluate the discharge and loss of energy in flow through pipes.
- Analyse the performance of hydraulic pumps and turbines for a given application.
- Apply the heat conduction equation to compute the rate of heat transfer in simple and composite systems.
- Determine the rate of heat transfer in convection mode.
- Determine the rate of heat transfer in radiation mode.

UNIT I BASIC CONCEPTS AND PROPERTIESOF FLUIDS

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by U Tube Manometer manometers.

UNIT II FLIUD KINEMATICS AND DYNAMICS

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net – Bernoulli's equation – applications - Venturi meter, Orifice meter, Pitot tube.

Incompressible Fluid Flow:

Viscous flow - Navier - Stoke's equation - flow through pipes - Darcy - weisback's equation - pipe roughness -friction factor - flow through pipes in series and in parallel - power transmission - Introduction to the concept of Boundary layer flows, boundary layer thickness, boundary layer separation ,drag and lift coefficients.

UNIT III PUMPS AND TURBINES

Impact of Jets-Eulers Equation-Theory of roto-dynamic machines-Velocity Componenet-Centrifugal, reciprocating and Rotary Pumps.

Pelton Wheel-Francis Turbine and Kaplan turbines-Performance curves-governing of turbines

UNIT IV HEAT CONDUCTION

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

UNIT V CONVECTION AND RADIATION

Convective Heat Transfer Coefficients – Boundary Layer Concept –Types of Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes

Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black BodyRadiation –Grey body radiation-Shape Factor Algebra- RadiationShields

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr.R.K.Bansal	A Textbook of Fluid Mechanics and Hydraulics Machines	Laxmi publications (P) Ltd, New Delhi	2010
2.	YunusA.Cengel, John M.Cimbala	Fluid Mechanics – Fundamentals and Applications	McGraw Hill Education	2013
3.	Holman.J.P, Souvik Bhattacharyya	Heat Transfer	McGraw –Hill Education (India) Private Limited	2011

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Victor Lyle Streeter, E. Benjamin Wylie and Keith W.Bedford	Fluid Mechanics	WCB/McGraw-Hill	2003
2.	Frank M.White	Fluid Mechanics	McGraw-Hill Higher Education	2011
3.	Nag.P.K	Heat and Mass Transfer	McGraw –Hill Education (India) Private Limited	2011

17BEAE403 AUTOMOTIVE CHASSIS 3 0 0 3 100

COURSE OBJECTIVES:

- To learn the design procedure of frame and springs.
- To study the design procedure of front axle and steering linkages.
- To provide knowledge on the design of clutches.
- To impart knowledge on the design of three speed and four speed gearboxes.
- To study the design of driveline components.
- To facilitate the understanding of shafts

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Design the frame and springs for automotive.
- Analyse the loads, moments and stresses at different sections of front axle.
- Design a suitable clutch for various engineering applications.
- Design the gearbox for various engineering applications.
- Design the propeller shaft to transmit required torque.
- Design the rear axle shafts

UNIT I INTRODUCTION

Types of chassis layout with reference to engine locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Testing of vehicle frames. UNIT Ised frame body construction: Loads acting on vehicle frame.

UNIT II FRONT AXLEAND STEERING SYSTEM

Types of front axles. Construction details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in - Conditions for true rolling motion of wheels during steering, turning radius, Wheel wobble and shimmy. Ackerman and Davis steering system. Slip angle-Oversteer and Understeer- Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts for conventional and independent suspension system. Power and power assisted steering.

UNIT III DRIVE LINE, REAR AXLE, FINAL DRIVE, AND DIFFERENTIAL

Effect of driving thrust and torque reactions. Hotch-kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity joints. Front wheel drive. Construction of rear axles. Types of loads acting on rear axles. Fully floating Three quarter floating and Semi floating rear axles. Rear axle housing. Construction of different types of axle housings. Multi axled vehicles. Construction details of multi drive axle vehicles. Different types of final drive. Double reduction. Differential principles. Constructional details of differential unit. Non -slip differential. Differential lock - Differential housing.

UNIT IV SUSPENSION SYSTEM

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension – Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

UNIT V BRAKING SYSTEM, WHEELS AND TYRES

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory. Determination of braking torque. Brake actuating systems - Mechanical, Hydraulic and Pneumatic – Detailed study of components. Parking and engine exhaust brakes. Factors influencing brake performance. Power and power assisted brakes.

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Tim Gilles	Automotive Chassis-Brakes,Steering and Suspension	Cengage Learning	2005
2.	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
3.	Reimpell.J, Stoll.H and Betzler.J.W	The Automotive Chassis: Engineering Principles	Elsevier India Pvt Ltd	2013

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Tom Birch	Automotive Braking Systems	Cengage Learning	1999
2.	Tom Birch	Automotive Chassis Systems	Cengage Learning	1999
3.	Tom Birch	Automotive Suspension and Steering Systems	Delmar Cengage Learning	1998
4.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAE Inc	2001
6.	John Peter Whitehead, Donald Bastow and Geoffrey Howard	Car Suspension and Handling	SAE Inc	2014

17BEAE404 AUTOMOTIVE TRANSMISSION 3 0 0 3 100

COURSE OBJECTIVES:

- To enrich the understanding of Clutch and Gear Box
- To introduce Hydrodynamic Drive
- To familiarize the students to understand Planetary Gear Boxes
- To introduce the concepts of Automatic Transmission Applications
- To provide knowledge on Hydrostatic Drive
- To provide knowledge on Electric Drive

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- To learn the detailed study of Clutch and Gear Box
- To learn the detailed study of Hydrodynamic Drive
- To learn the detailed study of Planetary Gear Boxes
- To learn the detailed study of Automatic Transmission Applications
- To learn the detailed study of Hydrostatic Drive
- To learn the detailed study of Electric Drive

UNIT I CLUTCH AND GEAR BOX

Requirements of transmission system. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles. Performance characteristics at different speeds. Different types of gearboxes - operation. Typical problems involving the above principles.

UNIT II HYDRODYNAMIC DRIVE

Fluid coupling - principle of operation, constructional details, torque capacity, performance characteristics, reduction of drag torque. Torque converter - Principle of operation, constructional details, performance characteristics, converter coupling, multistage and poly phase torque converters.

UNIT III SPECIAL TYPES OF GEARBOXES

Ford –T model gearbox, Wilson gearbox, Cotal electromagnetic transmission, Automatic over drive,

UNIT IV AUTOMATIC TRANSMISSION APPLICATIONS

Chevrolet Turbo glide transmission, Toyota “ECT-i” Power glides Transmission (Automatic Transmission with Intelligent Electronic control system), Mercedes Benz Automatic transmission, Hydraulic actuation system for automatic transmission system.

UNIT V HYDROSTATIC AND ELECTRIC DRIVES

Hydrostatic drive – principle, types, advantage and limitations. Comparison of hydrostatic drive with hydrodynamic drive. Construction and working of typical Janny hydrostatic drive.

Electric drive - Principle of early and modified Ward Leonard Control system. Advantage & limitations. Performance characteristics.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	N.Newton, W. Steeds and Garrett.T.K	The Motor vehicle, 13th edition	SAEInc	2001
2.	Heinz Heisler	Advanced Vehicle Technology	Butterworth Heinemann Publishers	2004
3	P.M Heldt	Automotive Chassis	P. M. Heldt 1945(45) Nyack, NY	1945

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Arthur William Judge	Modern Transmission systems	Massachusetts Robert Bentley Inc	1969
2.	Wlliam H. Crouse, Donald L.Anglin	Automotive Transmission and Power Trains construction	McGraw Hill.	1976

17BEAE405 AUTOMOTIVE EMISSIONS AND NVH CONTROL 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on the mechanism of pollutant formation in engines.
- To understand the importance of post-combustion treatments to control pollution.
- To study the pollution treatment and control techniques.
- To provide knowledge on the laws and regulations related to automotive emission levels.
- To introduce properties of tyres affecting vibration and noise
- To learn the noise and vibration control techniques.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the mechanism of pollutant formation in engines.
- Apply the knowledge of post-combustion treatments to control pollution.
- Discuss the control techniques and instrumentation for pollution measurements.
- State the laws and regulations related to automotive emission levels.
- Discuss the properties of tyres affecting vibration and noise
- Design the systems to reduce noise and vibration.

UNIT I MECHANISM OF POLLUTANT FORMATION AND POST COMBUSTION TREATMENTS

Introduction, Pollutants, sources, formation of HC and CO in SI engines, NOx formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on emission formation.

Post combustion treatments**:** physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers

UNIT II CONTROL TECHNIQUES AND INSTRUMENTATION FOR POLLUTION MEASUREMENTS

Crank case emission control, fuel evaporation & control, EGR, intake temp control, air injected exhaust, thermal reactors, SCR, catalytic converters – types, catalytic mechanism, tuning of mechanical systems - A/F ratio control. NDIR analyzer, flame ionization detectors, chemiliuminescent analyzer, smoke meters, gas chromatograph, On-board Diagonostic system.

UNIT IIILAWSAND REGULATIONS

Historical background, regulatory test procedures (European cycles), exhaust gas pollutants (European railroad limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Indian Emission Standards.

UNIT IV NOISE CONTROL

Identification of noise sources, quantification, control of air borne noise - use of noise absorber, barrier, different materials, criteria for the selection of materials, control of structure borne noise

- treatments for vibration damping materials for hood liner and head liner, resonance and ill effects of resonance. Characteristics of vehicle noise, sources of vehicle noise, engine noise, techniques for locating and measuring engine noise, engine noise control techniques, inlet and exhaust noise mechanism and control, noise from cooling system, transmission noise and tyre noise. Anechoi chamber.

UNIT V VIBRATION CONTROL

Introduction, vibration analysis, sources of vibration, damping of vibration, rubber mountings, vibration isolation and absorption. Constrained and extensive layer dampings. Engine and drivetrain vibrations, vehicle and chassis vibration. Application of plastics and composites in automobiles. Properties of tyres affecting vibration and noise

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Springer and Patterson	Engine Emission	Plenum Press.	1990
2.	Crouse.W.M and Anglin.A.L	Automotive emission control	McGraw Hill Co., New York	1993
3.	John B. Heywood	Internal Combustion Engine Fundamentals	McGraw Hill International Editions	2011
4.	Matthew Harrison	Vehicle Refinement – Controlling Noise and Vibration in Road Vehicles	Elsevier Butterworth-Heinemann, Burlington	2004

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ganesan.V	Internal Combustion Engines, 4th Edition	Tata McGraw Hill Co, New Delhi	2012
2.	Obert.E.F	Internal Combustion Engines	Harper and Row, New York	2000
3.	Heinz Heisler	Advanced Engine Technology	SAE	2002
4.	Robert Hickling and Mounir M. Kamal	Engine Noise – Excitation, Vibration and Radiation	Plenum press, New York	1982
5.	White.R.G and Walker.J.G	Noise and Vibration	Ellis Horwood Ltd, England	2000

17BEAE406	AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS	3 0 0 3 100

COURSE OBJECTIVES:

- To expose the different types of batteries and ignition systems.
- To provide knowledge on the working of starting system and charging system.
- To provide knowledge on automobile wiring system.
- To learn the automobile lighting system.
- To study the various sensors and actuators used in the automobile.
- To impart knowledge on the electronic engine management system.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Sketch and explain the working principle of battery and ignition system.
- Discuss working of the starting system and charging system.
- Illustrate the automobile wiring system.
- Illustrate the automobile lighting system.
- Identify the sensors and actuators used in the automobile.
- Explain the electronic engine management system.

UNIT I BATTERIES

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging.

UNIT II IGNITION AND STARTING SYSTEMS

Types of ignition systems and its working battery coil, magneto and electronic ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs. Dependence of ignition timing on load and speed- Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

UNIT III CHARGING SYSTEM

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

UNIT IV LIGHTING SYSTEM ANDDASHBOARDEQUIPMENTS

Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator-Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments,

onboard diagnostic system, security and warning system.

UNIT V SENSORS AND ACTUATORS

Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2.	William B.Riddens	Understanding Automotive Electronics, 5th Edition	Butterworth Heinemann Woburn	1988

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bechhold	Understanding Automotive Electronics	SAE.	1998
2.	Crouse.W.H	Automobile Electrical Equipment, 3rd Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	Judge.A.W	Modern Electrical Equipment of Automobiles	Chapman & Hall, London	1992
4.	Kholi.P.L	Automotive Electrical Equipment	Tata McGraw-Hill Co Ltd., New Delhi	1975
5.	Robert Bosch	Automotive Hand Book, 5th Edition	SAE.	2000
6.	Ganesan.V	Internal Combustion Engines 4th Edition	Tata McGraw-Hill Publishing Co., New Delhi	2012

17BEAE411 AUTOMOTIVE CHASSIS AND TRANSMISSION LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

- To expose the different types of Clutch, Gear Box, Brake system.
- To provide knowledge on Differential Unit
- To provide knowledge on Propeller Shaft Unit.
- To learn the Clutch, Gear Box, Brake system, Differential Unit
- To study the suspension system.
- To impart knowledge on different Frames.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Dismantling procedure of Clutch, Gear Box, Brake system
- Dismantling procedure of Differential Unit
- Study of Propeller Shaft Unit
- Assembling procedure of Clutch, Gear Box, Brake system, Differential Unit
- Study of suspension system
- Study of different Frames

LIST OF EXPERIMENTS

1. Dismantling and assembling of clutch assembly with play adjustment
2. Dismantling and assembling of gear box assembly
3. Dismantling and assembling of propeller shaft and universal joint assembly
4. Dismantling and assembling of drive shaft assembly
5. Dismantling and assembling of differential assembly
6. Dismantling and assembling of different types of rear axle floating
7. Dismantling and assembling of steering box assembly
8. Dismantling and assembling of suspension system
9. Dismantling and assembling of air-braking system
10. Dismantling, bleeding, play adjustment and assembling of hydraulic braking system.
11. Study of Frames used for HMV, LMV, Car and Two Wheelers

17BEAE412 SCIENTIFIC COMPUTING LABORATORY 2 0 2 3

Course Objectives:

- To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
- To implement the methods using the spread sheet in Excel
- To implement solution of numerical integration
- To implement solution of initial value problems governed by ODE
- To implement solution of BVP governed by PDE
- To implement solution of transcendental equation.

Course Outcomes:

1. To develop analytical skills for solving different engineering problems.
2. To understand the concepts of Matrices, sequences and series.
3. To solve problems by applying Differential Calculus and Differential equations.
4. To analysis initial value problems governed by ODE
5. To analysis BVP governed by PDE
6. To analysis transcendental equation.

LIST OF EXPERIMENTS

1. Solution of Transcendental equation
   - i) Newton – Raphson Method
   - ii) Bisection method
   - iii) Iterative method by reducing the equation to the form x= f(x)
2. Solution of algebraic simultaneous equations
   - i) Gauss Jacobi method
   - ii) Gauss Seidel method
3. Numerical integration
   - i) Gauss 2 point and 3 point formulae
   - ii) Trapezoidal method
   - iii) Simpson‟s 1/3 rule
4. Solution of initial value problems governed by ODE
   - i) Runge - Kutta 4^{th} order method
   - ii) Modified Euler‟s method
   - iii) Milne‟s method
   - iv) Adam – Bashforth method
5. Solution of BVP governed by PDE
   - i) Laplace Equation
   - ii) One – dimensional heat equation
     - a) Explicit method : Bender – Schmidt‟s method
     - b) Implicit method : Crank - Nicolson‟s method
   - iii) One dimensional wave equation
     Implicit method

REFERENCES:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Steven C. Chapra, Raymond P. Canale	Numerical Methods for Engineers	McGraw - Hill Pub. Co. Ltd	2014
2	Curtis F. Gerald and Patrick O. Wheatley	Applied Numerical Analysis	Pearson Education, South Asia	2009

17BEAE413 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

0 0 3 2 100

COURSE OBJECTIVES:

- To expose the different types of batteries, starting motors and generators
- To provide knowledge on ignition system
- To provide knowledge on electrical wiring.
- To learn the rectifiers, filters, logic gates, adder, flip-flops, SCR and IC timer
- To study the microcontrollers.
- To impart knowledge on automotive lighting system.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Understand different types of batteries, starting motors and generators
- Describe the ignition system
- Study of electrical wiring.
- Study of rectifiers, filters, logic gates, adder, flip-flops, SCR and IC timer
- Obtain knowledge on microcontrollers
- Obtain knowledge on automotive lighting system

List of Experiments:

A. Electrical Laboratory

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of alternators
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

B. Electronics Laboratory

6. Study of rectifiers, filters, logic gates, adder, flip-flops, SCR and IC timer
7. Interfacing A/D converter and simple data acquisition
8. Display and Keyboard interface using microcontroller
9. Interfacing sensors using microcontroller.
10. Stepper motor and DC motor interface using microcontroller.
11. Simulation of automotive lighting system

17BEAE414 COURSE ORIENTED PROJECT-II 1 0 0 1 100

The objective of this project is to provide opportunity for the students to implement their skills acquired and design projects based on courses in fourthcurrent semester

The students in convenient groups of not more than 3 members have to take up a project work in any subject of their choice in the fourth semester. Every project work shall have a guide who is the member of the faculty of the institution.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Identify a problem and develop the solutions.
- Identify, formulate and analyse problems and justify solutions using scientific knowledge.
- Apply technical ideas, strategies and methodologies.
- Design and conduct experiments, as well as analyse and interpret data.
- Familiar with cost-effectiveness analysis.
- Prepare technical report and oral presentations.

17BEAE451 FUELS AND LUBRICANTS 1 0 0 100

COURSE OBJECTIVES:

- To provide knowledge on the theory of lubrication.
- To familiarise the manufacturing process of fuels and lubricants.
- To study the properties of lubricants and fuel.
- Define the various terminologies associated with fuel.
- Explain the manufacture of automotive lubricants
- Explain the Thermo-chemistry of fuels

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the manufacturing process of fuels and lubricants.
- Describe the refining process
- Define the various terminologies associated with fuel.
- Explain the manufacture of automotive lubricants
- Explain the Thermo-chemistry of fuels
- Select the suitable lubrication type for a particular application.

PART I MANUFACTURE OF FUELS AND LUBRICANTS

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

PART II PROPERTIES AND TESTING OF FUELS

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapour pressure, flash point, Fire point, Self Ignition Temperature, Higher calorific value, Lower calorific value, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, etc.

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

17BEAE501 DESIGN OF MACHINE ELEMENTS 3 2 0 4 100

COURSE OBJECTIVES:

- To learn the design procedure of machine elements subjected to simple loads.
- To understand the various types of stresses induced in different machine members.
- To study the design procedure of shafts and couplings.
- To provide knowledge on the design of bolted and welded joints.
- To impart knowledge on the design of helical spring and flywheel.
- To study the selection procedure of sliding and rolling contact bearings.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Design machine elements subjected to simple loads.
- Design shaft for various engineering applications.
- Design couplings for various engineering applications.
- Design bolted and welded joints subjected to static and eccentric loading conditions.
- Design helical spring and flywheel for various engineering applications.
- Design and select journal bearings and rolling contact bearings for various machines.

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – Factor of safety - theories of failure – stress concentration.

UNIT II DESIGN OF SOLID AND HOLLOW SHAFTS

Design of solid and hollow shafts based on strength, rigidity and critical speed. Basic concepts of rigid and flexible couplings.–Introduction and concepts of keys, key ways, Knuckle joints.

UNIT III DESIGN OF BOLTED JOINTS AND WELDED JOINTS

Design of bolted joints including eccentric loading –square threaded screws, Efficiency, Maximum efficiency.. Design of welded joints for structures -Purpose of Screw Jack, Introduction to fasteners.

UNIT IV DESIGN OF SPUR GEARS.

Design of energy storing elements- springs and flywheels.

UNIT V DESIGN OF BEARINGS

Introduction to bearings – sliding contact and rolling contact types. – Cubic mean load – Design of Journal bearings – McKee‟s equation – Lubrication in journal bearings – calculation of bearing dimensions.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Juvinall.R.C and Marshek K.M	Fundamentals of Machine Component Design, 5th Edition	John Wiley & Sons.	2011
2.	Bhandari.V.B	Design of Machine Elements 3rd Edition	Tata McGraw-Hill Book Co.	2010
3.	Robert L.Mortt	Machine elements in Mechanical Design	Macmillan Publishing Co, London	2017
4.	Shigley and Mischke	Mechanical Engineering Design	McGraw Hill, New York.	2008

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Norton.RL	Design of Machinery	Tata McGraw-Hill Book Co., New Delhi	2004
2.	Orthwein .W	Machine Component Design	Jaico Publishing Co., New Delhi.	2006
3.	Ugural .A.C	Mechanical Design – An Integrated Approach	McGraw-Hill Book Co, New York.	2004
4.	Spotts.T.E,Shoup.T.H.E	Design of Machine Elements 8th Edition	Pearson Education, New Delhi.	2003
5.	Maitra.G.M	Handbook of Gear design	Tata McGraw Hill, New Delhi	2004

17BEAE502 **IC ENGINE DESIGN** **3 2 0 4 100**

COURSE OBJECTIVES:

- To learn the design procedure of cylinder and piston.
- To study the design procedure of connecting rod.
- To provide knowledge on the design of crankshaft.
- To impart knowledge on the design of valves and valve actuating components.
- To study the design procedure of timing belt and pulley
- To acquaint the student with the concepts of sprocket and chain.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Design cylinder and piston for the specified power and torque.
- Design connecting rod of an engine.
- Design crankshaft of an engine.
- Design valves and valve actuating components.
- Select suitable timing belt and pulley.
- Select suitable transmission chains and sprockets

UNIT I DESIGN OF CYLINDER AND PISTON

Choice of material for cylinder and piston, piston friction, piston slap, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

UNIT II DESIGN OF CONNECTING ROD, CRANKSHAFT

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft

UNIT III DESIGN OF VALVES AND FLYWHEEL

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel.

UNIT IV DESIGN OF VALVE ACTUATING COMPONENTS

Design of valve springs, tappet. Cam design, cam profile generation, cam shaft design, rocker and rocker shaft design considerations, materials.

UNIT V DESIGN OF BELT, PULLEY, TIMING CHAIN AND SPROCKET

Selection of V belts and pulleys – selection of Flat belts and pulleys - Selection of Transmission chains and Sprockets. Design of pulleys and sprockets

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Jain.R.K	Machine Design	Khanna Publishers, New Delhi.	1997
2	Charles Fayette Taylor	The Internal Combustion engine in Theory and Practice	MIT Press Ltd	2001

REFERENCE BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Heldt.P.M	High Speed Combustion Engines	Oxford-IBH Publishing Co., Calcutta.	1966
2	Kolchin.A and Demidov.V	Design of Automotive Engines	MIR Publishers, Moscow.	1984
3	Sundararaja Murthy T.V.	Machine Design	Khanna Publishers, New Delhi.	1991

DESIGN DATA BOOK:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	PSG College of Technology	Design Data Book	Kalaikathir Achagam, Coimbatore.	1978
2	Karpagam University	IC Engine Design Data Book	Karpagam University	2017

17BEAE503 VEHICLE DYNAMICS 3 0 0 3 100

COURSE OBJECTIVES:

- To study the fundamental concept of vibration of a single degree of freedom system.
- To acquire knowledge on the road vehicle dynamics, stability and handling.
- To develop an understanding of the relationships between vehicle design variables and vehicle dynamic behaviour.
- To apply modelling techniques to predict the dynamic behaviour of road vehicles.
- To introduce the concepts of gradeability, tractive force, braking force and stopping distance
- To provide knowledge on steady state cornering model to design the steering system.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the basic elements of vibration of single degree of freedom system.
- Analyse the cornering and tractive property of a tyre.
- Understand the sources of vibration
- Design and analyse the suspension system of a vehicle.
- Analyse the gradeability, tractive force, braking force and stopping distance of a vehicle.
- Apply steady state cornering model to design the steering system of a vehicle.

UNIT I INTRODUCTION

Fundamental of vibration, Mechanical vibrating systems. Modelling and Simulation - Model of an automobile - Single, two, multi degrees of freedom systems – Free, forced and damped vibrations. Magnification factor - Transmissibility - Vibration absorber.

UNIT II MULTI DEGREE OF FREEDOM SYSTEMS

Closed coupled system - Eigen value problems - Far coupled Systems - Orthogonality of mode shapes – Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled and branched systems.

UNIT III SUSPENSION AND TYRES

Requirements. Sprung mass frequency. Wheel hop, wheel wobble, wheel shimmy. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and apt directions. Ride characteristics of tyre - Effect of driving and braking torque - Gough's tyre characteristics.

UNIT IV VEHICLE HANDLING

Over steer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.

UNIT V STABILITY OF VEHICLES

Load distribution, Calculation of Tractive effort and reactions for different drives - Stability of a

vehicle on a slope, on a curve and a banked road.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giri .N.K,	Automobile Mechanics 8th Edition	Khanna Publishers,New Delhi.	2013
2.	Rao.J.S and Gupta.K	Theory and Practice of Mechanical Vibrations	Wiley Eastern Ltd. Delhi.	1999
3	Rao Srinivas.V, Dukkipati.J	Textbook of Mechanical Vibrations	PHI	2012
4	Wong.J.Y	Theory of Ground Vehicles	John Wiley & Sons; 4th Edition edition	2008

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Heldt.P.M	Automotive Chassis	Chilton Co., New York	1992
2.	Ellis.J.R	Vehicle Dynamics	Business Books Ltd., London	1991
3.	Giles.J.G	Steering, Suspension and Tyres	llliffe Books Ltd, London	1998
4.	Gillespie.T.D	Fundamental of Vehicle Dynamics	Society of Automotive Engineers, USA	1992

17BEAE504 MANUFACTURING TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on the basic principle and manufacturing methods of components.
- To study the steps involved in the casting process.
- To learn the theory of metal cutting and calculate the forces involved in it.
- To introduce the basic concepts of integrated manufacturing.
- To introduce the basic concepts of grinding process
- To provide an exhaustive knowledge on various generic process and benefits of rapid prototyping techniques.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- List and explain the steps involved in the casting process.
- Understand the theory of metal cutting
- Select the suitable type of machine for machining operations.
- Describe the types of grinding process.
- Select the suitable material handling and storage system for flexible manufacturing systems.
- Select appropriate rapid prototyping process for engineering applications.

UNIT I FOUNDRY AND CASTING

Patterns Moulds-Cupola Furnace-types of moulds. Core making, melting, Processes-shell moulding, investment castings, centrifugal castings, die casting, Casting defects and remedies.

UNIT II THEORY OF METAL CUTTING AND MACHINE TOOLS

Introduction, mechanics of metal cutting, orthogonal and oblique cutting, merchants equation, chip formation, heat generation, cutting fluids, cutting tool life - recent developments and applications (Dry machining and high speed machining).

Cutting tool materials, cutting tool nomenclature, introduction to machine tools, lathe, shaper, planning, milling, drilling-machining time calculation and cost estimation.

UNIT III MANUFACTURE OF COMPONENTS AND SURFACE FINISHING PROCESSES

Production of axis-symmetrical components- shafts. Production of prismatic components-housings, lathe beds, gearboxes, machine columns. Hole production in components using drilling and boring.

Gear manufacturing processes-Gear form machining-generation process and gear hobbing, shaping machines, manufacture of spur, helical, bevel.

Surface finishing processes- Grinding machines, grinding wheel specification, super finishing surface integrity concepts.

UNIT IV INTEGRATED MANUFACTURING SYSTEM

Definition – application – features – types of manufacturing systems – machine tools – computer

control system – DNC systems manufacturing cell Flexible manufacturing systems (FMS) – transfer systems – head changing FMS, Group Technology.

UNIT V RAPID PROTOTYPING

Introduction, FDM- Principle, process parameters, applications, SLS- Types of machines, principles of operation, process parameters, applications. Rapid Tooling- Indirect rapid tooling – silicone rubber tooling, -direct rapid tooling - direct AIM, quick cast process, copper polyamide, rapid tool.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bhattacharya.A	New Technology	IN Publishing, New Delhi	1984
2.	Milton C. Shaw	Metal Cutting Principles	Clarendon Press, Oxford	2005
3.	Singh.D.K	Manufacturing Technology	Pearson Education	2014
4.	Kalpakjian	Manufacturing Engineering and Technology, 3rd Edition	Addison Wesley Publishing Company Inc	2014
5.	Khanna .O.P	Welding Technology	DhanpatRai and Sons, New Delhi.	2012
6.	Duc Pham and Dimov S S	Rapid manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling	Springer	2011

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	HMT	Production Technology	Tata McGraw-Hill Co, New Delhi	2004
2.	James Brown	Advanced Machining Technology Handbook	McGraw Hill Book Company, New York	1998
3.	Pandey.P.C	Modern Machining Processes	Tata McGraw Hill Publications Co. Ltd, New Delhi	2013

17BEAE505A **MECHATRONICS** **3 0 0 3 100**

COURSE OBJECTIVES:

- To introduce the concept and working of sensors used in the mechatronic system.
- To study different types of actuators used in the mechatronic system.
- To provide knowledge on feedback mechanism for improving the reliability of the mechatronic system.
- To impart knowledge on working of microcontroller in the mechatronic system.
- To learn the Programmable Logic Controller (PLC) used in the mechatronic system.
- To expose students to program for PLC

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Select the different types of sensor for various mechatronics applications.
- Identify suitable actuator used in a mechatronic system.
- Design a feedback controller for mechatronic systems.
- Develop a controller using microcontroller for the mechatronic system.
- Describe the PLC
- Write a program for PLC used in the mechatronic systems.

INTRODUCTION

Concept and scope of automation: Socio economic Consideration: Low cost automation. Necessity of Multidisciplinary study – Evolution of Mechatronics – Brief introduction to manufacturing – Principles of Mechatronics.

UNIT I PNEUMATIC AND HYDRAULIC SYSTEMS

Hydraulics and pneumatic power supplies, Direction control valves, Pressure control valve: pressure limiting, pressure relief and pressure sequencing valves, speed control valve, servo valves and servo systems, time delay valves, shuttle valve, Actuators: Single acting and double acting cylinders, Cushion assembly, Rotary actuators, Vane Motor, Pilot operation, Cylinders sequencing and process control.

UNIT II PROGRAMMABLE LOGIC CONTROLLER(PLC)

Function of PLC, Architecture, Components Of PLC, selection of PLC, Ladder Logic Diagram, and Logic Functions: latching, sequencing, counters, shift registers, jumpers, manipulation of data, arithmetic operations. Application of personal computer in control and automation: Data acquisition: ADC, DAC, digital input, digital output, control of DC motor, stepper motor. Solid State Switches, Solenoid, DC/AC Motors, and Stepper Motors.

UNIT III ROBOTICS

Introduction, classification based on geometry, devices, control and path movements, End effectors- types and application: Sensors- types and application, Concept of Robotics/Machine vision, Teach Pendant.

Application: Material transfer, machine loading /unloading, welding, assembly and spray painting operations.

UNIT IV TRANSDUCERS, SENSORS&ACTUATORS

Define Transducer and Sensor - Transduction Principle – Transducer types – Photo emissive, Photoconductive and Photovoltaic Transducers – Thermistors – Thermo devices – Thermocouple – Inductive Transducers – Piezo-electric Transducer- Hall-effect Transducer – Strain-gauge type Transducers.

Sensors: Types – Active or Self-generating and Passive or Modulating types – Pressure Sensing – Variable resister, Variable Inductance, Variable differential transformer, Strain gauge and Piezo-resistive types – Position and Level sensing – Magnetic-variable reluctance, d.c.excited inductive, hall-effect, Reed Switch, Optical & Fibre Optics and Capacitance types – Air Flow Sensing – Hot wire, Flap type and Aneroid Gas Sensing – Exhaust Gas Oxygen Sensor – Knock Sensing.

Actuators: Introduction – Types and application areas – Stepper Motor – Pneumatic actuators – Valves - Hydraulic actuators.

UNIT V MECHATRONIC SYSTEMS

Definition and approach of Mechatronics, Measurement and Control Systems and Mechatronics Approach. Traditional and Mechatronics design, possible Mechatronics design solutions, case studies.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bolton.W	Mechatronics	Pearson Education Asia, New Delhi	2003
2.	Ramesh S. Gaonkar	Microprocessor Architecture, Programming, and Applications with the 8085 6th Edition	Penram International, India	2013

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bradley D.A, Dawson.D, Buru.N.C and Loader.A.J,	Mechatronics	Chapman and Hall, New Delhi	1993
2.	Dan Necsulesu	Mechatronics	Pearson Education Asia, New Delhi.	2002
3.	Lawrence J. Kamm	Understanding Electro – Mechanical Engineering, An Introduction to Mechatronics	Prentice – Hall of India Pvt., Ltd., New Delhi.	2000

4.	Nitaigour Premchand Mahadik	Mechatronics	Tata McGraw-Hill publishing Company Ltd, New Delhi.	2003
5.	Groover.M.P	Industrial Robotics – Technology, Programming and Applications	McGraw-Hill, New Delhi.	2001

17BEAE505B INTELLIGENT VEHICLE TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

- To learn the various advanced driver assistance systems.
- To provide knowledge of the vehicle telematics.
- To impart knowledge on safety and security systems.
- To study the various comfort systems.
- To introduce the adaptive control systems.
- To introduce the concepts of the global positioning systems

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- List and explain the various driver assistant systems.
- Discuss the global positioning systems
- Describe the vehicle telematics and its applications.
- Explain the safety and security systems for automotive.
- Discuss the various comfort systems.
- Explain the adaptive control systems.

UNIT I DRIVER ASSISTANCE SYSTEMS

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, collision avoidance, vehicle status monitoring-Night vision system

UNIT II TELEMATICS

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

UNIT III SAFETY AND SECURITY SYSTEMS

Airbags, seat belt tightening system, collision warning systems, child lock, anti lock braking systems. Anti theft technologies, smart card system, number plate coding.

UNIT IV COMFORT SYSTEMS

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column, power windows-Adaptive lighting system

UNIT V ADAPTIVE CONTROL SYSTEMS

Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut- off technology.-Autonomous vehicles

TEXT BOOKS

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ljubo Vlacic, Michael Saren and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001
2.	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems –Progress in Technology	Automotive Electronics Series,SAE, USA.	1998

REFERENCES

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William B Riddens	Understanding Automotive Electronics, 5th Edition	Butterworth Heinemann Woburn.	1998
2.	Bechhold	Understanding Automotive Electronics	SAE	1998
3.	Robert Bosch	Automotive HandBook, 5th Edition	SAE	2000

17BEAE5E-- PROFESSIONAL ELECTIVE- I 3 0 0 3 100

17BEAE511 THERMAL ENGINEERING LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

- To impart knowledge on the flash point, fire point and viscosity of the fuel.
- To learn the port timing and valve timing diagram of internal combustion engines.
- To study the performance of the internal combustion engine and refrigeration system.
- To understand the thermal conductivity, heat transfer and emissivity.
- To know the effectiveness of heat exchangers.
- To study the coefficient of performance of a refrigeration system

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Measure the flash point, fire point and viscosity of given sample.
- Draw the port timing diagram of two-stroke and valve timing diagram of four-stroke internal combustion engines.
- Evaluate the performance of internal combustion engine and reciprocating air compressor.
- Calculate the coefficient of performance of a refrigeration system.
- Estimate the thermal conductivity of material, heat transfer from surface and emissivity of a grey surface.
- Calculate the effectiveness of a heat exchanger.

List of Experiments:

1. Determination of Viscosity of Oils – Red Wood Viscometer.
2. Determination of Flash Point and Fire Point of fuels
3. Valve timing and port timing diagram
4. Performance test on automotive multi-cylinder CI engines
5. Morse test on multi-cylinder SI engine
6. Thermal conductivity measurement by guarded plate method
7. Natural convection heat transfer from a vertical cylinder
8. Heat transfer from pin-fin (natural & forced convection modes)
9. Determination of emissivity of a grey surface
10. Effectiveness of Parallel/counter flow heat exchanger
11. Determination of COP of a refrigeration system
12. Performance test on single/two stage reciprocating air compressor.

17BEAE512 DYNAMICS ANDMECHATRONICS LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

- To study the working principle of governor and gyroscope.
- To familiarize the students to understand gyroscopic law and gyroscopic couple
- To provide knowledge on the balancing of rotating and reciprocating masses.
- To learn the concept of transverse and torsional vibration.
- To introduce the concept and working of sensors used in the mechatronic systems.
- To impart knowledge on working of microcontroller in the mechatronic systems.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Select the suitable governor for various engineering applications.
- Familiar with gyroscopic law and determine the gyroscopic couple
- Estimate the balancing mass for rotating and reciprocating masses.
- Calculate the natural frequency of transverse and torsional vibration.
- Select the different types of sensor for various mechatronics applications.
- Develop a controller using the microcontroller for mechatronic system.

LIST OF EXPERIMENTS

1. Governors – Determination of sensitivity, effort, etc. for Watt, Porter, Proell, and spring controlled Governors
2. Cam – Determination of jump speed and profile of the cam.
3. Motorized Gyroscope–Verification of laws –Determination of gyroscopic couple.
4. Whirling of shaft–Determination of critical speed of shaft with concentrated loads.
5. Balancing of rotating and reciprocatingmasses.
6. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
7. Vibrating system – spring mass system – Determination of damping co–efficient of single degree of freedom system
8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped moment of inertia.
9. Transverse vibration –free– Beam. Determination of natural frequency and deflection of beam.
10. Design and testing of fluid power circuits tocontrol
    (i) velocity (ii) direction and (iii) force of single and double acting actuators
11. Design of circuits with logic sequence using Electro pneumatic trainer kits.
12. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
13. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.

17BEAE513 COURSE ORIENTED PROJECT-III 1 0 0 1 100

The objective of this project is to provide opportunity for the students to implement their skills acquired and design projects based on courses in the fifth semester

The students in convenient groups of not more than 3 members have to take up a project work in any subject of their choice in the fifth semester. Every project work shall have a guide who is the member of the faculty of the institution.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Identify a problem and develop the solutions.
- Identify, formulate and analyse problems and justify solutions using scientific knowledge.
- Apply technical ideas, strategies and methodologies.
- Design and conduct experiments, as well as analyse and interpret data.
- Familiar with cost-effectiveness analysis.
- Prepare technical report and oral presentations.

17BEAE551 IN-PLANT TRAINING 0 0 0 0 100

Students will undergo industrial training for three weeks during the vacation at the end of IV semester and a report with the training completion certificate from the industry will be subsequently submitted to the department within a week after completion. Viva – Voce exam will be conducted at the end of V semester and 100 marks will be awarded.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Apply theoretical knowledge to practical work situations.
- Become updated with all the modern changes in technological world.
- Learn, practice and acquire the skills necessary
- Acquire knowledge through interaction with professionals
- Prepare report and presentation with effective visual aids
- To deliver effective presentation with clarity

17BEAE552 TECHNICAL PRESENTATION 1 0 0 - 100

COURSE OBJECTIVES:

- To develop self-learning skills of utilizing various technical resources to make a technical presentation.
- To promote technical presentation and communication skills.
- To understand the guidelines to prepare the slides and effectively use it for presentation.
- To promote the ability for interacting and sharing attitude.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Refer and utilise various technical resources available from multiple fields.
- Demonstrate sound technical knowledge on a given topic.
- Learn, practice and acquire the skills necessary
- Use a structured presentation methodology to prepare presentation material and effective visual aids
- Determine and develop personal presentation style
- To deliver effective presentation with clarity

17BEAE601 AUTOMOTIVE CHASSIS DESIGN 3 2 0 4 100

COURSE OBJECTIVES:

- To learn the design procedure of frame and springs.
- To study the design procedure of front axle and steering linkages.
- To provide knowledge on the design of clutches.
- To impart knowledge on the design of three speed and four speed gearboxes.
- To study the design of driveline components.
- To facilitate the understanding of shafts

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Design the frame and springs for automotive.
- Analyse the loads, moments and stresses at different sections of front axle.
- Design a suitable clutch for various engineering applications.
- Design the gearbox for various engineering applications.
- Design the propeller shaft to transmit required torque.
- Design the rear axle shafts

UNIT I INTRODUCTION

Assumptions to be made in designing a vehicle, Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, gradability in different gears, Basics of Automobile Design.

UNIT II VEHICLE MOTION &PERFORMANCE CURVES

Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation. Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different\vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

UNIT – III VEHICLE FRAME AND SUSPENSION

Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

UNIT – IV FRONT AXLEAND STEERING SYSTEMS

Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

UNIT – V FINAL DRIVE AND REAR AXLE

Design of propeller shaft, design details of final drive gearing, design details of full floating,

semi-floating and three quarter floating rear shafts and rear axle housings.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giri.N.K	Automobile Mechanics 8th Edition	Khanna Publishers, New Delhi.	2013
2.	Prabhu.T.J	Design of Transmission Elements	P R Lithographers	2003
3.	Lichty	IC Engines	Kogakusha Co., Limited, Tokyo.	1986
4.	Julien Happian-Smith	An Introduction to Modern Vehicle Design	Butterworth Heinemann Publishers	2000

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giles.J.G	Engine Design	lliffe Books Ltd., London	1968
2.	John Fenton	Gasoline Engine analysis for CAD	MEP, London.	1986
3.	Fred Schaefer and Richard Van Basshuysen	Internal Combustion Engine Handbook-Basic Components, Systems and Perspectives	SAE.	2004
4.	Heldt P M	High Speed Combustion Engines	Oxford IBH Publishing Co., Calcutta	1986

17BEAE602 INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH 3 0 0 3 100

COURSE OBJECTIVES:

- To familiarise the production planning methodologies and layout design.
- To learn the concept of work study.
- To impart knowledge on the basics of linear programming techniques.
- To understand the transportation and assignment models.
- To provide knowledge on the importance of inventory control.
- To provide knowledge on economic order quantity

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Select suitable production planning methodologies, production system and plant layout for the industry.
- Execute an effective work study and ergonomics for better productivity.
- Formulate and select a suitable method to solve the linear programming problem.
- Solve different transportation and assignment-based models.
- Solve the inventory decision-making problem using mathematical modelling.
- Describe the economic order quantity

UNIT I INTRODUCTION

Evolution of industrial engineering, fields and functions of industrial engineering. Methods engineering process charts, motion study, work sampling and work measurement.

UNIT II PRODUCTION PLANNING AND CONTROL

Introduction, objectives, components of PPC, manufacturing systems, plant layout, types of layouts, forecasting, product planning, loading and scheduling, dispatching, production control, material handling principles, case studies.

Human engineering- Ergonomics, design of controls and displays, heating, ventilation, glare, airflow, influence of factory environment on productivity, industrial safety.

Cost analysis - Cost structure of a product-labor, material, overhead. Overhead absorption, machine hour rate, cost computation for simple machined components, learning curve, „Make-or-Buy" decision.

UNIT III LINEAR PROGRAMMING TECHNIQUES

Operations research and decision-making, types of mathematical models and constructing the model. Role of computers in operations research, formulation of linear programming problem, applications and limitations, simplex method, variants in simplex method (analytical and graphical).

UNIT IV DISTRIBUTION METHODS AND ASSIGNMENT MODELS

Vogel"s approximation method, modified distribution method, optimization models, unbalance

and degeneracy in transportation model. Hungarian algorithm, traveling salesman problem, routing problems, processing „n" jobs through two machines and three machines, processing two jobs through „m" machines.

UNIT V INVENTORY CONTROL

Variables in inventory problems, inventory models with penalty, storage and quantity discount, safety stock, inventory models with probability, lead time, demand, multi item deter ministic model.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Frederick S.Hillier and Gerald J.Lieberman	Introduction to Operations Research	Tata McGraw Hill Publishing Company Ltd., New Delhi	2006
2.	Chase R.B, Jacob F.R.E.D and Aquilano N.J	Operations Management for Competitive Advantage, 10th Edition	Tata McGraw Hill, New Delhi	2004
3.	Elwood S. Buffa	Modern Production /Operations Management 8th Edition	Wiley Eastern, New Delhi.	2007
4.	KantiSwarup Gupta P.K and Manmohan	Operations Research	Sultan Chand and Sons, New Delhi.	1995

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Srinath.C	PERT and CPM – Principles and Applications 3rd Edition	East West Press, New Delhi	2001
2.	Dharani Venkatakrishnan.S	Operations Research	Keerthi Publication House, Coimbatore	1991
3.	Kannappan.D, Paranthaman.D, Augustine.A.G	Mechanical Estimating and Costing	Tata mcGraw Hill, (New Delhi :)	2003
4.	Saravanan.R	Manufacturing optimization through intelligent techniques	CRC Press, Florida.	2006

5.	Gupta.P.K and Hira.D.S	Operations Research	S. Chand & Co, New Delhi.	2012
6.	Panneerselvam.R	Production and Operations Management, 2nd Edition	Prentice Hall of India (P) Ltd.	2007

17BEAE603 VEHICLE BODY ENGINEERING AND SAFETY 3 0 0 3 100

COURSE OBJECTIVES:

- To understand the vehicle aerodynamics.
- To impart knowledge on body construction of the car, bus and commercial vehicles.
- To study the body materials, mechanisms and repair.
- To impart knowledge on the safety aspect of bus body
- To introduce the concepts of regulations
- To expose students to material used in bodybuilding, tools used and body repairs

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Distinguish the various aerodynamic forces and moments.
- Explain different aspects of the car body, bus body and commercial vehicle.
- Describe the safety aspect of bus body
- Describe the commercial vehicle bodies
- Explain the regulations.
- Describe the material used in bodybuilding, tools used and body repairs.

UNIT I CAR BODY

Types: Saloon, Convertibles, Limousine, Estate Van, racing and sports car - Driver's seat, Body Mechanisms - window winding, Door lock, seat adjustment. Driver's visibility and tests for visibility. Minimum space requirements and methods of improving space in cars. Safety - safety design, safety equipments. Car body construction.

UNIT II BUS BODY

Types: Mini bus, single and double decker, two level, split level and articulated bus. Bus body layout – Floor height - Engine location - Entrance and exit location - Seating dimensions. Constructional details: Frame construction, Double skin construction -Types of metal section used - Regulations -Conventional and integral type construction.

UNIT III COMMERCIAL VEHICLE

Types: Flat platform, drop side, fixed side, tipper body, tanker body. LCV body types: pickup, van. Dimensions of driver's seat in relation to controls and steering angle -Driver cab design.

UNIT IV VEHICLE AERODYNAMICS AND ERGONOMICS

Objectives -Vehicle drag and types - various types of forces and moments -Effects of forces and moments – Side wind effects -Various body optimization techniques for minimum drag –Wind tunnel testing: Flow visualization techniques, Scale model testing, Component balance to measure forces and moments. Simple problems.

ERGONOMICS: Introduction, seating dimensions, interior ergonomics, ergonomics system

design, seat comfort, suspension seats, split frame seating, back passion reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical packa ge layout, goods vehicle layout.

UNIT V BODY MATERIALS, TRIM AND MECHANISMS

Aluminium alloy sheet, extrusion and casting, stainless steels, alloy steels, Metal Matrix Composites. Structural timbers -properties. Designing in GRP and high strength composites, Thermo plastics, Load bearing plastics, semi-rigid PUR foams and sandwich panel construction. Corrosion, Anticorrosion methods. Selection of paint and painting process -Body trim items. Prototype making and crash test analysis on full scale model

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Powloski.J	Vehicle Body Engineering	Business Boob Ltd.	1989

REFERENCE BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giles.J.C	Body construction and design	Iliffe Boob Butterworth & Co	1971
2.	John Fenton	Vehicle Body layout and analysis	Mechanical Engg Publication Ltd, London	1982
3.	Braithwaite.J.B	Vehicle Body building and drafting	Heinemann Educational Book-I Ltd., London.	1977
4.	Dieter Anselm	The Passenger Car Body	ISBN Number: 0-7680-0708-9, SAE International	2000

17BEAE604 **PRODUCTION PROCESS FOR AUTOMOTIVE COMPONENTS** **3 0 0 3 100**

COURSE OBJECTIVES:

- To impart knowledge on basic principle and production methods of automotive components.
- To learn the surface coating technologies used in the automotive industry.
- To understand the importance of suitable process for the manufacturing automotive components.
- To enrich the understanding of casted and forged engine components
- To know the application of the emission control system
- To expose students to the stretch forming of auto body panels

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Select the materials for the components based on its functionality.
- Analyse suitable process for the manufacturing automotive components.
- List the casted and forged engine components.
- Select suitable surface coating technologies for the components.
- Describe the emission control system
- Explain the stretch forming of auto body panels.

UNIT I FORMING PROCESS

Forging - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft ,propeller shaft, foot brake linkage, steering knuckles, Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins. Hydro forming: Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing. Stretch forming - Process,

UNIT II CASTING, MACHINING AND GEAR MANUFACTURING

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburettor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons -Hobbing and shaping - Gear finishing and inspection.

UNIT III POWDER METALLURGY AND RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS

Process flow chart - Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes - Testing and inspection of PM parts.
Powder injection moulding – Shot peen hardening of gears - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming -Squeeze casting of pistons - aluminum composite brake rotors

UNIT IV WELDING & ALLIED PROCESSES

Classification of Welding Processes; Arc Welding- Principle of Arc, Metal Transfer, Arc Characteristics; Working and applications of Carbon Arc Welding, TIG (GTAW), MIG (GMAW), SAW and ESW; Resistance Welding- Gas Welding- Oxy Acetylene and Oxy Hydrogen; Thermit Welding; Solid State Welding Processes; Fusion Welding Pool and Welding Defects, Allied Processes- Brazing and Soldering.

UNIT V UN CONVENTIONAL MACHINING PROCESSES

Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. Electric Discharge Machining (EDM) - Chemical machining and Electro-Chemical machining (CHM and ECM) Laser Beam machining (LBM), plasma Arc machining (PAM) and Electron Beam Machining - Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Heldt.P.M	High Speed Combustion Engines	Oxford Publishing Co., New York	1990
2.	Philip F.Ostwald and Jairo Munoz	Manufacturing Processes and Systems	John Wiley & Sons, New York	Reprint 2008

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Haslehurst.S.E	Manufacturing Technology	ELBS, London	1990
2.	Rusinoff	Forging and forming of metals	D.B.Taraporevala Sons & Co. Pvt Ltd., Mumbai	1999
3.	Sabroff.A.M	Forging Materials & Processes	Reinhold Book Corporation, New York.	1988
4.	ASTME	High Velocity Forming of Metals	Prentice Hall of India (P) Ltd., New Delhi	1990

16BEAE605 HYBRID VEHICLE TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

- To introduce the working of different configurations of electric vehicles and their components.
- To impart knowledge on modelling of battery.
- To introduce the basic principle and operation of the fuel cell.
- To provide knowledge on the design of electric and hybrid electric vehicles.
- To learn the power electronic converter for battery charging.
- To impart knowledge on energy storage design

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the working of different configurations of electric vehicles.
- Analyse the performance characteristics of the battery.
- State the basic principle of operation of the fuel cell.
- Design series and parallel hybrid electric drive trains.
- Discuss the various charging methods for the battery.
- Discuss the energy storage design.

UNIT I ELECTRIC AND HYBRID ELECTRIC VEHICLES

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains

UNIT II ENERGY STORAGE FOR EV AND HEV

Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super Capacitors.

UNIT III ELECTRIC PROPULSION

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives

UNIT IV DESIGN OF ELECTRIC AND HYBRID ELECTRIC VEHICLES

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS

Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy

storage design

UNIT V POWER ELECTRONIC CONVERTER FOR BATTERY CHARGING

Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z-converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	M. Ehsani, Y. Gao, S. Gay and Ali Emadi,	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	CRC Press	2009
2.	Iqbal Husain	Electric and Hybrid Vehicles: Design Fundamentals	CRC Press	2010

REFERENCE BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Sheldon S. Williamson	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles	Springer	2013
2.	Ron Hodkinson and John Fenton	Light Weight Electric/Hybrid Vehicle Design	Butterworth-Heinemann	2001
1.	Chan.C.C and.Chau.K.T	Modern Electric Vehicle Technology	OXFORD University Press	2001
2.	Chris Mi, M. Abul Masrur, David Wenzhong Gao	Hybrid Electric Vehicles Principles And Applications With Practical Perspectives	Wiley Publication	2011

17BEAE6E-- PROFESSIONAL ELECTIVE- II 3 0 0 3 100

17BEAE611 AUTOMOBILE VEHICLE MAINTENANCE AND RE-CONDITIONING LABORATORY 0 0 3 2 100

COURSE OBJECTIVES:

- To study the garage layout and general procedure for servicing.
- To learn the tuning of gasoline engine.
- To expose students to tuning of diesel engines
- To impart knowledge on fault diagnosis in electrical and electronic ignition systems.
- To provide knowledge on troubleshooting of fuel feed system, charging system, starting system and lighting system.
- To familiarise with adjustment of the headlight beam.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- List the procedure for servicing of an automobile.
- Demonstrate the tuning of gasoline engines.
- Demonstrate the tuning of diesel engines.
- Identify the fault in electrical and electronic ignition systems.
- Analyse and troubleshoot the faults of fuel feed system, charging system, starting system and lighting system.
- Demonstrate the adjustment of the headlight beam.

List of Experiments:

I AUTOMOBILE VEHICLE MAINTENANCE

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different types of tools and instruments, different statements/records required for the repair and maintenance works
3. Minor and major tune up of gasoline and diesel engines
4. Fault diagnosis in electrical and electronic ignition systems
5. Gasoline fuel system, diesel fuel system and rectification
6. Study of faults in the electrical systems such as Head lights, Side of Parking lights, Trafficator lights, Electric horn system, Windscreen wiper system, Starter system and charging system.
7. Study of fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet)
8. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
9. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
10. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
11. Adjustment of head lights beam.

II AUTOMOBILE RE-CONDITIONING

12. Removal and fitting of tire and tube.
14. Cylinder reboring – checking the cylinder bore.
14. Setting the tool and reboring.
15. Valve grinding, valve lapping, setting the valve angle and checking for valve leakage
16. Calibration of fuel injection pump

17. Chassis alignment testing

17BEAE612 MANUFACTURING PROCESSES LABORATORY 0 0 3 2 100

- To facilitate the understanding of lathe machine and its operations.
- To provide practical knowledge on Preparing a flat and contour surface using milling machine.
- To provide practical knowledge on Preparing holes with higher finish by Drilling / Tapping / Reaming.
- To facilitate the understanding of surface and cylindrical grinding operations for surface finish.
- To introduce Surface preparation and etching techniques, heat treatment and metallographic studies.
- To impart knowledge on Forging processes.

COURSE OBJECTIVES:

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Perform various operations on of lathe machine.
- Prepare a flat and contour surface using milling machine.
- Prepare holes with higher finish by Drilling / Tapping / Reaming.
- Perform surface and cylindrical grinding operations for surface finish.
- Prepare Surface preparation and etching techniques, heat treatment and metallographic studies..
- Perform various Forging processes.

List of Experiments:

1. Introduction- lathe machine, plain turning, Step turning & grooving (Including lathe mechanisms, simple problems).
2. Taper turning-compound rest/offset method & Drilling using lathe (Including Drilling feed mechanism, Twist drill nomenclature, and Different types of taper turning operations).
3. External threading-Single start (Including Thread cutting mechanism-simple problems)
4. Eccentric turning-Single axis
5. Shaping-V-Block (Including Shaper quick return mechanism)
6. Grinding-Cylindrical /Surface/Tool & cutter
7. Slotting-Keyways (Including Broaching tool nomenclature and Slotter mechanism)
8. Milling-Polygon /Spur gear (Including Milling mechanism, simple problems)
9. Gear hobbing-Helical gear
10. Drilling, reaming, counter boring
11. Planning/Capstan lathe/Burnishing process (Planner Mechanism, Description of capstan and turret lathe)
12. Surface preparation and etching techniques, heat treatment and metallographic studies.
14. Laboratory experiments in fabrication processes: Spot, MIG, ARC and Gas Welding, Testing of Joints.
14. Basic Forging processes like upsetting, drawing down and forge welding

17BEAE613 **MINI PROJECT** **1 0 0 2 - 100**

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Demonstrate sound technical knowledge of a selected project topic.
- Apply the knowledge of mathematics, science and engineering to solve complex engineering problems.
- Identify, formulate and analyse problems and justify solutions using scientific knowledge.
- Design and conduct experiments
- Analyse and interpret data.
- Prepare technical report and oral presentations.

The mini-project involves the following:

- Preparing a project brief proposal including
- Problem identification
-A statement of system / process specification proposed to be developed (Block diagram / concept tree)
-List of possible solutions including alternative and constraints
-Cost benefit analysis and time line of activities-
-Consolidated report preparation and highlighting the design finalization (based on functional requirements& standards)
- Fabrication,testing & validation of the developed system
- Learning in the Project

17BEAE651 ENGINE AND VEHICLE MANAGEMENT SYSTEMS 1 0 0 - 100

COURSE OBJECTIVES:

- To learn the fundamentals of automotive electronics and the principle of engine management.
- To impart knowledge of Microprocessor architecture
- To learn the fundamentals of the fuel system components
- To impart knowledge of vehicle management systems.
- To introduce vehicle security systems
- To provide an overview of working of various vehicle management systems

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Sketch the layout and explain the working of engine management systems.
- Explain the Microprocessor architecture
- Describe the working of the fuel system components
- Discuss the working of various vehicle management systems.
- Explain the vehicle security systems
- Discuss the working of various vehicle management systems.

PART – I ENGINE MANAGEMENT SYSTEM

Microprocessor architecture-open and closed loop control strategies-PID control-Look up tables-Introduction to modern control strategies like Fuzzy logic and adaptive control-Parameters to be controlled in SI and CI engines and in the other parts of the automobile-Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic-Group and sequential injection techniques. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff-Fuel control maps, open loop control of fuel injection and closed loop lambda control.

PART – II VEHICLE MANAGEMENT SYSTEM

Engine and wheel speed sensor, steering position sensor, tire pressure sensor- brake pressure sensor- steering torque sensor – crash sensor- Electronic control of suspension – Damping control-Cruise control-Vehicle tracking system-On board diagnostics-Collision avoidance-Radar warning system

TEXT BOOK

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William B Ribbens	Understanding Automotive Electronics	SAE Publications	2003

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Robert Bosch	Diesel Engine Management	SAE Publications	2006
2	Robert Bosch	Gasoline Engine Management	SAE Publications	2006

17BECC701 PROFESSIONAL ETHICS, PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3 100

Course Objectives

- To enable the students to create an awareness on Engineering Ethics, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.
- To study ethics in society and realize the responsibilities and rights in the society
- To study advanced philosophical knowledge of the profession of recreation and leisure
- To study synthesis of trends and issues as related to current professional practice
- To evaluation of organizational theories and human resource management principles
- To study the ethical practice and ethical management

Course Outcome

At the end of this course, students will be able to

- Apply ethics in society and realize the responsibilities and rights in the society
- Discuss the ethical issues related to engineering
- Advanced philosophical knowledge of the profession of recreation and leisure
- Synthesis of trends and issues as related to current professional practice
- Evaluation of organizational theories and human resource management principles
- Ethical practice and ethical management

UNIT I ENGINEERING ETHICS

Senses of 'Engineering Ethics' – variety of moral issued – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – Models of Professional Roles – theories about right action – Self–interest – customs and religion – uses of ethical theories.

UNIT II FACTORS OF CHANGES

Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws.Social changes – Meaning and nature – Theories.

UNIT III HISTORICAL DEVELOPMENT, PLANNING, ORGANISING

Definition of Management – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies and Planning Premises– Forecasting – Decision–making – Formal and informal organization – Organization Chart.

UNIT IV DIRECTING AND CONTROLLING

Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment –Process of Communication – System and process of Controlling – Requirements for effective control – Control of Overall Performance – Direct and Preventive Control – Reporting

UNIT V ENTREPRENEURSHIP AND MOTIVATION

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth– Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception T est – Stress management, Entrepreneurship Development Programs – Need, Objectives.

TEXT BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Harold Kooritz and Heinz Weihrich	Essentials of Management	Tata McGraw Hill, New Delhi	2010
2	Khanka S.S	Entrepreneurial Development	S.Chand and Co. Ltd., NewDelhi	2006
3	Mike Martin and Roland Schinzinger	Ethics in Engineering	McGraw–Hill, NewYork	2005

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Tripathy P.C and Reddy P.N	Principles of Management	Tata McGraw Hill, New Delhi	2008
2	Rabindra N Kanungo	Entrepreneurship and innovation	Sage Publications, New Delhi	1998
3	Charles E Harris, and Michael J Rabins	Engineering Ethics – Concepts and Cases	Wadsworth Thompson Learning, New Delhi	2013

WEB REFERENCES

1. http://www.managementstudyguide.com/taylor_fayol.htm
2. http://tutor2u.net/business/gcse/people_motivation_theories.htm
3. http://lfkkb.tripod.com/eng24/gilliganstheory.html
4. http://www.developingeyes.com/five–types–of–entrepreneurs/

17BEAE702 FINITE ELEMENT ANALYSIS 3 2 0 4 100

COURSE OBJECTIVES:

- To impart basic knowledge on the finite element method.
- To provide knowledge on one- and two-dimensional elements.
- To study heat conduction problems using finite element method.
- To present knowledge on the higher order and isoparametric elements.
- To Study and acquire knowledge on numerical methods
- To provide knowledge on Gaussian quadrature method

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Apply the numerical methods to formulate the simple finite element problems.
- Apply the one-dimensional finite element method to solve bar, beam and truss type problems.
- Apply the finite element method for plane stress, plane strain and axisymmetric conditions.
- Determine the temperature distribution of one and two dimensional heat transfer problems using one and two dimensional finite elements.
- Apply the numerical methods to formulate the higher order and isoperimetric problems.
- Apply Gaussian quadrature method.

UNIT I INTRODUCTION

Historical background – Matrix approach – Application to the continuum – Discretization – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

UNIT II ONE DIMENSIONAL PROBLEMS

Finite element modeling – Coordinates and shape functions– Potential energy approach – Galerkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT III TWO DIMENSIONAL CONTINUUM

Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galerkin approach – Stress calculation – Temperature effects

UNIT IV AXISYMMETRIC CONTINUUM

Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs

UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUMS

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

TEXT BOOKS:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rao S.S	The Finite Element Method in Engineering 5th Edition	Butter worth Heinemann imprint, USA	2010
2	Logan D.L	A First course in the Finite Element Method 5th Edition	Cengage Learning, Stamford, USA.	2012

REFERENCES:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Chandrupatla T.R., and Belegundu A.D	Introduction to Finite Elements in Engineering	Pearson Education, Delhi.	2013
2	David V Hutton	Fundamentals of Finite Element Analysis	McGraw–Hill Int. Ed, New York.	2013

17BEAE7E-- PROFESSIONAL ELECTIVE- III 3 0 0 3 100

OPEN ELECTIVE- I 3 0 0 3 100

OPEN ELECTIVE- II 3 0 0 3 100

17BEAE711 AUTO SCANNING AND VEHICLE TESTING LABORATORY

0 0 3 2 100

COURSE OBJECTIVES:

- To introduce knowledge of Computerized engine analyzer.
- To provide knowledge on wheel balancing.
- To impart knowledge on wheel alignment.
- To learn about Head light focusing test.
- To impart knowledge on emission test
- To expose students to Braking distance test and Visibility test

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Analysis of engine using Computerized engine analyzer.
- Perform wheel balancing.
- Perform wheel alignment.
- Understand Head light focusing test
- Perform emission test.
- Perform Braking distance test and Visibility test

List of Experiments:

1. Computerized engine analyzer study and practice;
2. Computerized wheel balancing machine study and practice:
3. Computerized wheel alignment machine study and practice;
4. Head light focusing test;
5. Exhaust emission test of petrol and diesel engine;

Study of NDIR Gas Analyser and FID.

Study of Chemiluminescent NOx analyzer.

Measurement of HC, CO, CO2, O2 using exhaust gas analyzer.

Diesel smoke measurement.

6. Braking distance test and Visibility test.

17BEAE712 COMPUTER AIDED DESIGN ANALYSIS L A B O R A T O R Y 0 0 3 2 100

COURSE OBJECTIVES:

- To introduce knowledge of the FEA software as a tool for analysis.
- To provide knowledge on contact stress analysis using FEA software.
- To impart knowledge on transient analysis using FEA software.
- To learn about temperature distribution for heat conduction using FEA software.
- To impart knowledge on coupled field analysis using FEA software.
- To expose students to analysis of the simple structure using FEA software

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Analysis of piston and connecting rod using FEA software.
- Analysis of bumper using FEA software.
- Analysis of leaf spring using FEA software.
- Analysis of composite structure using FEA software
- Find the temperature distribution for heat conduction using FEA software.
- Dynamic analysis of the simple structure using FEA software.

List of Experiments:

1. Transient analysis of connecting rod.
2. Crash analysis of bumper.
3. Thermal analysis of piston.
4. Contact stress analysis of leaf spring.
5. Coupled field analysis of brake shoes.
6. Study of Combustion analysis.
7. Study of Aerodynamic analysis.
8. Contact stress analysis of gear pair.
9. Stress analysis of composite structure.
10. Vibration analysis of quarter car model.

17BEAE791 PROJECT WORK PHASE-I 0 0 4 2 100

- Identification of a real life problem in thrustareas
- Developing a mathematical model for solving the above problem
- Finalization of system requirements andspecification
- Proposing different solutions for the problems based on literature survey
- Future trends in providing alternatesolutions
- Consolidated report preparation ofthe above

17BEAE751 **INDUSTRIAL ROBOTICS** **1 0 0 -100**

COURSE OBJECTIVES:

- To learn the construction and fundamentals of robots.
- To expose students to the various sensors
- To provide knowledge on types of drives and end effectors in robots.
- To impart knowledge on sensors and machine vision system.
- To provide knowledge on the applications of robots in industries.
- To provide knowledge on economic analysis of robots

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Identify the components and construction of robot manipulator.
- Understand the sensors
- Select a suitable drive and an end effect for industrial robots.
- Choose sensors and machine vision system for industrial robots.
- Discuss the usage and applications of robots in industries.
- Understand the economic analysis of robots

PART – I FUNDAMENTALS OF ROBOT

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications. Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features. End Effectors – Grippers. Requirements of a sensor, Principles and Applications of sensors – Position of sensors, Proximity Sensors, Touch Sensors - Camera, Frame Grabber, Sensing and Digitizing Image.

PART – II ROBOT CELL DESIGN

Robot cell design – simulation software (Robo Wave). Robot cell layouts – Multiple robots and machine interference – robot cell planning – robot cycle time analysis for assembly, welding and painting shop. Safety Considerations for Robot Operations, Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TEXT BOOK

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION

1.	Groover.M.P	Industrial Robotics – Technology, Programming and Applications	McGraw-Hill	2011

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Richard D Klafter, Thomas Achmielewski and MickaelNegin	Robotic Engineering – An integrated Approach	Prentice Hall India, New Delhi	2001

17BEAE801 TOTAL QUALITY MANAGEMENT 3 0 0 3 100

COURSE OBJECTIVES:

- To learn concepts, dimension quality and philosophies of TQM.
- To study the TQM principles and its strategies.
- To expose the seven statistical quality and management tools.
- To impart knowledge on TQM tools for continuous improvement.
- To introduce the quality systems and procedures adopted.
- To acquaint the student with the concepts of quality management system

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Use the concepts, dimension of quality and philosophies of TQM.
- Apply the principles of TQM and its strategies in industries.
- Apply the statistical quality tools and seven management tools.
- Choose suitable TQM tools for continuous improvement.
- Understand the Failure Modes and Effects Analysis
- Use the concepts of quality management system in industries.

UNIT I INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

TEXT BOOK

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dale H.Besterfiled	Total Quality Management	Pearson Education, Inc.	2011

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	James R.Evans and William M.Lindsay	The Management and Control of Quality	South Western College	2010
2.	Feigenbaum.A.V,	Total Quality Control	McGraw-Hill Professional	2009
3.	Oakland.J.S	Total Quality Management and Operational Excellence	Routledge	2014
4.	Narayana.V and Sreenivasan.N.S	Quality Management – Concepts and Tasks	New Age International Ltd., New Delhi.	1996

17BEAE8E-- PROFESSIONAL ELECTIVE- IV 3 0 0 3 100

17BEAE891 PROJECT WORK PHASE-II AND VIVA- VOCE ----------24 12 300

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Demonstrate sound technical knowledge of the project topic.
- Apply the knowledge of mathematics, science and engineering to solve complex engineering problems.
- Identify, formulate and analyse problems and justify solutions using scientific knowledge.
- Design and conduct experiments, as well as analyse and interpret data.
- Execute the project based on the design developed during phase - I.
- Prepare technical report and oral presentations.

17BEAE5E01 DESIGN FOR MANUFACTURE AND ASSEMBLY 3 0 0 3 100

COURSE OBJECTIVES:

- To introduce the way of specifying dimension and tolerance in engineering drawing by using geometric dimensioning and tolerancing.
- To indicate the design considerations while casting, welding and forming of components.
- To familiarise with the concept and design guidelines for manufacturing parts by different machining processes.
- To study the factors affecting the easy assembly of parts into a final product.
- To impart knowledge on the environmental impact of products manufactured and engineering ways to minimise it
- To Study and acquire knowledge on disassembly, recyclability, remanufacture

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Apply geometric dimensioning and tolerancing techniques in engineering drawing.
- Apply design considerations to minimise the difficulty in fabrication of components by casting, welding and forming processes.
- Apply design for manufacturing concept to reduce the machining time and manufacturing cost.
- Perform the parts assembly of the given component using design for assembly guidelines.
- Design components taking into consideration the environmental impact.
- Describe disassembly, recyclability, remanufacture,

UNIT I DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY

DFM approach, DFM guidelines, standardization, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka - Yoke principle; 6σ concept; design creativity.

Tolerance Analysis: Process capability, process capability metrics, Cp, Cpk , cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

UNIT II SELECTIVE ASSEMBLY

Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples.

Datum Systems: Degrees of freedom, grouped datum systems-different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, grouped datum system with spigot and recess pair and tongue-slot pair, computation of translational and

rotational accuracy, geometric analysis and applications.

UNIT III TRUE POSITION TOLERANCING THEORY

Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.

UNIT IV FORM DESIGN OF CASTINGS AND WELDMENTS

Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – design considerations for plastic component manufacturing.

Tolerance Charting Technique: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining, datum features - functional and manufacturing, component design-machining considerations, redesign for manufacture, examples.

UNIT V LEAN MANUFACTURING

Need for lean concepts, different types of waste, metrics of manufacturing, an overview of value stream mapping- present state map, future state map, evaluation of benefits – Process FMEA, Design FMEA

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Harry Peck,	Designing for Manufacture	Pitman Publications, London	1983
2	Robert Matousek D C Johnson	Engineering Design a Systematic Approach	Blackie and Son Ltd., London.	1974

REFERENCES

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Spotts.M.F	Dimensioning and Tolerance for Quantity Production	Prentice Hall Inc., New Jersey, USA.	1983
2	Oliver R Wade	Tolerance Control in Design and Manufacturing	Industrial Press Inc., New York.	1967

3	James G.Bralla	HandBook of Product Design for Manufacturing	McGraw Hill Publications, New Delhi.	1983

17BEAE5E02 AUTOMOTIVE AERODYNAMICS 3 0 0 3 100

COURSE OBJECTIVES:

- To provide knowledge on the fundamentals of aerodynamics and vehicle body optimisation.
- To introduce the use of wind tunnels in testing the vehicles.
- various aerodynamic shapes of car
- To introduce aerodynamics for design of the vehicle body
- To study the features of characteristics of forces and moments
- To understand the importance computational fluid dynamics analysis

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the importance of aerodynamics for automobiles.
- Apply principles of aerodynamics for design of the vehicle body.
- Analyse the various aerodynamic shapes of car.
- Discuss the characteristics of forces and moments.
- Apply the concept of wind tunnel for the aerodynamic design of automobiles.
- Apply the computational fluid dynamics analysis.

UNIT I INTRODUCTION

Scope - historical development trends - Fundamental of fluid mechanics - Flow phenomenon related to vehicles - External & Internal flow problem - Resistance to vehicle motion - Performance - Fuel consumption and performance - Potential of vehicle aerodynamics.

UNIT II AERODYNAMIC DRAG OF CARS

Cars as a bluff body - Flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - strategies for aerodynamic development - low drag profiles.

UNIT III SHAPE OPTIMIZATION OF CARS

Front end modification - front and rear wind shield angle - Boat tailing - Hatch back, fast back and square back - Dust flow patterns at the rear - Effects of gap configuration - effect of fasteners.

UNIT IV VEHICLE HANDLING

The origin of forces and moments on vehicle - side wind problems - methods to calculate forces and moments- vehicle dynamics under side winds - the effects of forces and moments - Characteristics of forces and moments - Dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.

UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC

Introduction - Principle of wind tunnel technology - Limitation of simulation - Stress with scale models – full scale wind tunnels - measurement techniques - Equipment and transducers - road testing methods – Numerical methods.

TEXT BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hucho .W.H	Aerodynamic of Road vehicles	Butterworth's Co. Ltd, London.	1997

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Alan Pope William H. Rae Jewel B. Barlow	Low-Speed Wind Tunnel Testing, 3rd Ed	John Wiley & Sons, New York.	1999
2	SAE	Automotive Aerodynamic	Update SP-706, SAE	1987
3	SAE	Vehicle Aerodynamic	SP-1145, SAE.	1996

17BEAE5E03 **CONTROL SYSTEM** **3 0 0 3 100**

Course Objectives

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis
- To introduce Driveline Control System
- To introduce Anti – Lock Braking Control Systems.

Course Outcomes

1. Derive the transfer function of electrical and mechanical systems using various reduction techniques
2. Analyze the response of the control system by investigating steady state error and time domain specifications
3. Construct the root locus to find the stability of the system and explain the effects of different types of controller
4. Construct the frequency response of the system using various plots and correlate the time and frequency domain specifications and effect of compensation
5. Explain the Driveline Control System
6. Explain the Anti – Lock Braking Control Systems

UNIT 1 INTRODUCTION

Control system - Basic elements in control systems - Open and closed Loop - Effect of feedback - System representations - Transfer functions of single input & single output and multivariable systems – Block diagram reduction techniques – Signal flow graphs – Gain formula – Modeling of control components – Mechanical and electrical systems

UNIT-II TRANSFER FUNCTION MODEL AND ANALYSIS

Test signals– Time response of second order system- Time response – Damping ratio - Natural frequency – Effects of adding poles and zeros – Dominant poles - Stability – Routh Hurwitz criterion – Root locus plots of typical systems – Root locus analysis

UNIT-III FREQUENCY DOMAIN ANALYSIS

Polar plots - Magnitude and phase angle curves - Straight line approximation - Corner frequencies - Bode plots - Assessment of stability - Gain margin and phase margin Assessment- Bode plots for automotive suspension.

UNIT-IV DRIVELINE CONTROL SYSTEM

Drive line modeling - Basic drive line equations- Modeling of neutral gear- Stationary and dynamic gear shift equation- Drive line speed control modeling – Transmission torque control criterion – Torque control design. Signal flow graph model for transmission system.

UNIT V ANTI – LOCK BRAKING CONTROL SYSTEMS

Anti-lock braking control systems, control cycles of ABS system - Control of the yaw dynamics-PID for ABS system - Mathematical model for ABS model- vehicle controllability – Vehicle motion characteristics and controllability-Possibility of handling quality evaluation based on driver model – Stability analysis for ABS model.

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Nagrath.J and Gopal.M	Control Systems Engineering	New Age International Publishers Reprint	2008
2	Kiencke and Nielsen	Automotive control systems	Springer /SAE – Verlag Berlin Heidelberg	2007
3	Ogata K	Modern Control Engineering	Pearson/Prentice-Hall of India Pvt Ltd., New Delhi	2008

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Richard C. Dorf and Robert H. Bishop	Modern Control Systems	Pearson Education	2009
2	GalipUlsoy, Huei Peng	Automotive Control Systems	Cambridge University Press, London	2012
3	Wong J.Y	Theory of Ground Vehicles	John Wiley & Sons, New York	2008

17BEAE5E04 TWO AND THREE WHEELER TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

- To impart technical knowledge on construction and working of the power train and drive train of two and three wheeler vehicles.
- To familiarise with maintenance procedures of the engine and subsystems of two and three wheelers.
- To impart knowledge on types of transmission systems
- To impart knowledge on types of steering and suspension systems
- To impart knowledge on types of wheels, tyres and brakes for two and three wheelers
- To make the students conversant on servicing of two and three wheelers.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Construct the frames of two and three wheelers of different layouts.
- Demonstrate the constructional details and principle of operation of various engine components.
- Identify and explain the types of transmission systems.
- Identify and explain the types of steering and suspension systems.
- Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
- Explain the servicing of two and three wheelers.

UNIT I INTRODUCTION

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS

2 stroke and 4 stroke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburetor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III CLUTCHES AND TRANSMISSION

Types of clutches for 2 and 3 wheelers.Design of clutch system.Gears for two and three wheelers.Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, Types of wheels - construction.Function of tyres - Solid and pneumatic Tyres. Constructional details of pneumatic tyres.

UNIT V THREE WHEELERS

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Irving P.E.	Motor Cycle Engineering.	Temple Press Book, London.	1992
2.	Srinivasan.S.	Motor cycle, Scooter, Mobeds.	New century book house.	1988

REFERENCES:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Griffin.M.M	Motor cycles from inside and outside.	Prentice Hall Inc, New Jersey.	1978
2.	Bruce A. Johns, David D.Edmundson and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

17BEAE5E05 OPTIMIZATION FOR ENGINEERING DESIGN 3 0 0 3 100

COURSE OBJECTIVES:

- To formulate design optimization problems for engineering applications.
- To provide knowledge on single variable unconstrained problems.
- To learn multi-objective unconstrained optimization problems.
- To introduce concepts of constrained non-linear optimization problems.
- To interpret non-traditional optimization techniques for engineering problems.
- To study the features of neural network-based optimization

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Formulate design optimization problem from real-world applications.
- Compute the solution for single variable unconstrained optimization problems.
- Determine the solution for multivariable unconstrained optimization problems.
- Find the solution for the constrained non-linear optimization problems.
- Apply non-traditional optimization techniques to solve engineering problems.
- Apply the neural network-based optimization

UNIT I SINGLE VARIABLE OPTIMIZATION ALGORITHM

Introduction - Engineering optimization problems - Optimality criteria - Bracketing methods – Region elimination methods - Point estimation methods - Gradient based methods - Root finding using optimization techniques - Computer Programmes.

UNIT II MULTI VARIABLE OPTIMIZATION ALGORITHM

Optimality criteria - Unidirectional search - Direct search methods - gradient based methods – Computer programmes.

UNIT III CONSTRAINED OPTIMIZATION ALGORITHMS

Kuhn-Tucker conditions - Transformation methods - sensitivity analysis - Direct search for constrained minization - Unearized search techniques method - Gradient projection method - Computer programmes

UNIT IV SPECIALIZED ALGORITHMS

Integer programming - Geometric programming

UNIT V NON TRADITIONAL OPTIMIZATION ALGORITHMS

Genetic algorithms - Simulated annealing - Global optimization - Computer programmes.

TEXT BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Kalyanmoy Deb	Optimization for Engineering Design, 5th print	Prentice Hall of India, New Delhi.	2003

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Taha.H.A	Operations Research	Macmillan, New York.	1986
2.	Rao.S.S	Engineering Optimization: Theory and Practice, 4th Ed	Wiley Eastern, New Delhi.	2009
3.	Murthy.K.G	Linear Programming	Wiley New York.	1987
4.	Reklaitis.G.V, Ravindran.A and Regedit K.M	Engineering optimization methods and applications	Wiley, New York.	2006

17BEAE5E06 AUTOMOTIVE EMBEDDED SYSTEM 3 0 0 3 100

Course Objectives

- To provide a clear understanding of Embedded system terminologies and its devices.
- To introduce Electronics in Automobile
- To introduce the concepts of Drive-By-Wire
- To understand the concept of Hardware Modules
- To Study and acquire knowledge Software Development Tools
- To understand Integration of Hardware And Software

Course Outcomes

At the end of the course the students will be able to

1. Understand of Embedded system terminologies and its devices.
2. Acquire knowledge on Electronics in Automobile.
3. Gain knowledge on Drive-By-Wire
4. Discuss about Hardware Modules
5. Gain knowledge about Software Development Tools.
6. Gain knowledge of Hardware and Software Integration.

UNIT I ELECTRONICS IN AUTOMOBILE

Power train Management – MPFI, GDI & CRDI, ignition systems, body and convenience electronics, vehicle power supply controllers, lighting modules, door control modules, safety anti-lock braking system, electronic stability program, supplementary restraint system, traction control system – 42 V technology.

UNIT II DRIVE-BY-WIRE

Challenges and opportUNIT Ies of X-by-wire system & design requirements, steer-by-wire, brake-by-wire, electronic throttle including adaptive cruise control, shift-by-wire. Semiconductor concepts for X-by-wire systems, Future of automotive electronics.

UNIT III HARDWARE MODULES

16-bit Infineon microcontrollers-architectural overview of C166 family-memory organization, fundamental CPU concepts and optimization measures, on-chip system resources, peripheral event controller (PEC) ad interrupt control, external bus interface, parallel ports, general purpose timers(GPT), watchdog timer, serial channels, capture/compare units, pulse width modulation unit, analog to digital converter, real time clock, on-chip I^2C bus module, on-chip CAN module, universal serial bus (USB) interface, SDLM interface, power management monitoring features, special features of XC166 family.

UNIT IV SOFTWARE DEVELOPMENT TOOLS

Introduction to KEIL integrated development environment (IDE), creating new project, creating new

file, adding files to project, options for target, compile and building project, simulation and debugging, set breakpoints, monitor on-chip peripherals using simulators, study of example programs. Introduction to digital application virtual engineer (DAVE) software, configuring the on-chip resources using DAVE software, automatic code generation using DAVE software.

UNIT V INTEGRATION OF HARDWARE AND SOFTWARE

Introduction to Infineon microcontroller development kit (easy kit), developing project using KEIL software, downloading embedded software into target system, introduction to on-chip debugging resources (JTAG), debugging target system using on-chip debugging support (OCDS).

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ronald K Jurgen	Automotive Electronics Handbook	McGraw Hill	1999
2	Werner Klingenstein& Team	Semiconductors: Technical Information, Technologies and Characteristic Data	Publicis Corporate Publishing	2004
3	LjuboVlacic, Michel Parent &FurnioHarshima	Intelligent Vehicle Technologies: Theory and Applications	Butterworth-Heinemann Publications	2001

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Arnold Berger	Embedded System Design: An Introduction to Processes, Tools, and Techniques	CMP Books	2001
2	David E Simon	An Embedded Software Primer	Pearson Education	2001
3	Wayne Wolf	Computers as Components	Morgan Kaufmann Publishers	2001

17BEAE5E07 FUEL CELL TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

- To address the need and promise of alternative clean energy.
- To introduce the concept of fuel cells for use in automobiles.
- To learn the fuel cell components and their impact on performance.
- To impart knowledge on Alkaline Fuel Cells & Phosphoric Acid Fuel Cells
- To impart knowledge on Solid Oxide Fuel Cells & Molten Carbonate Fuel Cells
- To impart knowledge on Direct Methanol and Proton Exchange Membrane Fuel Cells

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- List the types of fuel cells.
- Explain the thermodynamics and electrochemical kinetics of fuel cells.
- Describe the fuel cell performance characteristics
- Explain the various components of the fuel cell.
- Describe the various types of fuel cells
- Understand the working of various types of fuel cells

UNIT I INTRODUCTION AND THERMODYNAMICS

Introduction: Basic operating principles – Historical highlights – Classification. Thermodynamics: Electrochemical energy conversion – Theoretical efficiency – Electrochemical energy conversion – Factors affecting electrochemical energy conversion

UNIT II ELECTRODE KINETICS

Electrode double layer – Electrolyte double layer – Double layer models (Helmoltz model, Gouy-Chapman Model, Stern model, Grahame model – Bockris, Devenathan and Muller model, and chemical models) – Solid metallic electrode – Semiconductor electrode – Specific adsorption – Zero potential.

UNIT III ALKALINE FUEL CELLS & PHOSPHORIC ACID FUEL CELLS

Alkaline Fuel Cells: Working principle – Components – Modules and stacks – Performance characteristics (power density, space applications, atmospheric pressure cells) – Limitations and R&D challenges – Systemissues – Ammonia as fuel. Phosphoric Acid Fuel Cells: Cell reactions – Electrodes (stability of catalysts, electrode fabrication – fuel cell performance) – Stacks and systems.

UNIT IV SOLID OXIDE FUEL CELLS & MOLTEN CARBONATE FUEL CELLS

Solid Oxide Fuel Cell: Principle of operation - Benefits and limitations – Cell components (electrolytes, zirconia systems, ceria based electrolytes, perovskite-based systems) – Cathode materials – Anode materials –Interconnects – Fuel reactions –Configurations and performance (tubular, monolithic, planar) – Environmental impact – Applications. Molten Carbonate Fuel Cell: General principle – Components (electrolyte and matrix, cathode and anode materials) – Electrode reactions – Life time

UNIT V DIRECT METHANOL AND PROTON EXCHANGE MEMBRANE FUEL CELLS

Direct Methanol Fuel Cells, Operating principle**:** – Noble metal issue – Electro-oxidation of methanol (catalysts, oxygen electro-reduction, electrolyte, non-catalytic aspects) - Methanol crossover – Catalyst optimization – Vapor feed versus liquid feed cells.

Proton Exchange Membrane Fuel Cells: Operating principle (membranes, electrodes and electrolysis, optimization of membrane and electrode assembly,
Impurities) – Technology development (single cell and stacks, composite plates) – Fuel processing – Modeling studies (membrane, electrode, membrane-electrode assembly, fuel cell, stack and system) – Technology development and applications.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Viswanathan.B and Scibioh M. Aulice	Fuel Cells Principles and Applications	Universities Press (India) Pvt. Ltd., Hyderabad.	2006
2.	Hoogers.G	Fuel Cell Technology Handbook	CRC Press, Washington D. C	2003

REFERENCE BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Larminie. J and Dicks. A,	Fuel Cell Systems Explained, 2nd Edition	John Wiley & Sons, Ltd., New York.	2003

17BEAE6E01 ALTERNATE FUELS AND ENERGY SYSTEMS 3 0 0 3 100

COURSE OBJECTIVES:

- To acquire knowledge of alternative fuels and changes in the engine design for handling them.
- To learn the various energy systems for use in the automobiles.
- To equip them with skills to modify the engines
- To make the students conversant of bio fuels
- To make the students conversant of synthetic fuels
- To give exposure to combustion, performance and emission characteristics of engines

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Analyse the thermodynamics of combustion characteristics of alternative fuels.
- Distinguish the various types of alternative fuels based on need and scope.
- Modify the engines according to the type of alternative fuel.
- Explain the bio fuels
- Explain the synthetic fuels
- Analyse the combustion, performance and emission characteristics of engines

UNIT I INTRODUCTION

Estimation of petroleum reserve - Need for alternate fuel - Availability and properties of alternate fuels – general use of alcohols - LPG - Hydrogen - Ammonia, CNG, and LNG - Vegetable oils and Biogas - Merits and demerits of various alternate fuels.

UNIT II ALCOHOLS

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine. Methanol and gasoline blends - Combustion characteristics in engines - emission characteristics.

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS

Availability of CNG, properties, modification required to use in engines - performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG - Hydrogen – Storage and handling, performance and safety aspects.

UNIT IV VEGETABLE OILS

Various vegetable oils for engines - Esterification - Performance in engines - Performance and emission Characteristics

UNIT V ELECTRIC AND SOLAR POWERED VEHICLES

Layout of an electric vehicle - Advantage and limitations - Specifications - System component.Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar

powered vehicles.

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	MaheswarDayal	Energy today & tomorrow	I & B Harish India.	1982
2.	Nagpal.G.K	Power Plant Engineering	Khanna Publishers, New Delhi.	2002
3.	Bechtold.R.L	Alternative Fuels Guide Book	SAE	1997

17BEAE6E02 ADVANCED THEORY OF IC ENGINES 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on advancement in IC engine construction and combustion process.
- To familiarise the combustion modelling.
- To enrich the understanding of advances in IC Engines
- To expose students to performance of the IC engines
- To facilitate the understanding of computer control of engine parameters
- To impart knowledge on performance maps

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the operating cycles of SI engines, CI engines and gas turbines.
- Understand the IC engine combustion processes.
- Analyse the causes of knocking in combustion.
- Apply new techniques to improve the performance of the IC engines.
- Explain the computer control of engine parameters for pollution control
- Explain the performance maps.

UNIT I CYCLE ANALYSIS

Operating cycles of S.I. and C.I. engines and Gas turbines - Comparison of Air standard cycle - Fuel air cycle and actual cycle.

UNIT II COMBUSTION OF FUELS

Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels - Chemical energy and heating values - Chemical equilibrium and maximum temperature - SI engine combustion - Flame velocity and area of flame front - CI engine combustion. Fuel spray characteristics - droplet size, penetration and atomization.

UNIT III COMBUSTION MODELLING

Basic concepts of engine simulation - Governing equation - Flow models, thermodynamic models - SI engine and CI engine models.

UNIT IV ADVANCES IN IC ENGINES

Adiabatic and L.H.R. engines - MAN combustion chamber and multifuel engines - HCCI, VCR Engines and GDI Engines Stratified charged and lean burn engines - Locomotive and marine engines.

UNIT V OPERATION AND PERFORMANCE

Computer control of engine parameters for pollution control and better efficiency - Closed loop control of engine parameters - Hybrid operation - performance maps.

TEXT BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ganesan.V	Internal combustion engines, 4^{th} Edition	Tata McGraw Hill Publishing Co.	2012

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ganesan.V	Computer Simulation of Spark Ignition engine process	Universities Press (India) Ltd, Hyderabad.	1996
2.	John.B.Heywood	Internal Combustion Engine Fundamentals	McGraw Hill Publishing Co., New York.	2011

17BEAE6E03 VIBRATION AND NOISE CONTROL 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on the basics of vibration and noise.
- To understand the importance of single degree and two degrees of freedom vibration systems.
- To equip them with skills to Calculate the total sound pressure level
- To enrich the understanding of frequency analysis
- To understand the sources of vibration and noise.
- To learn the vibration and noise control techniques.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- List and explain the types of vibrations.
- Analyse a single degree and two degrees of freedom vibration systems.
- Calculate the total sound pressure level produced by two sounds of different levels.
- Apply frequency analysis
- Identify the sources of vibration in automobiles.
- Design the systems to reduce vibration and noise.

UNIT I SIMPLIFICATION OF VIBRATION PROBLEMS TO ONE DEGREE OF FREEEDOM

Basic equation of motion for various vibration problems – Torsional, Free, Damped and Forced vibration problems, critical speed, nature of exciting forces, vibration isolation, vibration instruments.

UNIT II TWO AND MULTI-DEGREE OF FREEDOM SYSTEMS

Two degree – Formulation of solution - Coupling between rotating and translation - Applications. Multi degree – Governing equation for closed coupled systems - Lateral vibration, Geared systems - Effect of gyroscopic acceleration.

UNIT III SOLUTION OF VIBRATION PROBLEMS

Approximate methods (or) Numerical methods – Holzer's method, Myklestadt's method, Sturn sequence Energy methods – Rayleigh's Approach – Closed coupled systems. For coupled systems – Dunkerley's method, Rayleigh Ritz method.

UNIT IV DIAGNOSTICS AND FIELD MEASUREMENT

Diagnostic tools - Condition monitoring in real time - Balancing of rotors - Field measurements on various compressors, fans, machine foundation.

UNIT V MACHINERY NOISE AND CONTROL

Basics of noise - Introduction, amplitude, frequency, wavelength and sound - Pressure level, noise dose level - Measurement and analysis of noise. Methods for control of noise - Mechanical noise - Predictive analysis, Sound in enclosures - Sound energy absorption - Sound transmission through barriers.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ramamurthy .V,	Mechanical Vibration Practice with Basic Theory	Narosa Publishing House, Chennai	2000
2	KewelPujara	Vibration and noise for engineers	Dhanpatrai& Sons	1992

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rao .J.S and Gupta. K	Introductory course on theory and practice of mechanical vibrations	Wiley Eastern, New Delhi.	1984
2	Rao.S.S	Mechanical vibrations,3rd Edition	Wesley publishing company, New York	1995
3	Thomson.W.T	Theory of Vibration and its Applications	Prentice Hall, New Delhi	1982

17BEAE6E04 FAILURE ANALYSIS AND DESIGN 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on significance of failure analysis in engineering design.
- To understand failure mechanism.
- To equip them with skills to handle the specific failure component
- To enrich the understanding of detailed root-cause analysis
- To understand the material factors that cause the failure
- To learn the corrective and preventive guidelines.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the significance of failure analysis in engineering design.
- Design and implement an appropriate strategy to handle the specific failure component
- Implement detailed root-cause analysis
- Apply various tools and techniques to identify the failure mechanism
- Describe the various material factors that cause the failure
- Propose appropriate corrective and preventive guidelines

UNIT I MATERIALS AND DESIGN PROCESS

Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, designing for hostile environments, material processing and design, processes and their influence on design, process attributes, systematic process selection, screening, process selection diagrams, ranking, process cost.

UNIT II FRACTURE MECHANICS

Ductile fracture, brittle fracture, Cleavage-fractography, ductile-brittle transition-Fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage

LINEAR ELASTIC FRACTURE MECHANICS: Griffith theory, Energy release rate, instability and R-curve, stress analysis of cracks-stress intensity factor, K-threshold, crack growth instability analysis, crack tip stress analysis.

UNIT III ELASTIC PLASTIC FRACTURE MECHANICS

Crack tip opening displacement (CTOD), J integral, relationship between J and CTOD,dynamic and time-dependent fracture: Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, Creep crack growth-C Integral, Visco elastic fracture mechanics, visco elastic J integral

UNIT IV DETERMINATION OF FRACTURE TOUGHNESS VALUES

Experimental determination of plane strain fracture toughness, K- R curve testing, J measurement, CTOD testing, effect of temperature, strain rate on fracture toughness.

UNIT V FAILURE ANALYSIS TOOLS

Reliability concept and hazard function, life prediction, life extension, application of poisson, exponential and Weibull distribution for reliability, bath tub curve, parallel and series system, MTBF,MTTR, FMEA definition-Design FMEA, Process FMEA , analysis causes of failure, modes, ranks of failure modes, fault tree analysis, industrial case studies/projects on FMEA.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John M. Barsom and Stanley T Rolte	Fracture and Fatigue Control in Structures	Prentice Hall, New Delhi.	1987
2.	ASM Metals Handbook	Failure Analysis and Prevention,10^{th} edition,Vol.10	ASM Metals Park, Ohio, USA.	1995
3.	Michael F. Ashby	Material Selection in Mechanical Design	Butterworth Heinemann.	1999

REFERENCES

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Shigley and Mischke	Mechanical Engineering Design	McGraw Hill.	1992
2.	Mahmoud M.Farag	Material Selection for Engineering Design	Prentice Hall, New Delhi.	1997

Faculty of Mechanical Engineering, PSG College of Technology “Design Data Book”, DPV Printers,1993

17BEAE6E05 COMPUTER AIDED VEHICLE DESIGN 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on significance of CAD.
- To impart knowledge on Vehicle Frame and Suspension
- To acquire the ability in designing of Front Axle and Steering Systems
- To acquire the ability in designing of Clutch
- To provide an overview of drawing of Gear Box
- To provide an overview of Drive Line and Read Axle

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Acquire knowledge on significance of CAD
- Acquire knowledge on Vehicle Frame and Suspension
- Understand designing of Front Axle and Steering Systems
- Understand designing of Clutch
- Acquire knowledge on drawing of Gear Box
- Acquire knowledge on Drive Line and Read Axle

UNIT I VEHICLE FRAME AND SUSPENSION

Study of loads - moments and stresses on frame members. Computer aided design of frame for passenger and commercial vehicle - Computer aided design of leaf springs - Coil springs and torsion bar springs.

UNIT II FRONT AXLEAND STEERING SYSTEMS

Analysis of loads - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of bearings. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

UNIT III CLUTCH

Torque capacity of clutch. Computer aided design of clutch components, Design details of roller and sprag type of clutches.

UNIT IV GEAR BOX

Computer aided design of three speed and four speed gear boxes.

UNIT V DRIVE LINEAND READ AXLE

Computer aided design of propeller shaft. Design details of final drive gearing. Design details of full floating. semi-floating and three quarter floating rear shafts and rear axle housings.

TEXT BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Dan Evans	Automobile Chassis Design	iliffe Books Ltd	1992

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Heldt.P.M,	Automotive Chassis	Chilton Co., New York	1992
2	Steeds.W	Mechanics of Road vehicles	iliffe Books Ltd, London.	1990
3	Newton, Steeds & Garrett	Motor vehicle	iliffe Books Ltd., London.	2001
4	Giri.N.K	Automobile Mechanics 8th Edition	Khanna Publisher, New Delhi.	2008

17BEAE6E06 **QUALITY CONTROL AND RELIABILITY ENGINEERING** **3 0 0 3 100**

COURSE OBJECTIVES:

- To introduce the concept of Statistical Quality Control (SQC).
- To familiarise with various statistical process control methods.
- To study the methods and characteristics of sampling.
- To describe the concept of reliability and its models.
- To impart knowledge on the design of reliability process.
- To describe the concept of product life cycles

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Summarise the concept of quality and process control for variables.
- Apply the process control for attributes.
- Explain the importance of sampling methods and their characteristics.
- Explain the concept of life testing.
- Evaluate the reliability concept with their models.
- Explain the product life cycles

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart.

UNIT II PROCESS CONTROL FOR ATTRIBUTES

Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABLITY

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit

and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note: Use of approved statistical table permitted in the examination.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Grant, Eugene .L	Statistical Quality Control	McGraw-Hill, New Delhi.	1996
2.	Srinath. L.S	Reliability Engineering	Affiliated East west press.	1991

REFERENCES

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Monohar Mahajan	Statistical Quality Control	Dhanpat Rai & Sons, New Delhi.	2001
2.	Besterfield.D.H,	Quality Control	Prentice Hall, New Delhi.	1993
3.	Sharma.S.C	Inspection Quality Control and Reliability	Khanna Publishers, New Delhi.	1998
4.	Connor. P.D.T.O	Practical Reliability Engineering, 4^{th} Edition	John Wiley, London.	2002

17BEAE6E07 COMPUTATIONAL FLUID DYNAMICS 3 0 0 3 100

COURSE OBJECTIVES:

- To introduce governing equations of viscous fluid flows.
- To acquaint the student with the concepts of finite difference and finite volume methods for diffusion.
- To familiarize the students to understand the finite volume method for convective diffusion
- To introduce numerical modelling and its role in the field of fluid flow and heat transfer.
- To provide knowledge on the various discretization methods, solution procedures and turbulence modelling.
- To impart knowledge on use of software tools.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Derive the governing equations and boundary conditions for fluid dynamics.
- Analyse finite difference and finite volume methods for diffusion.
- Analyse finite volume method for convective diffusion.
- Analyse the flow field problems.
- Explain and solve the turbulence models and mesh generation techniques.
- Use software tools.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent flow - Turbulence -Kinetic -Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method.

Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNIT III HEAT CONDUCTION

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

UNIT IV CONVECTION AND DIFFUSION

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion.

UNIT V CALCULATION OF FLOW FIELD

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation (k-ε) models.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Versteeg. H.K and Malalasekera. W	An Introduction to Computational Fluid Dynamics: The Finite Volume Method	Longman	1998
2.	Ghosh dastidar. P. S	Computer Simulation of flow and heat transfer	Tata McGraw-Hill Publishing Company Ltd., New Delhi.	1998

REFERENCES

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Patankar. S.V	Numerical Heat Transfer and Fluid Flow	And- Books2004 Indian Edition, McGraw-Hill, New Delhi.	1980
2.	Muralidhar.K and Sundararajan.T	Computational Fluid Flow and Heat Transfer	Narosa Publishing House, New Delhi.	1995
3.	Bose.D.K,	Numerical Fluid Dynamics	Narosa publishing House,New Delhi.	1997
4.	Muralidhar.K and Biswas	Advanced Engineering Fluid Mechanics	Narosa Publishing House, New Delhi.	1996

17BEAE7E01 VEHICLE TRANSPORT MANAGEMENT 3 0 0 3 100

COURSE OBJECTIVES:

- To study Transport Management
- To understand the concept of Organisation
- To learn about Vehicle Maintenance
- To be aware of the Supply Management and Budget
- To provide knowledge on Scheduling and Fare Structure
- To introduce Motor Vehicle Act

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Acquire in-depth knowledge of Transport Management.
- Analyse concept of Organisation.
- Describe Vehicle Maintenance.
- Knowledge on Supply Management and Budget.
- Knowledge on Scheduling and Fare Structure.
- Awareness on Motor Vehicle Act

UNIT I ORGANISATION AND MANAGEMENT

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety.Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

UNIT II VEHICLE MAINTENACE

Scheduled and unscheduled maintenance - Planning and scope - Evaluation of PMIprogramme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options.

UNIT III VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems – Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses - Fleet management and data processing - Data processing systems - Software. Model - Computer controlling offleet activity - Energy management.

UNIT IV SCHEDULING AND FARE STRUCTURE

Route planning - Scheduling of transport vehicles - Preparation of timetable – preparation of vehicle and crew schedule - Costs, fare structure – Fare concessions - Methods of fare collection - Preparation of fare table.

UNIT V MOTOR VEHICLE ACT

Schedules and sections - Registration of motor vehicles - Licensing of drivers and conductors - Control of permits - Limits of speed - traffic signs - Constructional regulations - Description of goods carrier, delivery van, tanker, tipper, municipal, fire fighting and break down service vehicle.

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John Dolu	Fleet Management	McGraw-Hill Co.	1984
2.	Rex W. Faulks	Bus and Coach Operation	Butterworth.	1987
3.	Kitchin L.T.D	Bus operation, 3rd Edition	iliffe and Sons Ltd., London.	1992

17BEAE7E02 **LEAN MANUFACTURING** **3 0 0 3 100**

COURSE OBJECTIVES:

- To acquire the general knowledge to deliver consistently high quality and value added products and services to the customer in a lean environment.
- To understand the terminology relating to lean operations in both service and manufacturing organizations.
- To impart knowledge on principles of lean manufacturing on the shop floor
- To enrich the understanding of just in time concept
- To expose students to concepts of visual management, 5Sand total productive maintenance
- To expose students to Jidoka principle

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Summarise the quality requirements to provide products and services in a lean environment.
- Apply the principles of lean manufacturing on the shop floor.
- Explain the just in time
- Explain the concepts of visual management, 5Sand total productive maintenance.
- Examine the Jidoka principle.
- Illustrate the culture of lean management.

UNIT I INTRODUCTION

Objectives of lean manufacturing-key principles and implications of lean manufacturing- Traditional Vs lean manufacturing – Lean benefits. Lean Manufacturing Concepts: Value creation and waste elimination- Major kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement / Kaizen- Worker involvement.

UNIT II GROUP TECHNOLOGY

Part family- Production flow analysis – Composite part concept – Machine cell design-Case studies.

UNIT III LEAN MANUFACTURING TOOLS & METHODOLOGIES

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventive maintenance-total quality management-total productive maintenance-changeover/setup time -batch size reduction.

UNIT IV VALUE STREAM MAPPING

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -poke yoka-Kanban – overall equipment effectiveness.

UNIT V JIT AND LEAN MANUFACTURING

Just In Time Manufacturing: Introduction - elements of JIT - Kanban system. Implementing Lean - Road map-senior management Involvement-best practices. Reconciling Lean With Other Systems: Toyota production system-lean six sigma-lean and ERP-lean with ISO9001: 2000

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Michael L.George, David T.Rowlands and Bill Kastle	What is Lean Six Sigma	McGraw-Hill, New York.	2004
2.	Askin R.G and Goldberg J.B	Design and Analysis of Lean Production Systems	John Wiley and Sons Inc.	2001
3.	Michael Wader	Lean Tools: A Pocket guide to Implementing Lean Practices	Productivity and Quality Publishing Pvt Ltd., New Delhi.	2002

REFERENCES

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Joseph D.E. Feo, William W Barnard	Juran Institute's Six Sigma Break Through and Beyond	Tata McGraw-Hill Edition, New Delhi	2004
2.	Richard B. Chase, Robert Jacobs F and Nicholas J Aquilano	Operation Management for Competitive Advantage, Tenth Edition.	McGraw- Hill.	2003
3.	Poka - Yoke	Improving Product Qualit Preventing Defects	Productivity Press.	1992
4.	Alan Robinson	Continuous Improvement Operations	Productivity Press, Portland, Oregon.	1991

17BEAE7E03 SUPPLY CHAIN MANAGEMENT 3 0 0 3 100

COURSE OBJECTIVES:

1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies
2. To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
3. To explain basics of SCM and logistics
4. To impart knowledge, need for inventory management
5. To expose students to value of information in SCM
6. To understand the concept of information technology involved in SCM

COURSE OUTCOMES

On completion of this course, students will learn about

1. Basics of SCM .
2. Understand the need for inventory management
3. Apply the need for value of information in SCM
4. Describe about the various strategic alliances
5. Explain about the various issues in the international SCM
6. Get knowledge in information technology involved in SCM

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

Definition, global optimization, objectives of SCM.Logistics networks- data collection, model and data elevation, solution techniques.

UNIT II INVENTORY MANAGEMENT

Introduction, single warehouse, Inventory examples, economic lot size model, effect of demand uncertainty. Risk pooling, centralized and decentralized system, managing inventory in the supply chain, forecasting.

UNIT III VALUE OF INFORMATION

Bullwhip effect, information and supply chain technology. Supply chain integration- push, pull and push-pull system. Demand driven strategies, impact of internet on SCM, distribution strategies.

UNIT IV STRATEGIC ALLIANCES

Framework for strategic alliance, third party logistics, retailer, supplies partnership, distributor-integration, procurement and out servicing strategies.

UNIT V INTERNATIONAL ISSUES IN SCM

Introduction, risks and advantages- design for logistics, supplies integration into to new product development, mass customization. Issues in customer value.Information Technology for SCM: Goals, standardization, infrastructure, DSS for supply chain management.

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Simchi – Levi David, Kaminsky Philip and Simchi-Levi Edith,	Designing and Managing the Supply Chain, 3rd Edition	Tata McGraw- Hill Publishing Company Ltd, New Delhi.	2007
2.	Sunil Chopra and Peter Meindl,	Supply Chain Management – Strategy, Planning and Operation, 3rdEdition	Prentice Hall, New Delhi	2006

17BEAE7E04 MODERN VEHICLE TECHNOLOGY 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge on trends in the vehicle power plants.
- To learn the various advanced driver assistance systems.
- To study the working of advanced suspension and braking systems in an automobile.
- To give information about motor vehicle emission and noise pollution control.
- To provide knowledge of the vehicle telematics.
- To give information about the noise control techniques

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Distinguish and describe the various modern vehicle power plant systems.
- List and explain the various driver assistant mechanisms.
- Identify and describe the working of advanced suspension and braking systems.
- Apply the knowledge of motor vehicle emission and noise pollution control.
- Describe the noise control techniques
- Describe the vehicle telematics and its applications.

UNIT I TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

UNIT II SUSPENSION BRAKES AND SAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

UNIT III NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNIT IV VEHICLE OPERATION AND CONTROL

Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT V VEHICLE AUTOMATED TRACKS

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Beranek.L.L	.Noise Reduction	McGraw-Hill Book Co., Inc, New York	1993
2	SAE	Bosch Hand book	3rd Edition, SAE	1993

17BEAE7E05 PROCESS PLANNING AND COST ESTIMATION 3 0 0 3 100

COURSE OBJECTIVES:

- To introduce the process planning concepts.
- To impart importance of the cost estimation process and procedures.
- To study the procedure to calculate direct, indirect and overhead expenses.
- To facilitate the understanding of the production cost of forging, welding, and foundry.
- To learn the procedure to estimate the various machining costs.
- To acquire the procedure to estimate the machining time for lathe, drilling, boring, shaping, milling and grinding operations.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the concepts of process planning and cost estimation.
- Assess the importance of cost estimation process and its procedures.
- Compute direct, indirect and overhead expenses.
- Determine the production cost of forging, welding, and foundry.
- Calculate the machining time for lathe, drilling, boring and shaping operations.
- Calculate the machining time for milling and grinding operations.

UNIT I PROCESS PLANNING

Process Planning, selection and analysis – Manual, Experience based planning – CAPP, Variant, Generative - Processes analysis – Types of Production.

UNIT II COSTING, ESTIMATION, COSTS AND EXPENSES

Aims of costing and Estimation – Functions and Procedure – Introduction to Costs, Computing Material cost, Direct Labor cost, Analysis of Overhead costs, Factory expenses, Administrative expenses, Selling and Distributing expenses – Cost Ladder - Cost of Product - Depreciation – Analysis of Depreciation.

UNIT III ESITMATION OF COSTS IN DIFFERENT SHOPS

Estimation in Foundry shop – Pattern cost, Casting cost - Illustrative examples. Estimation in Forging Shop – Losses in forging – Forging cost - Illustrative examples

UNIT IV ESTIMATION OF COSTS IN FABRICATION SHOPS

Estimation in welding shop – Gas cutting – Electric Welding - Illustrative examples. Estimation in sheet metal shop – Shearing and Forming - Illustrative examples

UNIT V ESITMATION OF MACHINING TIMES AND COSTS

Estimation of machining time for lathe operations - Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations - Illustrative examples

TEXT BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Adithan.M.S and Pabla	Estimating and Costing	Konark Publishers vt., Ltd, New Delhi	1989
2	Chitale.A.K and Gupta.R.C	Product Design and Manufacturing	Prentice Hall of India, New Delhi	1997

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Nanua Singh	System Approach to Computer Integrated Design and Manufacturing	John Wiley Inc.	1996
2	Joseph G. Monks	Operations Management Theory and Problems	McGraw Hill Book Company.	1982
3	Narang.G.B.S and Kumar.V	Production and Planning	Khanna Publishers ,New Delhi.	1995
4	Banga.T.R and Sharma.S.C	Estimating and Costing	Khanna publishers,New Delhi.	1986

17BEAE7E06 AUTOMOTIVE AIR CONDITIONING 3 0 0 3 100

COURSE OBJECTIVES:

- To gain knowledge of fundamentals of the automotive air conditioning.
- To study the working of automotive cooling and heating systems.
- To provide knowledge on air conditioning controls, delivery system and refrigerants.
- To impart knowledge on working of automatic temperature control.
- To learn the system servicing and testing.
- To impart knowledge on special tools for servicing

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Apply the psychrometry principles.
- Explain the components of vehicle air conditioning systems.
- Describe the air conditioning controls.
- Select the suitable sensors and actuators for automatic temperature control.
- Discover and troubleshoot the fault in vehicle air conditioning systems.
- Describe the special tools for servicing vehicle air conditioning

UNIT I AIRCONDITIONING FUNDAMENTALS

Basic air conditioning system - Location of air conditioning components in a car - Schematic layout of a refrigeration system. Compressor components - Condenser and high pressure service ports. Thermostatic expansion value - Expansion value calibration - Controlling evaporator temperature - Evaporator pressure regulator - Evaporator temperature regulator.

UNIT II AIR CONDITIONER - HEATING SYSTEM

Automotive heaters - Manually controlled air conditioner - Heater system - Ford automatically controlled air conditioner and heater systems - Automatic temperature control - Air conditioning protection – Engine protection.

UNIT III REFRIGERANTS

Containers - Handling refrigerants - Tapping into the refrigerant container - Refrigeration system diagnosis -Diagnostic procedure - Ambient conditions affecting system pressures.

UNIT IV AIR ROUTING & TEMPERATURE CONTROL

Objectives - Evaporator care air flow through the Dash recirculating unit - Automatic temperature control – Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

UNIT V AIR CONDITIONING SERVICE

Air conditioner maintenance and service - Servicing heater system Removing and replacing components.Trouble shooting of air controlling system - Compressor service.

TEXT BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	William H. Crouse and Donald L Anglin	Automotive Air conditioning	McGraw-Hill Inc.	1990

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Mitchell	Mitchell Automatic Heating and Air Conditioning Systems	Prentice Hall India	1989
2	Paul Weller	Automotive Air Conditioning	Reston Publishing Co Inc.	1990
3	MacDonald.K.L,	Automotive Air Conditioning	Theodore Audel series	1978
4	Goings.L.F	Automotive Air Conditioning	American Technical services	1978

TEXT BOOKS:

17BEAE8E01 SPECIAL VEHICLES 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge of the construction layout and applications of the off-road vehicles.
- To learn the various earth moving constructional machines.
- To study the construction and working details of industrial vehicles.
- To acquire knowledge on the working of tractor attachments and military vehicles.
- To provide knowledge on the mechanism of brake, suspension and steering in off-road vehicles.
- To impart knowledge on earth moving machines

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the construction layout and features of off-road vehicles.
- Select earth moving constructional machine for a particular application.
- Describe the construction details and working of industrial vehicles.
- State the special features of tractor attachments and military vehicles.
- Illustrate the mechanism of brake
- Illustrate the mechanism of suspension and steering

UNIT I EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS

Construction layout, capacity and applications of earthmovers for dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders etc. criteria for selection of prime mover fro dumpers and front end loaders based on vehicle performance characteristics.

UNIT II POWER TRAIN CONCEPTS

Engine – converter match curves. Epicyclic type transmissions.Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

UNIT III VEHICLE SYSTEMS, FEATURES

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders.Power steering system.Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler. Articulated vehicles, double decker.Fire fighting equipment.

UNIT IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS

Constructional features, capacity and stability of jib cranes. Vibratory compactors. Stackers, borewell machines, concrete mixtures.

UNIT V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES

Ride and stability characteristics, power take off, special implementations. Special features and

TEXT BOOKS:
constructional details of tankers, gun carriers and transport vehicles. Harvesting vehicles.

TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Pipenger.	Industrial Hydraulics.	Mcgraw Hill, Tokoyo.	1979
2.	Astakhov.A	Truck cranes.	MIR Publishers, Moscow.	1971
3.	Bart H Vanderveen.	Tanks and Transport Vehicles.	Frederic Warne and co.Ltd., London.	1974
4.	Abrosimov.K, Bromberg.A and Katayer.F	Road making machineries.	MIR Publisher, Moscow.	1975
5.	SAE Handbook – Vol III, 1995.			

17BEAE8E02 TRACTOR AND FARM EQUIPMENTS 3 0 0 3 100

COURSE OBJECTIVES:

- To familiarise the components of a tractor and its controls.
- To impart knowledge on the various farm equipment.
- To expose students to the types of tractors.
- To familiarize the students to understand the performance characteristics of a tractor engine.
- To facilitate the understanding of cooling and lubrication system for troubleshooting.
- To impart knowledge on tractor attachments

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Classify the types of tractors.
- Explain the performance characteristics of a tractor engine.
- Discuss the construction and operation of the valve mechanism.
- Analyse the cooling and lubrication system for troubleshooting.
- Discuss the tractor attachments
- List and explain the various farm equipment.

UNIT I GENERAL DESIGN OF TRACTORS

Classification of tractors - Main components of tractor - Safety rules.

UNIT II CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION

Tractor controls and the starting of the tractor engines - Basic notions and definition - Engine cycles – Operation of multi cylinder engines - General engine design - Basic engine performance characteristics.

UNIT III ENGINE FRAME WORKAND VALVE MECHANISM OF TRACTOR

Cylinder and pistons - Connecting rods and crankshafts - Engine balancing - Construction and operation of the valve mechanism - Valve mechanism components - Valve mechanism troubles.

UNIT IV COOLING SYSTEM, LUBRICATION SYSTEM ANDFUEL SYSTEM

Cooling system - Classification - Liquid cooling system - Components, Lubricating system servicing and troubles -Fuel tanks and filters - Fuel pumps- Air cleaner and turbo charger

UNIT V FARM EQUIPMENTS

Working attachment of tractors - Farm equipment - Classification - Auxiliary equipment - Trailers and body tipping mechanism.

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Rodichev and Rodicheva.G	Tractor and Automobiles	MIR Publishers.	1987
2.	Kolchin.A and Demidov.V	Design of Automotive engines for tractor	MIR Publishers.	1984

17BEAE8E03 OFF ROAD VEHICLES 3 0 0 3 100

COURSE OBJECTIVES:

- To impart knowledge of the construction layout and applications of the off-road vehicles.
- To learn the various earth moving constructional machines.
- To study the construction and working details of industrial vehicles.
- To acquire knowledge on the working of tractor attachments and military vehicles.
- To provide knowledge on the mechanism of brake, suspension and steering in off-road vehicles.
- To impart knowledge on earth moving machines

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the construction layout and features of off-road vehicles.
- Select earth moving constructional machine for a particular application.
- Describe the construction details and working of industrial vehicles.
- State the special features of tractor attachments and military vehicles.
- Illustrate the mechanism of brake
- Illustrate the mechanism of suspension and steering

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES

Power plants, chassis and transmission, Multi axle vehicles.

UNIT II LAND CLEARING MACHINES

Bush cutter, Stampers, Tree dozer, Rippers.

UNIT III EARTH MOVING MACHINES

Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

UNIT IV SCRAPERS AND GRADERS

Scrapers, elevating graders, self powered scrapers and graders.

UNIT V SHOVELS AND DITCHERS

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Abrosimov.K, Bryan berg.A and Katayer.K	Road making Machinary	MIR Publishers, Moscow.	1971
2.	Wong.J.Y	Theory of Ground vehicles	John Wiley & Sons, New York	2008

17BEAE8E04 VEHICLE MAINTENANCE 3 0 0 3 100

COURSE OBJECTIVES:

- To understand the need for vehicle maintenance and its importance.
- To familiarise the maintenance procedure for various components of an automobile.
- To familiarize the students to understand servicing of transmission and driveline components.
- To make the students conversant on the procedure for steering and suspension
- To make the students conversant on the procedure for wheel and brake maintenance.
- To Study and acquire knowledge on the fault diagnosis in the electrical and air conditioner systems.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Describe and differentiate the types of maintenance.
- List the procedure for dismantling, servicing and assembling of engine components.
- Demonstrate the servicing of transmission and driveline components.
- Discuss the procedure for steering and suspension
- Discuss the procedure for wheel and brake maintenance.
- Explain the fault diagnosis in the electrical and air conditioner systems.

UNIT I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re boring machine, fuel injection calibration machine. Importance of maintenance.Schedule and unscheduled maintenance.Scope of maintenance.Equipment downtime.Vehicle inspection.Reports.Log books.Trip sheet. Lay out and requirements of maintenance shop.

UNIT II POWER PLANT REPAIR AND OVERHAULING

Dismantling of power plant and its components.Cleaning methods.Inspection and checking.Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system,- lubrication system. Power plant trouble shooting chart.

UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems. Tyre maintenance.

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY

Body panel tools for repairing. Tinkering and painting.Use of soldering, metalloid paste.

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS

Care, maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator and regulator.Transistorized regulator problems.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Judge.A.W	Motor Vehicle Servicing.	3rd Edition, Pitman Paperpack, London .	1969
2.	W.Crouse.	Everyday Automobile repair.	Intl.student edition, TMH, New Delhi.	1986
3.	Ernest Venk., Edward spicer.	Automotive maintenance and trouble shooting.	D.B. Taraporevala Sons, Bombay.	1963

REFERENCES:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Stator Abbey.	Automotive steering, braking and suspension overhaul.	Pitman publishing, London.	1971
2.	Frazee, fledell, Spicer.	Automobile collision Work.	American technical publications, Chicago.	1953
3.	John Dolce.	Fleet maintenance.	Mcgraw Hill, Newyork.	1984
4.	A,W.Judge.	Maintenance of high speed diesel engines.	Chapman Hall Ltd., London.	1956
5.	V.L.Maleev.	Diesel Engine operation and maintenance.	McGraw Hill Book Co., Newyork..	1995

17BEAE8E05 INTELLECTUAL PROPERTY RIGHTS (IPR) 3 0 0 3 100

COURSE OBJECTIVES:

- To introduce the basic concepts of Intellectual Property Rights (IPR).
- To compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
- To study the various agreements and legislation related to IPR.
- To learn digital products and law.
- To provide knowledge on enforcement of IPRs.
- To provide knowledge on the Infringement of IPRs

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Outline the basic concepts of intellectual property rights.
- Explain the registration of copyrights, trademarks, patents, geographical indications, trade secrets and industrial design registration.
- State the various agreements and legislation related to IPR.
- Describe digital products and law.
- Explain the enforcement measures of IPRs.
- Explain the Infringement of IPRs

UNIT I

Introduction - Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property i. Movable Property ii. Immovable Property and iii.Intellectual Property).

UNIT II

IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration - Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures.

UNIT III

International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities - History - General Agreement on Trade and Tariff (GATT).

UNIT IV

Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

UNIT V

Case Studies on Patents - Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

TEXT BOOK

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Subbaram.N.R	Handbook of Indian Patent Law and Practice	S. Viswanathan (Printers and Publishers) Pvt. Ltd.	1998

REFERENCE BOOKS

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Eli Whitney	United States Patent Number	72X, Cotton Gin	March 14, 1794.

17BESHOE01 PROBABILITY AND RANDOM PROCESS 3 0 0 3 100

OBJECTIVES:

- To gain knowledge in measures of central tendency.
- To provide necessary basic concepts in probability and random processes.
- Mean, Median, Mode
- Learners acquire skills in handling situations involving more than one random variable and functions of random variables.
- The students will have an exposure of various distribution functions, correlation and spectral densities.
- Learners acquire skills in handling situations involving more than one random variable and functions of randomvariables..

INTENDED OUTCOMES:

- Learners acquire skills in handling situations involving more than one random variable and functions of random variables.
- The students will have an exposure of various distribution functions, correlation and spectral densities.
- To gain knowledge in measures of central tendency.
- To provide necessary basic concepts in probability and random processes.
- Mean, Median, Mode
- Learners acquire skills in handling situations involving more than one random variable and functions of random variables.

UNIT I MEASURES OF CENTRAL TENDENCY AND PROBABILITY

Measures of central tendency – Mean, Median, Mode - Standard Deviation ,Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem.

UNIT II STANDARD DISTRIBUTIONS

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – **Chebyshev's inequality**.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

UNIT IV CLASSIFICATION OF RANDOM PROCESS

Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

UNIT VCORRELATION AND SPECTRAL DENSITIES

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross

REFERENCES:

correlation function - Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

REFERENCES:

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Peebles Jr, P.Z	Probability Random Variables and	Tata McGraw-Hill Pubishers, New Delhi.	2002
		Random Signal Principles		

REFERENCE BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ross, S	A first Course in Probability	Pearson Education, New Delhi (Chap 2 to 8)	2012
2	Gupta, S.C. and Kapoor, V.K	Fundamentals of Mathematical Statistics	Sultan Chand and Sons, New Delhi.	2014
3	Veerarajan,T.	Probabilitiy, Statistics and Random process	Tata McGraw-Hill Education pvt. Ltd., New Delhi	2008
4	Henry Stark and John W. Woods	Probability and Random Processes with Applications to Signal Processing	Pearson Education, Third edition, Delhi	2002

WEBSITES:

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com

REFERENCES:

17BESHOE02 FUZZY MATHEMATICS 3 0 0 3 100

OBJECTIVES:

- To understand basic knowledge of fuzzy sets and fuzzy logic.
- To apply the basic knowledge of fuzzy operations.
- To know the basic definitions of fuzzy relations.
- To apply basic fuzzy inference and approximate reasoning.
- To know the applications of fuzzy technology.
- Describe the methods of fuzzy logic.

INTENDED OUTCOME:

- Explain the main subject of fuzzy sets.
- Discuss the concept of fuzziness involved in various systems and fuzzy set theory.
- Describe the methods of fuzzy logic.
- Comprehend the concepts of fuzzy relations.
- Analyse the application of fuzzy logic control to real-time systems.
- Understand the fuzzy relational inference

UNIT I FUZZY SETS

Fuzzy Sets : Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

UNIT II OPERATIONS ON FUZZY SETS

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZY RELATIONS

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZY MEASURES

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNIT V FUZZY INFERENCE

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

REFERENCES:
TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	George J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic : Theory and Applications	Prentice Hall of India, New Delhi.	2003

REFERENCE BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Zimmermann H.J.	Fuzzy Set Theory and its Applications	Kluwer Academic publishers, USA.	2001
2	Michal Baczynski and BalasubramaniamJayaram	Fuzzy Implications	Springer-Verlag publishers, Heidelberg	2008
3	Kevin M Passino and Stephen Yurkovich	Fuzzy Control	Addison Wesley Longman publishers, USA	1998

WEBSITES:

1. www.mathcentre.ac.uk
2. www.mathworld. Wolfram.com
3. www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm

17BESHOE03 LINEAR ALGEBRA 3 0 0 3 100

OBJECTIVES:

- To introduce the basic concepts of vector space.
- To know the fundamentals of linear algebra.
- To solve the system of linear equations.
- To study the linear transformations.
- To introduce the concepts of inner product spaces.
- Express linear transformations as a matrix form.

INTENDED OUTCOMES:

The student will be able to

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Apply the fundamental concepts in their respective engineering fields.
- Express linear transformations as a matrix form.
- Explain the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers.
- Discuss the importance of linear algebra
- Discuss the applications of linear algebra in branches of mathematics.

UNIT I VECTOR SPACES

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space

UNIT II EIGEN VALUES AND EIGEN VECTORS

Eigen values and Eigen vectors - Diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS

Direct methods, Gauss elimination method, Gauss Jordan method, Crout's method, iterative methods, Gauss-Jacobi method, Gauss–Seidel method, convergence criteria.

UNIT IV LINEAR TRANSFORMATIONS

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

UNIT V INNER PRODUCT SPACES

The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Shahnaz Bathul	Text book of Engineering Mathematics(Special Functions and Complex Variables)	PHI Publications, New Delhi.	2009

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Anton and Rorres	Elementary Linear Algebra, Applications version	Wiley India Edition, New Delhi.	2012
3	Jim Defranza, Daniel Gagliardi	Introduction to Linear Algebra with Application	Tata McGraw-Hill, New Delhi.	2008

WEBSITES:

1. www.sosmath.com
2. www.nptel.ac.in
3. www.mathworld.wolfram.com

17BESHOE04 **ENGINEERING ACOUSTICS** **3 0 0 3 100**

OBJECTIVES:

- To disseminate the fundamentals of acoustic waves.
- To inculcate the characteristics of radiation and reception of acoustic waves.
- To divulge knowledge on the basics of pipe resonators and filters.
- To introduce the features of architectural acoustics.
- To impart the basic knowledge of transducers and receivers.
- Explain the basic ideas of pipe resonators and filters.

INTENDED OUTCOME:

- Develop the idea of the fundamentals of acoustic waves.
- Apply the concepts of radiation and reception of acoustic waves.
- Explain the basic ideas of pipe resonators and filters.
- Illustrate the basics of architectural acoustics.
- Illustrate the transducers and receivers and its applications in various electronic devices.
- Apply the knowledge inputs of the course for engineering applications.

UNIT I INTRODUCTION

Acoustics waves – Linear wave equation – sound in fluids – Harmonic plane waves - Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales.Reflection and Transmission:Transmission from one fluid to another normal and oblique incidence –method of images.

UNIT II RADIATION AND RECEPTION OF ACOUSTIC WAVES

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation impedance - Fundamental properties of transducers.Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

UNIT III PIPES RESONATORS AND FILTERS

Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters – low pass, high pass and band pass. Noise, Signal detection, Hearing and speech. Noise, spectrum level and band level – combing band levels and tones – detecting signals in noise – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

UNIT IV ARCHITECTURAL ACOUSTICS

Sound in endosure – A simple model for the growth of sound in a room – reverberation time - Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design.Environmental Acoustics: Highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

UNIT V TRANSDUCTION

Transducer as an electives network – canonical equation for the two simple transducers transmitters –

moving coil loud speaker– horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

TEXT BOOK:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	LawerenceE.Kinsler, Austin R.Frey	Fundamentals of Acoustics	John Wiley & Sons	2000

REFERENCE:

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	AltonEverest.F & Ken Pohlmann	Master Handbook of Acoustics	McGraw Hill Professional	2014

WEBSITES:

1. www.acousticalsociety.org
2. www.acoustics-engineering.com
3. www.nptel.ac.in
4. www. ocw.mit.edu

17BESHOE05 SOLID WASTE MANAGEMENT 3 0 0 3 100

OBJECTIVES:

- To make the students conversant with the basics of solid wastes and its classification.
- To make the student acquire sound knowledge of different treatments of solid wastes.
- To acquaint the student with concepts of waste disposals.
- To develop an understanding of the basic concepts of hazardous waste management.
- To acquaint the students with the basics of energy generation from waste materials.
- Identify the methods of wastes disposals.

INTENDED OUTCOME:

- Outline the basic principles of solid waste and separation of wastes.
- Identify the concepts of treatment of solid wastes.
- Identify the methods of wastes disposals.
- Examine the level of hazardousness and its management.
- Examine the possible of energy production using waste materials.
- Integrate the chemical principles in the projects undertaken in the field of engineering and technology.

UNIT I SOLID WASTE

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

UNIT II WASTE TREATMENT

Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III WASTE DISPOSAL

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfill Remediation

UNIT IV HAZARDOUS WASTE MANAGEMENT

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, risk assessment.

UNIT V ENERGY GENERATION FROM WASTE

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, Energy recovery systems. Biological & Chemical conversion

technologies – Aerobic composting, low solids.Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dara.S.S,Mishra.D.D	A Text book of Environmental Chemistry and Pollution Control	S.Chand and Company Ltd., New Delhi.	2011

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Naomi B. Klinghoffer and Marco J. Castaldi	Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy)	Woodhead Publishing Ltd., Cambridge, UK	2013
2.	Frank Kreith, George Tchobanoglous	Hand Book of Solid Waste Management- 2nd edition	McGraw Hill Publishing Ltd., New York	2002
3.	Shah, Kanti.L	Basics of Solid & Hazardous Waste Management Technology	Prentice Hall (P) Ltd., New Delhi.	1999

WEBSITES:

1. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
2. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
3. www.alternative-energy-news.info/technology/garbage-energy/
4. nzic.org.nz/ChemProcesses/environment/

TEXT BOOKS:

17BESHOE06 GREEN CHEMISTRY 3 0 0 3 100

OBJECTIVES:

- To make the students conversant about green chemistry.
- To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- To acquaint the student with concepts of green technology.
- To develop an understanding of the basic concepts of renewable energy resources.
- To acquaint the students with the basics information on catalysis.
- Apply the concepts combustion of green technology.

INTENDED OUTCOME:

- Outline the basic principles of green chemistry.
- Examine the different atom efficient process and synthesis elaborately.
- Apply the concepts combustion of green technology.
- Identify and apply the concepts of renewable energy.
- Apply the concepts of green catalysts in the synthesis.
- Integrate the chemical principles in the projects undertaken in the field of engineering and technology.

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY

Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air.Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV RENEWABLE RESOURCES

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy

TEXT BOOKS:

requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Sanjay K. Sharma, AckmezMudhoo	Green Chemistry for Environmental Sustainability	CRC Press , London	2010
2.	Ahluwalia V. K. and M.Kidwai	New Trends in Green Chemistry 2nd edition	Anamaya publishers., New Delhi.	2007

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr. SunitaRatan	A Textbook of Engineering Chemistry	S.K. Kataria and Sons., New Delhi.	2012
2.	MukeshDoble. Ken Rollins, Anil Kumar	Green Chemistry and Engineering, 1st edition	Academic Press, Elesevier., New Delhi.	2007
3.	Desai K. R.	Green Chemistry	Himalaya Publishing House, Mumbai.	2005
4.	Matlack A. S.	Introduction to Green Chemistry	Marcel Dekker: New York	2001

WEBSITES:

1. http://www.organic-chemistry.org/topics/green-chemistry.shtm
2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
4. http://www.epa.gov/research/greenchemistry/
5. http://www.amazon.in/Green-Chemistry-Catalysis

17BESHOE07 APPLIED ELECTROCHEMISTRY 3 0 0 3 100

OBJECTIVES:

- To make the students conversant with the information on electrochemical material.
- To make the student acquire sound knowledge of conducting polymers.
- To acquaint the student with concepts of energy storage devices.
- To develop energy storage devices.
- Apply the concepts of electrochemistry in storage devices.
- Identify the concepts of storage devices and their applications.

INTENDED OUTCOME:

- Outline the basic principles of chemistry in electrochemical material.
- Examine the properties of conducting polymers.
- Apply the concepts of electrochemistry in storage devices.
- Identify the concepts of storage devices and their applications.
- Apply suitable materials for the manufacturing of storage devices.
- Integrate the chemical principles in the projects undertaken in the field of engineering and technology.

UNIT I METAL FINISHING

Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating- Electro less plating of nickel- anodizing – Electroforming – Electro winning.

UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS

Lectropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers- poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT III BATTERIES AND POWER SOURCES-I

Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IV BATTERIES AND POWER SOURCES-II

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries, Lithium ion batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

UNIT V ELECTROCHEMICAL MATERIAL SCIENCE

Solar cells- Preparation of CdS/Cu_2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Cynthia G. Zoski	Hand Book of Electrochemistry	Academic Press, Elesevier., UK	2007
2.	D.Pletcher and F.C.Walsh	Industrial Electrochemistry	Chapman and Hall, London	1990

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	M. Barak	Electrochemical Power Sources	I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.	1997
2.	Bruno Scrosati	Applications of Electroactive Polymers	Chapman & Hall, London	1993
3.	K.L. Chopra and I. Kaur	Thin Film Devices and their Application	Plenum Press, New York.	1983
4.	M.M.Baizer	Organic Electrochemistry	Dekker Inc. New York	1983

WEBSITES:

1. http://www.anoplate.com/finishes/
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
3. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

17BESHOE08 INDUSTRIAL CHEMISTRY 3 0 0 3 100

OBJECTIVES:

- To make the students conversant with cement and lime and its uses.
- To make the student acquire sound knowledge of abrasives and refractories.
- To acquaint the student with concepts of inorganic chemicals.
- To develop an understanding of the basic concepts of explosives.
- To acquaint the students with the basics of agriculture chemicals.
- Identify the usage of inorganic chemicals.

INTENDED OUTCOME:

- Outline the basic chemistry of cement and lime.
- Examine the uses of abrasives and refractories.
- Identify the usage of inorganic chemicals.
- Identify the concepts of explosives and smoke screens.
- Identify the usage of agriculture chemicals.
- Integrate the chemical principles in the projects undertaken in the field of engineering and technology.

UNIT I CEMENT AND LIME

Manufacture of Portland cement – settling of hardening of portland cement – regauging cement – effect of fineness on setting and hardening – freezing – high early strength cement – high alumina cement Lime – raw materials- manufacture – slaking – lime mortar – types of lime – high – calcium or fat lime – calcium lime or lean lime – magnesian lime – dolomitic lime – hydraulic lime.

UNIT II ABRASIVES AND REFRACTORIES

Abrasives – hard abrasives – siliceous abrasives – soft abrasives – artificial abrasives – uses. Refractories – definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

UNIT III INORGANIC CHEMICALS

Common salt and soda ash – manufacture – different grades – products – alkalis – Na_2CO_3, caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture – absorption – uses, sulphur and sulphuric acid – extraction of sulphur – manufacture of H_2SO_4 – chamber – contact processes – industrial uses.

UNIT IV EXPLOSIVES

Explosives – uses – properties and tests – explosives for war – nitrocellulose – picric acid and T.N.T. – industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gas mask.

UNIT V AGRICULTURE CHEMICALS

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Harikrishan	Industrial Chemistry	Goel Publishing House, Meerut.	2014
2.	Sharma.B.K	Industrial Chemistry	Goel Publishing House, Meerut.	2000

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Chakrabarty.B.N	Industrial Chemistry	Oxford and IBH Publishing CO. New Delhi.	1998
2.	James A. Kent	Hand Book of Industrial Chemistry, 9^{th} edition	Van Nostrand Reinhold, New York.	1992
3.	Sherve.R.N	Chemical Process Industries	McGraw-Hill, Kugakuisha Ltd., Tokyo.	1984
4.	Shukla.S.D and Pandy.G.N	A Text book of Chemical Technology	Vikas Publishing House (P) Ltd, New Delhi.	1979

WEBSITES:

1. http://en.wikipedia.org/wiki/Cement
2. http://www.hon.ch/HONselect/Selection/D01.html
3. http://fas.org/man/dod-101/navy/docs/fun/part12.htm
4. http://toxics.usgs.gov/topics/agchemicals.html

17BESHOE08 ENGLISH FOR TECHNOCRATS 1 4 0 3 100

PURPOSE

It provides techniques of writing and also trains the students to write without their influence of mother tongue. In addition to honing their skills as professional writers, students will develop technical vocabularies that will aid writing research articles and discussing articles produces by their peers.

OBJECTIVE

1. To practise using reading strategies for effective writing.
2. To develop abilities to write technically and expressively.
3. To recognise writing as a constructive and meaningful process.
4. To practice using reading strategies for effective writing.
5. To design effective technical documents for both print and digital media.
6. To identify the qualities of good technical writing.

INTENDED OUTCOMES

Students undergoing this course are able to

1. Create simple sentences and correct common grammatical errors in written English.
2. Use their reading ability for effective writing.
3. Restate to minimize word, sentenceand paragraph length without sacrificing clarity or substance.
4. Discuss the basic technical writing concepts and termssuch as audience analysis, jargon, format, visuals, and presentation.
5. Demonstrate the basic components of definitions, descriptions, process explanations and other common forms of technical writing.
6. Organize the structure of thesis and articles

UNIT – I BASICS OF WRITING

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing– Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer's block – Prioritizing for effective writing– Avoiding plagiarism.

UNIT – II PARAGRAPHS AND ESSAYS

Expressing Ideas – Paragraph construction – Cohesion and Coherence – Adequate development – Kinds of paragraphs – Writing drafts – Paragraph length and pattern – Types of Essays – Characteristics of Essays – Salient point of sentence constructions.

UNIT – III LETTERS, MEMOS AND EMAIL

Formal written correspondence – Types of messages – Business letters – Structure of letters – Language in letters – Tense in letters – Cover letters – Resumes – Curriculum vitae – Memos – Emails – Email Etiquette – Effectiveness and purpose.

UNIT – IV THE ART OF CONDENSATION AND TECHNICAL PROPOSALS

Steps to Effective précis writing – Guidelines – Technical Proposals – Types of Proposals – Characteristics – Body of the Proposals – Style and appearance – Evaluation of proposals – Proof Reading – Book /Film Review – Travelogue – Dialogue Writing.

UNIT – V REPORTS AND RESEARCH ARTICLES

Discussion of newspaper articles -Objectives of Reports – Characteristics of Reports – Structure of Reports – Types of Reports – Writing an article – Writing research articles – Essential features of Dissertation – Organizing the structure of thesis and articles – Writing technical description.

TEXT BOOKS

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	V.N. Arora & Lakshmi Chandra	Improve Your Writing: Revised First Edition	OUP	2014

REFERENCES

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Crème, P. and M. Lea.	Writing at University: A guide for students.	OUP	2003
2	Graham King	Collins Improve Your Writing	Collins; First edition	2009
3	David Morley	The Cambridge Intro. To Creative Writing	Cambridge	2008

WEBSITES

http://www.stevepavlina.com/blog/2006/08/10-ways-to-improve-your-technical-skills/

http://www.nyu.edu/classes/keefer/brain/net2.html

https://www.udemy.com/technical-writing-and-editing/

http://techwhirl.com/what-is-technical-writing/

17BECSOE01 INTERNET PROGRAMMING 3 0 0 3 100

OBJECTIVES:

- To introduce the Java programming language and explore its current strengths and weaknesses.
- To study the way that object-oriented concepts are implemented in the Java programming language.
- To write working Java code to demonstrate the use of applets for client side programming.
- Discuss the way that exceptions are detected and handled in the Java programming language.
- Create Java code that demonstrates multiple threads of execution.
- Describe internet telephony

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Explain the basic and advanced concepts and techniques of Java.
- Design an application based upon the concepts of Java and advance Java.
- Discuss the way that exceptions are detected and handled in the Java programming language.
- Create Java code that demonstrates multiple threads of execution.
- Describe internet telephony
- Explain multimedia applications

UNIT I INTRODUCTION

Introduction - Network of Networks, Intranet, Extranet and Internet.World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing- Classful and Classless Addressing, Subnetting

UNIT II HTML

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.CGI Scripts- Introduction- Environment Variable, GET and POST Methods.

UNIT III PERL

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets- Container Class, Components, Applet Life Cycle, Update method, Applications.

UNIT IV CLIENT-SERVER PROGRAMMING

Client-Server programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V INTERNET TELEPHONY

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Paul Deitel, Harvey Deitel and Abby Deitel	Internet and World Wide Web-How to Program-5th Edition	Pearson	2011
2	Gopalan.N.P and. Akilandeswari.J	Web Technology: A Developer's Perspective	PHI Learning, Delhi	2013

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rahul Banerjee	Internetworking Technologies, An Engineering Perspective	PHI Learning, Delhi	2011
2	Robert W. Sebesta	Programming the World Wide Web	Pearson Education	2016

17BECSOE02 MULTIMEDIA AND ANIMATION 3 0 0 3 100

OBJECTIVES:

- To study the graphics techniques and algorithms.
- To study the multimedia concepts and various I/O technologies.
- To enable the students to develop their creativity
- To impart the fundamental concepts of Computer Animation and Multimedia. To write working Java code that demonstrates multiple threads of execution
- Discuss the fundamental concepts of computer animation and multimedia.
- Explain the various latest interactive multimedia devices, the basic concepts about images

COURSE OUTCOMES:

- Discuss the fundamental concepts of computer animation and multimedia.
- Explain the various latest interactive multimedia devices, the basic concepts about images and image formats.
- Explain the data compression techniques, image compression techniques like JPEG
- Explain the video compression techniques like MPEG, and the basic concepts about animation
- Create an interactive multimedia presentation by using multimedia devices
- Identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

Upon successful completion of the course, the students should be able to:

UNIT I INTRODUCTION

What is mean by Animation – Why we need Animation – History of Animation– Uses of Animation– Types of Animation – Principles of Animation – Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -Creating Animation.

UNIT II CREATING ANIMATION IN FLASH

Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based Animation - Working with the Timeline and Tween-based Animation – Understanding Layers - Action script.

UNIT III3D ANIMATION & ITS CONCEPTS

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.

UNIT IVMOTION CAPTION

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different Language of Script Animation Among the Software.

UNIT V CONCEPT DEVELOPMENT

Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

TEXTBOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Malay K. Pakhira	Computer Graphics, Multimedia and Animation	PHI Learning PVT Ltd	2010

REFERENCE BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Ranjan Parekh	Principles of Multimedia (Unit I, Unit V)	TMH	2007
2	Ashok Banerji, Ananda Mohan Ghosh	Multimedia Technologies	McGraw Hill Publication.	
3	Pankaj Dhaka	Encyclopedia of Multimedia and Animations	Anmol Publications	2011

17BECSOE03 PC HARDWARE AND TROUBLESHOOTING 3 0 0 3 100

COURSE OBJECTIVES:

- To assemble/setup and upgrade personal computer systems.
- To perform installation, configuration, and upgrading of microcomputer hardware and software.
- To install/connect associated peripherals.
- Define the terms that are directly related to processors such ascaching, multi-threading, dual-core technology, multi-processing, and pipelining.
- Explain the PC memories such as RAM and ROM devices.
- Discuss about motherboards and the various technologies connected to mainboards such as chipsets, buses, and various BIOS types.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Identify the main components of the PC.
- Use the skills to troubleshoot various power-related problems.
- Define the terms that are directly related to processors such as caching, multi-threading, dual-core technology, multi-processing, and pipelining.
- Explain the PC memories such as RAM and ROM devices.
- Discuss about motherboards and the various technologies connected to mainboards such as chipsets, buses, and various BIOS types.
- Prepare a HDD for storing data; install Windows OS and various programs.

UNIT I INTRODUCTION

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II PERIPHERAL DEVICES

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III PC HARDWARE OVERVIEW

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V TROUBLESHOOTING

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Govindarajalu.B	IBM PC Clones Hardware, Troubleshooting and Maintenance,2/E	TMH	2002

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Peter Abel, NiyazNizamuddin	IMB PC Assembly Language and Programming	Pearson Education	2007
2	Scott Mueller	Repairing PC's	PHI	1992

17BECSOE04 JAVA PROGRAMMING 3 0 0 3 100

COURSE OBJECTIVES:

- To understand the fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To understand the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Demonstrate the concepts of polymorphism and inheritance.
- List the important topics and explain the principles of software development.
- Create a computer program to solve specified problems.
- Use the Java SDK environment to create, debug and run simple Java programs

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Identify classes, objects, members of a class and relationships among them needed for a specific problem.
- Demonstrate the concepts of polymorphism and inheritance.
- List the important topics and explain the principles of software development.
- Create a computer program to solve specified problems.
- Use the Java SDK environment to create, debug and run simple Java programs.
- Describe the basics of event handling

UNIT I INTRODUCTION TO JAVA

Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members –constructors – finalize method

UNIT II PACKAGES

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy –polymorphism – dynamic binding – final keyword – abstract classes

UNIT III I/O STREAMS

The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes.

UNIT IV EXCEPTION HANDLING

Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging

UNIT V THREADS

Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads, Summary

TEXTBOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Cay S. Horstmann and Gary Cornell	Core Java: Volume I– Fundamentals	Sun Microsystems Press	2008

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Arnold.K and Gosling.J	The JAVA programming language Third edition	Pearson Education	2009
2	Timothy Budd	Understanding Object-oriented programming with Java Updated Edition	Pearson Education	2002
3	Thomas Wu.C	An introduction to Object-oriented programming with Java Fourth Edition	Tata McGraw-Hill Publishing company Ltd	2008

WEBSITES:

http://elvis.rowan.edu/~kay/cpp/vc6_tutorial/
http://www.winprog.org/tutorial/msvc.html
http://www.tutorialized.com/tutorials/Visual-C/1
http://www.freeprogrammingresources.com/visualcpp.html

17BEEEOE01 **ELECTRIC HYBRID VEHICLE** **3 0 0 3 100**

OBJECTIVES

- To understand the basic concepts of an electric hybrid vehicle.
- To gain knowledge about the electric propulsion unit.
- To understand and gain knowledge about various energy storage devices.
- Evaluate the different energy management strategies.
- Describe the concept of different energy storage devices.
- Analyse the different motor drives used in hybrid electric vehicles.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Explain the concept of hybrid electric vehicles.
- Discuss the concept of hybrid electric drive-trains.
- Evaluate the different energy management strategies.
- Describe the concept of different energy storage devices.
- Analyse the different motor drives used in hybrid electric vehicles.
- Discuss the fuel cell based energy storage and its analysis

UNIT I INTRODUCTION

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRIC PROPULSION UNIT

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

TEXT BOOK

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Iqbal Hussein	Electric and Hybrid Vehicles: Design Fundamentals	CRC Press – 2nd edition	2010

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	MehrdadEhsani, Yimi Gao, Sebastian E. Gay, Ali Emadi	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	Standardsmedia – 2nd edition	2009
2	James Larminie, John Lowry	Electric Vehicle Technology Explained	Wiley – 2nd edition	2012

17BEEEOE02 ENERGY MANAGEMENT AND ENERGY AUDITING 3 0 0 3 100

OBJECTIVES

- To gain the knowledge about energy management.
- To understand the basic concepts in economic analysis in energy management.
- To understand the basic principles of energy audit.
- Analyse the different energy efficient motors.
- Describe the concept of energy conservation.
- Analyse the different methods to improve power factor.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Explain the concept of energy management.
- Analyse the different methods for economic analysis.
- Discuss the basic concept of energy audit and types.
- Analyse the different energy efficient motors.
- Describe the concept of energy conservation.
- Analyse the different methods to improve power factor.

UNIT I ENERGY MANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNIT II ECONOMIC ASPECTS AND ANALYSIS

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNIT III BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT IV ENERGY EFFICIENT MOTORS

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

Energy conservation: Importance-energy saving measures in DG set-fans and blowers pumps- air conditioning system- energy efficient transformers.

UNIT V POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice- lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application of PLCs.

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Murphy W.R. and Mckay Butter worth.G	Energy Management	Heinemann Publications	2007

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	John.C.Andreas	Energy Efficient Electric Motors	Marcel Dekker Inc Ltd – 3rd edition	2005
2	W.C.Turner Steve Doty	Energy Management Handbook	Lulu Enterprises, Inc. - 8th Edition Volume II	2013

17BEEEOE03 PROGRAMMABLE LOGIC CONTROLLER 3 0 0 3 100

OBJECTIVES

- To understand the basic principles of PLC systems.
- To gain the knowledge about data handling functions.
- To understand the principles of PID.
- Describe programmable controller networking and supervisory control.
- Design logic circuits to perform industrial control functions of medium complexity.
- Demonstrate the correct operation of logic circuits by programming them into the programmable logic controller.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Examine the typical PLC hardware structure.
- Interpret relay ladder diagrams.
- Examine the issues related to using PLCs for batch processes and sequential control.
- Describe programmable controller networking and supervisory control.
- Design logic circuits to perform industrial control functions of medium complexity.
- Demonstrate the correct operation of logic circuits by programming them into the programmable logic controller.

UNIT I INTRODUCTION

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT II PLC PROGRAMMING

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III REGISTERS AND PLC FUNCTIONS

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV DATA HANDLING FUNCTIONS

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions

and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V PID PRINCIPLES

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXT BOOK:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hackworth.JR and Hackworth.F.D – Jr	Programmable Logic Controllers – Programming Method and Applications	Pearson	2006

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	John Webb and Ronald A Reiss	Programmable Logic Controllers – Principle and Applications	Fifth edition, PHI	2004
2	Bolton.W	Programmable Logic controller	Elsevier Newnes Publications, 5th Edition	2009

WEBSITE

http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm,- Introduction to programmable Logic controller

17BEEEOE04 RENEWABLE ENERGY SOURCES 3 0 0 3 100

OBJECTIVES

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
- To understand the basic principles fuel cell, Geo thermal powerplants.
- To gain the knowledge about hydro energy.
- Explain the need of wind energy and the various components used in energy generation.
- Discuss the need of hydro energy and the various types of hydro energy.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Explain the need of renewable energy resources, historical and latest developments.
- Describe the use of solar energy and the various components used in the energy production with respect to applications.
- Explain the need of wind energy and the various components used in energy generation.
- Discuss the need of hydro energy and the various types of hydro energy.
- Analyse the different energy sources for energy production.
- Explain the need of ocean thermal power plants

UNIT I INTRODUCTION

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

UNIT IV HYDRO ENERGY

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes.Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy

conversion.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rai.G.D	Non-conventional sources of energy	Khanna publishers	2011
2	Khan.B.H	Non-Conventional Energy Resources	The McGraw Hills, Second edition	2009

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rao.S. &Parulekar	Energy Technology	Khanna publishers, Eleventh Reprint	2013
2	Godfrey Boyl	Renewable Energy: Power sustainable future	Oxford University Press, Third edition	2012
3	John W Twidell and Anthony D Weir	Renewable Energy Resources	Taylor and Francis – 3rd edition	2015

WEBSITES:

1. www.energycentral.com
2. www.catelelectricpowerinfo.com

17BEECOE01 REAL TIME EMBEDDED SYSTEMS 3 0 0 3 100

OBJECTIVES

- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking.
- To study about task management
- To learn about semaphore management and message passing to study about memory management
- Gain knowledge about task management
- Gain knowledge about semaphore management

COURSE OUTCOMES

- Ability to understand embedded systems, its hardware and software.
- Gain knowledge about devices and buses used for embedded networking.
- Gain knowledge about task management
- Gain knowledge about semaphore management
- Gain knowledge about message passing
- Gain knowledge about memory management

UNIT - I INTRODUCTION TO EMBEDDED SYSTEM

Introduction - Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture (CISC and RISC) - Categories of Embedded Systems - embedded processor selection &tradeoffs - Embedded design life cycle - Product specifications - hardware/software partitioning - iterations and implementation - hardware software integration - product testing techniques – ARM 7

UNIT - II OPERATING SYSTEM OVERVIEW

Introduction –Advantage and Disadvantage of Using RTOS – Multitasking – Tasks - Real Time Kernels – Scheduler - Non-preemptive Kernels - Preemptive Kernels – Reentrancy- Reentrant Functions – Round Robin Scheduling - Task Priorities - Static Priorities – Mutual Exclusion – Deadlock – Intertask Communication – Message Mailboxes – Message Queues - Interrupts - Task Management – Memory Management - Time Management – Clock Ticks.

UNIT - III TASK MANAGEMENT

Introduction - µ C/OS-II Features - Goals of µ C/OS-II - Hardware and Software Architecture – Kernel Structures: Tasks –Task States – Task Scheduling – Idle Task – Statistics Task – Interrupts Under µ C/OS-II – Clock Tick - µ C/OS-II Initialization. Task Management: Creating Tasks – Task Stacks – Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: Delaying a Task – Resuming a Delayed Task – System Time. Event Control Blocks- Placing a Task in the ECB Wait List – Removing a Task from an ECB waits List.

UNIT - IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

Semaphore Management: Semaphore Management Overview – Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox – Deleting Mailbox – Waiting for a Message box – Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue – Deleting a Message Queue – Waiting for a Message at a Queue – Sending Message to a Queue – Flushing a Queue.

UNIT - V MEMORY MANAGEMENT

Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memor y Block – Returning a Memor y Block .Getting Started with µ C/OS-II – Installing µ C/OS-II – Porting µ C/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with µ C/OS-II - µ C/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Anal yze the Multichannel ADC with help of µ C/OS-II.

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Jean J. Labrosse	MicroC/OS – II The Real Time Kernel	CMP BOOKS	2009
2	David Seal	ARM Architecture Reference Manual	Addison-Wesley	2008
3	Steve Furbe	ARM System-on-Chip, Architecture	Addison-Wesley Professional California	2000

17BEECOE02 CONSUMER ELECTRONICS 3 0 0 3 100

OBJECTIVES

- To study about various speakers and microphone
- To learn the fundamental of television systems and standards
- To learn the process of audio recording and reproduction
- To study the various telephone networks
- Gain knowledge about various speakers and microphone
- Gain knowledge about the fundamental of television systems and standards

COURSE OUTCOMES

- Gain knowledge about various speakers and microphone
- Gain knowledge about the fundamental of television systems and standards
- Gain knowledge about the process of audio recording and reproduction
- Gain knowledge about the various telephone networks
- To study about various speakers and microphone
- To learn the fundamental of television systems and standards

UNIT I LOUDSPEAKERS AND MICROPHONES

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNIT II TELEVISION STANDARDS AND SYSTEMS

Components of a TV system – interlacing – composite video signal.Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL, SECAM - Components of a Remote Control.

UNIT III OPTICAL RECORDING AND REPRODUCTION

Audio Disc – Processing of the Audio signal –read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems.

UNIT IV TELECOMMUNICATION SYSTEMS

Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network.Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems

UNIT V HOME APPLIANCES

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

TEXT BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Bali.S.P	Consumer Electronics	Pearson Education	2005

17BEECOE03 NEURAL NETWORKS AND ITS APPLICATIONS 3 0 0 3 100

OBJECTIVES

- To introduce the basic concepts of neural networks and its applications in various domain
- To educate how to use Soft Computing to solve real-world problems
- To have a solid understanding of Basic Neural Network.
- Understand the basic concepts of neural networks and its applications in various domain
- Ability to develop the use of Soft Computing to solve real-world problems

COURSE OUTCOMES

- Understand the basic concepts of neural networks and its applications in various domain
- Ability to develop the use of Soft Computing to solve real-world problems
- Understand the Basic Neural Network.
- To introduce the basic concepts of neural networks and its applications in various domain
- To educate how to use Soft Computing to solve real-world problems
- To have a solid understanding of Basic Neural Network.

UNIT I INTRODUCTION TO NEURAL NETWORKS

Introduction - biological neurons and their artificial models - learning, adaptation and neural network's learning rules - types of neural networks- single layer, multiple layer- feed forward, feedback networks

UNIT II LEARNING PROCESS

Error – correction learning – memory based learning - hebbian learning-competitive learning-Boltzmann learning- supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCE PTION

Single layer perception-Adaptive filtering-unconstrained optimization-Least-mean square algorithm-Leaning curve-Annealing Technique-perception convergence theorem-Relationship between perception and Baye's classifier-Back propagation algorithm

UNIT IV ATTRACTOR NEURAL NETWORK AND ART

Hopfield model-BAM model- BAM stability-Adaptive BAM -Lyapunov function-effect of gain-Hopfield design-Application to TSP problem-ART- layer 1-layer 2-orienting subsystem- ART algorithm-ARTMAP

UNIT V SELF ORGANIZATION

Self organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical vector Quantization. Applications of self-organizing maps: The Neural Phonetic Typewriter Learning Ballistic Arm Movements

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Simon Haykin	Neural Networks and Learning Machines-3/E	Pearson/ Prentice Hall	2009
2	Satish Kumar	Neural Networks : A Classroom Approach	TMH	2008
3	Freeman J.A., Skapura D.M	Neural networks, algorithms, applications, and programming techniques	Addition Wesley	2005
4	LaureneFausett	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications	Pearson/ Prentice Hall	1993
5	Robert J Schalkoff	Artificial Neural Networks	McGraw Hill	1997

17BEECOE04 FUZZY LOGIC AND ITS APPLICATIONS 3 0 0 3 100

OBJECTIVES

- To introduce the basic concepts of Fuzz y logic and its applications in various domain
- To educate how to use Fuzzy computation to solve real-world problems
- To have a solid understanding of Basic fuzzy models.
- Understand the basic concepts of Fuzzy logic and its applications in various sdomain
- Ability to develop how to use Fuzzy computation to solve real-world problems
- Understand basic fuzzy models.

COURSE OUTCOMES

- Understand the basic concepts of Fuzzy logic and its applications in various domain
- Ability to develop how to use Fuzzy computation to solve real-world problems
- Understand basic fuzzy models.
- To introduce the basic concepts of Fuzz y logic and its applications in various domain
- To educate how to use Fuzzy computation to solve real-world problems
- To have a solid understanding of Basic fuzzy models.

UNIT - I

Basics of Fuzzy Logic: Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT – II

Theory of Approximate Reasoning**:** Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference-fuzzy models

UNIT - III

Fuzz y Knowledge Based Controllers (Fkbc**):** Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures – Design of Fuzz y Logic Controller

UNIT - IV

Adaptive Fuzz y Control: Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNIT V

Simple applications of FKBC -washing machines- traffic regulations -lift control-fuzz y in medical applications-Introduction to ANFIS.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Diankar.D, Hellendoom.H and Reinfrank.M	An Introduction to Fuzzy Control	Narosa Publishers India	1996
2	Klir.G.J and Folger.T.A	Fuzzy Sets Uncertainty and Information	PHI IEEE	1995

17BTBTOE01 **BIOREACTOR DESIGN** **3 0 0 3 100**

OBJECTIVES

- To impart basic knowledge in bioprocess engineering.
- To design the bioreactors for various operations.
- To understand the principle and working of heat transfer equipments.
- To extend the knowledge in principle of heat transfer inside a bioreactor.
- To construct the equipments used in mass transfer operations.
- To learn the equipments used in the separation process.

COURSE OUTCOMES

- Summarise the basic concepts in biotechnology
- Summarise the basic concepts in bioprocess engineering.
- Design the bioreactors for various operations.
- Develop the heat transfer equipments for bioprocess engineering.
- Construct the equipments used in mass transfer operations.
- Categorise the equipments used in separation process.

UNIT I ENGINEERING PROPERTIES AND STORAGE TANK

Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

UNIT II REACTOR DESIGN

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III HEAT TRANSFER EQUIPMENTS

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

UNIT IV MASS TRANSFER EQUIPMENTS

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

UNIT V SEPARATION EQUIPMENTS

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson −walker crystallizer.

TEXTBOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	James Edwin Bailey, DavidF.Ollis	Biochemical Engineering	McGraw-Hill	2007
2	DonW.Green,RobertH. Perry	Chemical Engineer Handbook	The McGraw- Hill Companies,	2008

REFERENCES:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Pauline.M.Doran	Bioprocess Engineering Principles	Academic Press	2013

17BTBTOE02 FOOD PROCESSING AND PRESERVATION 3 0 0 3 100

OBJECTIVES

- To learn the scope and importance of food processing.
- To impart basic knowledge in different food processing methods carried out in the food tech companies.
- To extend the brief knowledge in food conservation operations.
- To study the methods of food preservation by cooling.
- To familiarise the students on the concepts of preservation methods for fruits.
- To create a deeper understanding of preservation methods for vegetables.

COURSE OUTCOMES

- Describe the scope and importance of food processing.
- Outline the various processing methods for foods.
- Extend the knowledge in food conservation operations.
- Describe the methods of food preservation by cooling.
- Summarise the preservation methods for fruits.
- Demonstrate the preservation methods for vegetables.

UNIT I SCOPE AND IMPORTANCE OF FOOD PROCESSING

Properties of food- Physical, thermal, mechanical, sensory. Raw material

Preparation - Cleaning, sorting, grading, peeling.

UNIT II PROCESSING METHODS

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning- additives- fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing-Concepts and equipment used.

UNIT III FOOD CONVERSION OPERATIONS

Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments- membrane separation- filtration- equipment and application.

UNIT IV FOOD PRESERVATION BY COOLING

Refrigeration, Freezing-Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V PRESERVATION METHODS FOR FRUITS AND VEGETABLES

Pre processing operations - preservation by reduction of water content: drying /

dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation– Food irradiation- Combined preservation techniques.

TEXT BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	PaulSingh.R,DennisR. Heldman	Introduction to food Engineering.	Academic Press	2001
2	Fellows.P	Food Processing Technology, Principles and practice.	Woodhead Publishing Ltd	2000
3	MirceaEnachescuDauthy	Fruit and Vegetable Processing	FAO agricultural services bulletin no.119	1995

REFERENCE BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rao.M.A, Syed S.H. Rizvi,AshimK.Datta	Engineering properties offoods	CRC Press	2005
2	Sivasankar.B	Food processing and preservation	PHI Learning Pvt.Ltd	2002

17BTBTOE03 **BASIC BIOINFORMATICS** **3 0 0 3 100**

OBJECTIVES

- To understand the available tools and databases for performing research in bioinformatics.
- To expose students to sequence alignment tool in bioinformatics.
- To construct the phylogenetic trees for evolution.
- To get familiar with the 3D structure of protein and classification.
- To acquire basic knowledge in protein secondary structure prediction.
- To extend the brief knowledge in microarray data analysis.

COURSE OUTCOMES

At the end of the course,

- Summarise the basic concepts and importance of bioinformatics in various sectors.
- Demonstrate the sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Analyse the three-dimensional protein structure and classification using various tools.
- Illustrate the protein secondary structure prediction by comparative modelling.
- Extend the knowledge in microarray technology and applications of bioinformatics in various sectors.

UNIT I OVERVIEW OF BIOINFORMATICS

The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II RETRIEVAL OF BIOLOGICAL DATA

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST.Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III PHYLOGENETICS

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences.Sequence annotation: principles of genome annotation; annotation tools

& resources.

UNIT IV STRUCTURAL BIOINFORMATICS

Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNIT V MICROARRAY DATA ANALYSIS

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharm informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

TEXT BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Dan E. Krane, Michael Rayme	Fundamental Concepts of Bioinformatics	Pearsoneducation	2004
2	Andreas D. Baxevanis, Francis Ouellette.B.F	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins	Wiley-Interscience	2004
3	David W. Mount	Sequence and Genome Analysis	ColdSpringHarbor Laboratory	2004
4	Jonathan Pevsner	Bioinformatics and Functional Genomics	Wiley-Liss	2003

REFERENCEBOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Michael J. Korenberg	Microarray Data Analysis: MethodsandApplications	Springer Science & BusinessMedia	2007

17BTBTOE04 FUNDAMENTALS OF NANOBIOTECHNOLOGY 3 0 0 3 100

OBJECTIVES

- To impart the skills in the field of nanobiotechnology and its applications.
- To acquire knowledge in the nanoparticles and its significance in various fields.
- To extend the knowledge in types and application of nanoparticles in sensors.
- To define the concepts of biomaterials through the molecular self assembly.
- To equip students with clinical applications of nanodevices.
- To describe a deeper understanding of the socio-economic issues in nanobiotechnology.

COURSE OUTCOMES

At the end of the course,

- Develop skills in the field of nanobiotechnology and its applications.
- Summarise the nanoparticles and its significance in various fields.
- Extend the knowledge in types and application of nanoparticles in sensors.
- Define the concepts of biomaterials through the molecular self assembly.
- Outline the clinical applications of nanodevices.
- Describe the socio-economic issues in nanobiotechnology.

UNIT I INTRODUCTION

Introduction, Scope and Overview, Length scales , Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

UNIT II NANO PARTICLES

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes.

UNIT III APPLICATIONS

Nanomedicine, Nanobiocensor and Nanofludics.Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems.Nano-Biodevices and Systems.Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine.

UNIT IV NANOBIOTECHNOLOGY

Clinical applications of nanodevices.Artificial neurons.Real-time nanosensors- Applications in cancer biology.Nanomedicine.Synthetic retinyl chips based on bacteriorhodopsins.High throughput DNA sequencing with nanocarbon tubules.Nanosurgical devices.

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial

Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

TEXTBOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Niemeyer,C.M. andMirkin,C.A	Nanobiotechnology:Concepts, Applicationsand	Wiley-VCH	2004
2	Goodsell,D.S.	Bionanotechnology	JohnWiley andSons, Inc	2004

REFERENCE BOOKS:

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Shoseyov,O. and Levy,I	Nano biotechnology: Bioinspired Devices and Materialsof theFuture	Humana Press	2007
2	Bhushan,B.	SpringerHandbookof Nanotechnology	Springer-VerlagBerlin Heidelberg	2004
3	FreitasJrR.A	Nanomedicine	Landes	2004
4	Kohler,M.and Fritzsche,W.	Nanotechnology–An Introduction to Nanostructurin	Wiley-VCH	2004

17BEMEOE01 COMPUTER AIDED DESIGN 3 0 0 3 100

OBJECTIVE

- To provide an overview of how computers are being used in mechanical component design.
- To study the various computer graphics concepts.
- To get basic knowledge of geometric modelling.
- To study the basics of parametric design and object representation.
- To get basic knowledge in product design and development.
- Explain the process involved in graphic transformations.

COURSE OUTCOMES

- Give an overview of the CAD systems and its importance.
- Explain the ideas and principles behind the computer graphics.
- Explain the process involved in graphic transformations.
- Understand the operations involved in geometric modelling.
- Describe the concepts of parametric design.
- Understand the basics of product design and development.

UNIT I OVERVIEW OF CAD SYSTEMS

Conventional and computer aided design processes-advantages and disadvantages.Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations.Networking of CAD systems.

UNIT II INTERACTIVE COMPUTER GRAPHICS AND GRAPHICS TRANSFORMATIONS

Generative, cognitive and image processing graphics.Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives - display transformation in Two- and Three – Dimensional graphics concepts, Graphical input technique, Geometric transpformations, Visual Realism, Computer animation, customizing graphics software.

UNIT III GEOMETRIC MODELING

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, boolean operations. Extracting entities from a solid.Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

UNIT IV PARAMETRIC DESIGN AND OBJECT REPRESENTATION

Types of co-ordinate systems.Parametric design - definition and advantages.Parametric representation of analytic and synthetic curves.Parametric representation of surfaces and solids - manipulations.

UNIT V PRODUCT DESIGN AND DEVELOPMENT

Automated 2D drafting - basics, mechanical assembly - bill of materials generation.Mass property calculations.

TEXT BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Vera B Anand	Computer Graphics and Geometric Modeling for Engineers	John Wiley & Sons, New York	2000
2	Radhakrishnan P and Subramanyan S	CAD/CAM/CIM	New Age International Pvt. Ltd	2004

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Radhakrishnan P and Kothandaraman C P	Computer Graphics and Design	Dhanpat Rai & Sons, New Delhi	2002
2	Ibrahim Zeid	CAD/CAM Theory and Practice	McGraw Hill Inc., New York	2003
3	Barry Hawhes	The CAD/CAM Process	Pitman Publishing, London	1998
4	William M Newman and Robert Sproul	Principles of Interactive Computer Graphics	McGraw Hill Inc., New York	1994
5	Sadhu Singh	Computer-Aided Design and Manufacturing	Khanna Publishers, New Delhi	1998
6	Rao S S	Optimisaiton Techniques	Wiley Eastern, New Delhi	2003

17BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT 3 0 0 3 100

OBJECTIVE

- To provide in-depth knowledge on industrial safety.
- Understand the various safety techniques involved in the industrial sector.
- Record and investigate the accident zone and prepare reports related to it.
- Conduct basic safety inspections using strategies that they have developed.
- Identify and demonstrate the working of safety monitoring.
- Train about education and training based on safety.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Understand the need and awareness of safety concepts.
- Understand the various safety techniques involved in the industrial sector.
- Record and investigate the accident zone and prepare reports related to it.
- Conduct basic safety inspections using strategies that they have developed.
- Identify and demonstrate the working of safety monitoring.
- Train about education and training based on safety.

UNIT I INTRODUCTION TO LOGISTICS

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

UNIT II PHASES OF SUPPLY CHAIN

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNIT III EVOLUTION OF SUPPLY CHAIN MODELS

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

UNIT IV SUPPLY CHAIN ACTIVITIES

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNIT V SCM ORGANISATION AND INFORMATION SYSTEM

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERP Software's

TEXT BOOKS

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Shari.P.B and Lassen.T.S	Managing the global supply chain	Viva books, New Delhi	2000
2	Ayers.J.B	Hand book of supply chain management	The St. Lencie press	2000

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Nicolas.J.N	Competitive manufacturing management - continuous improvement, Lean production, customer focused quality	McGrawHill, New York	1998
2	Steudel.H.J and Desruelle.P	Manufacturing in the nineteen - How to become a mean, lean and world class competitor	Van No strand Reinhold, New York	1992

17BEMEOE03 TRANSPORT PHENOMENA 3 0 0 3 100

OBJECTIVES

- To provide the basics of transport phenomena and its applications.
- To provide the knowledge over the properties of the systems and unit systems used.
- To understand the basics and mathematics involved in momentum transport.
- To provide the basics and applications of energy transport.
- To give basics and principles involved in the mass transport phenomena.
- Understand the basic concepts involved in momentum transport.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Understand the basic concepts of transport phenomena.
- Understand the essentiality of properties of a system and unit systems used.
- Understand the basic concepts involved in momentum transport.
- Apply the mathematics involved in fluid flow problems.
- Explain the various energy transport phenomena.
- Understand the basics of mass transport phenomena.

UNIT I INTRODUCTION AND BASIC CONCEPTS

General overview of transport phenomena including various applications, Transport of momentum, heat and mass , Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

UNIT II PROPERTIES, UNITS AND OTHER PHYSICAL PARAMETERS

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNIT III MOMENTUM TRANSPORT

Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non- Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

UNIT IV ENERGY TRANSPORT

Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection

heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heat transfer

UNIT V MASS TRANSPORT

Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion- Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

REFERENCE

S. NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Geankoplis, C. J	Transport Processes and Separation Processes Principles	Prentice Hall	2003

WEB REFERENCE

1. https://laulima.hawaii.edu/portal

17BEMEOE04 INTRODUCTION TO BIOMECHANICS 3 0 0 3 100

OBJECTIVES

- Understand the basics and importance of biomechanics.
- Present the nine fundamentals of biomechanics and its need.
- Explain the nine principles used for the application of biomechanics.
- Describe the human anatomy.
- Explain the need for biomechanics in muscle actions.
- Understand the basics of the mechanics involved in the musculoskeletal system.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- Understand the basics and importance of biomechanics.
- Present the nine fundamentals of biomechanics and its need.
- Explain the nine principles used for the application of biomechanics.
- Describe the human anatomy.
- Explain the need for biomechanics in muscle actions.
- Understand the basics of the mechanics involved in the musculoskeletal system.

UNIT I INTRODUCTION

Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application ofBiomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements - Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

UNIT IV ANATOMICAL DESCRIPTION

Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM

Tissue Loads - Response of Tissues To Forces - Biomechanics of The Passive Muscle–Tendon Unit - Biomechanics of Bone - Biomechanics of Ligaments - Three Mechanical Characteristics of Muscle - Stretch-Shortening Cycle (SSC) - Force–Time Principle - Neuromuscular Control

REFERENCES

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Duane Knudson	Fundamentals of Biomechanics	Springer Science+ Business Media, LLC	2007
2	Ross Ethier.C Craig A. Simmons	Introductory Biomechanics	Cambridge University Press	2007

17BECEOE01 HOUSING, PLAN AND MANAGEMENT 3 0 0 3 100

OBJECTIVES:

- To examine the role and tasks of basic housing policies and building bye-laws.
- To understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors.
- To analyse the innovative construction methods and materials.
- To analyse city management strategies and strengthen the urban governance through a problem solving approach.
- Use housing programmes and schemes.
- Plan and design housing projects.

COURSE OUTCOMES

- Explain the importance of basic housing policies and building bye-laws.
- Use housing programmes and schemes.
- Plan and design housing projects.
- Examine innovative construction methods
- Examine innovative construction materials.
- Describe housing finance and loan approval procedures.

UNIT I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 2002.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 2001.

REFERENCES

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 2000.

17BECEOE02 **BUILDING SERVICES** **3 0 0 3 100**

OBJECTIVES:

- To provide knowledge on machineries involved in building construction.
- To impart knowledge onelectrical systems in buildings.
- To understand theprinciples of illumination and design.
- To learn therefrigeration principles and its applications.
- To study the importance of fire safety and its installation techniques.
- Use the principles of illumination and design.

COURSE OUTCOMES

- Explain the machineries involved in building construction.
- Discuss the electrical system and its selection criteria.
- Use the principles of illumination and design.
- Illustrate the principle of refrigeration.
- Explain the importance of fire safety and its installation techniques.
- Apply fire safety installation techniques.

UNIT I MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required

and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

TEXT BOOKS

1. E.R.Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 2002.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

REFERENCES

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
2 A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, The Architectural Press, London, 2005.
3 National Building Code.

17BECEOE03 MANAGEMENT OF IRRIGATION SYSTEMS 3 0 0 3 100

OBJECTIVES:

- At the end of this course the students should have learnt the irrigation system requirements, irrigation scheduling, strategies in water use management, canal operation places and involvement of stakeholder
- At the end of this course the students should have learnt the irrigation system requirements
- At the end of this course the students should have learnt the irrigation scheduling
- At the end of this course the students should have learnt the strategies in water use management
- At the end of this course the students should have learnt the canal operation places and involvement of stakeholder
- At the end of this course the students should have learnt the Frequency and interval of irrigation

COURSE OUTCOMES

- At the end of this course the students should have learnt the irrigation system requirements, irrigation scheduling, strategies in water use management, canal operation places and involvement of stakeholder
- At the end of this course the students should have learnt the irrigation system requirements
- At the end of this course the students should have learnt the irrigation scheduling
- At the end of this course the students should have learnt the strategies in water use management
- At the end of this course the students should have learnt the canal operation places and involvement of stakeholder
- At the end of this course the students should have learnt the Frequency and interval of irrigation

UNIT I IRRIGATION SYSTEM REQUIREMENTS

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

UNIT II IRRIGATION SCHEDULING

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

UNIT III MANAGEMENT

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

UNIT IV OPERATION

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

UNIT V INVOLVEMENT OF STAKE HOLDERS

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

TEXT BOOKS

1. Dilip Kumar Majumdar, "Irrigation Water Management – Principles and Practice", Prentice Hall of India Pvt. Ltd., New Delhi, 2000
2. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi

REFERENCES

1. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project, Technical report No. 33, CWC, New Delhi, 2000
2. Maloney, C. and Raju, K.V., "Managing Irrigation Together", Practice and Policy in India, Stage Publication, New Delhi, India, 2000

17BECEOE04 ADVANCED CONSTRUCTION TECHNOLOGY 3 0 0 3 100

OBJECTIVES:

- Explain the modern concrete construction.
- Explain the construction methods.
- Describe the construction Equipment used for Earth Moving
- Describe the Construction Equipment used for Conveying,
- Explain the principles and Practices of Temporary structures
- Explain the operation and maintenance of construction equipment

COURSE OUTCOMES

- Explain the modern concrete construction.
- Explain the construction methods.
- Describe the construction Equipment used for Earth Moving
- Describe the Construction Equipment used for Conveying,
- Explain the principles and Practices of Temporary structures
- Explain the operation and maintenance of construction

UNIT I

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

UNIT II CONSTRUCTION METHODS FOR SPECIAL STRUCTURES

Construction Methods For Bridges, Construction Methods for Roads, Construction Methods For Special Structures for Railways, Construction Methods for Dams, Construction Methods for Harbour, Construction Methods for River Works Pipelines

UNIT III MODERN CONSTRUCTION EQUIPEMENTS -I

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting,Tunneling and hoisting

UNIT IV MODERN CONSTRUCTION EQUIPEMENTS -II

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

UNIT V PRINCIPLES AND PRACTICES OF TEMPORARY STRUCTURES

Principles and Practices of Temporary structures, Shoring, and Strutting,Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

TEXT BOOKS

1. Peurifoyu , R. L., , Ledbette, W.B., Construction Planning , Equipment and Methods, Mc Graw Hill Co., 2000.
2. Antill J.M., PWD, Civil Engineering Construction, Mc Graw Hill Book Co., 2005

REFERENCE

1. Varma, M Construction Equipment and its Planning & Applications, Metropoltian Book Co., 2000
2. Nunnaly, S.W., Construction Methods and Management , Prentice – Hall, 2000
3. Ataev, S.S., Construction Technology, MI

TEXT BOOKS

17BEAEOE01 AUTOMOBILE ENGINEERING 3 0 0 3 100

OBJECTIVES:

- To impart knowledge on the constructional details and principle of operation of various automobile components.
- To learn the function and working of various components in transmission and drive lines.
- To study the concept and working of steering and suspension systems in an automobile.
- To give knowledge on the wheels, tyres and brakes of automobiles.
- To provideinformation on thecurrent and future trends in automobiles.
- Explain the function and working of components in transmission and drive lines.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Demonstrate the operating principles and constructional details of various automobile components.
- Explain the function and working of components in transmission and drive lines.
- Identify and explain the types of steering system.
- Identify and explain the types of suspension system.
- Classify and describe the types of wheels, tyres and brakes of automobiles.
- Discuss the current and future trends in the automobiles.

UNIT I ENGINE AND FUEL FEED SYSTEMS

Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburettor working principle, requirements of an automotive carburettor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

UNIT II TRANSMISSION SYSTEMS

Requirements of transmission system.Flywheel. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles.Performance characteristics at different speeds. Different types of gearboxes - operation. Function of Propeller Shaft Construction details of multi drive axle vehicles. Different types of final drive. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock

UNIT III SUSPENSION SYSTEM

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension – Pneumatic suspension – Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

TEXT BOOKS

UNIT IV BRAKES

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory, Brake actuating systems - Mechanical, Hydraulic and Pneumatic. Parking and engine exhaust brakes. Power and power assisted brakes. Antilock Braking System (ABS).

UNIT V ELECTRICAL SYSTEM

Principle and construction of lead acid battery. Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.Starting System and charging system.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2.	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2003
3.	Dr.Kirpal Singh	Automobile Engineering	Standard Publisher	2011

REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
2.	Crouse.W.H	Automobile Electrical Equipment, 3rd Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAEInc	2001

REFERENCES:

17BEAEOE02 BASICS OF TWO AND THREE WHEELERS 3 0 0 3 100

OBJECTIVES:

- To impart technical knowledge on construction and working of the power train and drive train of two and three wheeler vehicles.
- To familiarise with maintenance procedures of the engine and subsystems of two and three wheelers.
- To impart knowledge on types of transmission systems
- To impart knowledge on types of steering and suspension systems
- To impart knowledge on types of wheels, tyres and brakes for two and three wheelers
- To make the students conversant on servicing of two and three wheelers.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Construct the frames of two and three wheelers of different layouts.
- Demonstrate the constructional details and principle of operation of various engine components.
- Identify and explain the types of transmission systems.
- Identify and explain the types of steering and suspension systems.
- Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
- Explain the servicing of two and three wheelers.

UNIT I INTRODUCTION

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III CLUTCHES AND TRANSMISSION

Types of clutches for 2 and 3 wheelers.Design of clutch system.Gears for two and three wheelers.Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

REFERENCES:

UNIT V THREE WHEELERS

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Irving P.E.	Motor Cycle Engineering.	Temple Press Book, London.	1992
2.	Srinivasan.S.	Motor cycle, Scooter, Mobeds.	New century book house.	1988

REFERENCES:

SL. NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Griffin.M.M	Motor cycles from inside and outside.	Prentice Hall Inc, New Jersey.	1978
2.	Bruce A. Johns, David D. Edmundson and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

17BEAEOE03 AUTOMOBILE MAINTENANCE 3 0 0 3 100

OBJECTIVES:

- To understand the need for vehicle maintenance and its importance.
- To familiarise the maintenance procedure for various components of an automobile.
- To familiarize the students to understand servicing of transmission and driveline components.
- To make the students conversant on the procedure for steering and suspension
- To make the students conversant on the procedure for wheel and brake maintenance.
- To Study and acquire knowledge on the fault diagnosis in the electrical and air conditioner systems.

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Describe and differentiate the types of maintenance.
- List the procedure for dismantling, servicing and assembling of engine components.
- Demonstrate the servicing of transmission and driveline components.
- Discuss the procedure for steering and suspension
- Discuss the procedure for wheel and brake maintenance.
- Explain the fault diagnosis in the electrical and air conditioner systems.

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

UNIT II ENGINE MAINTENANCE

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

UNIT III CHASSIS MAINTENANCE

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems. Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and

maintenance of modern electronic controls, checking and servicing of dash board instruments.

UNIT V MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VEHICLE BODY

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts, Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

TEXT BOOKS:

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John Doke	Fleet Management	McGraw Hill Co	1984
2.	James D Halderman	Advanced Engine Performance Diagnosis	Prentice Hall Publications	2011
3.	Service Manuals from Different Vehicle Manufacturers			

17BEAEOE04 **INTRODUCTION TO MODERN VEHICLE TECHNOLOGY** **3 0 0 3 100**

COURSE OUTCOMES:

- To impart knowledge on trends in the vehicle power plants.
- To learn the various advanced driver assistance systems.
- To study the working of advanced suspension and braking systems in an automobile.
- To give information about motor vehicle emission and noise pollution control.
- To provide knowledge of the vehicle telematics.
- To give information about the noise control techniques

COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- Distinguish and describe the various modern vehicle power plant systems.
- List and explain the various driver assistant mechanisms.
- Identify and describe the working of advanced suspension and braking systems.
- Apply the knowledge of motor vehicle emission and noise pollution control.
- Describe the noise control techniques
- Describe the vehicle telematics and its applications.

UNIT I TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

UNIT II DRIVER ASSISTANCE SYSTEMS

Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut- off technology, ABS, Driver Drowsiness Detection system

UNIT III SUSPENSION BRAKES AND SAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

UNIT IV NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNIT V TELEMATICS

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

TEXT BOOKS

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	LjuboVlacic, Michael Saren and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001
2.	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems –Progress in Technology	Automotive Electronics Series,SAE, USA.	1998

REFERENCES:

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William B Riddens	Understanding Automotive Electronics, 5th Edition	Butterworth Heinemann Woburn.	1998
2.	Bechhold,	Understanding Automotive Electronics	SAE	1998
3.	Robert Bosch	Automotive HandBook, 5th Edition	SAE	2000