B.Tech. SYLLABUS

(I and II Semester)

2015-16

NATIONAL INSTITUTE OF TECHNOLOGY

TIRUCHIRAPPALLI 620015

TAMILNADU, INDIA

B.Tech I – Semester Courses

CODE	COURSE	L	T	P	Credits
HM 101	English for Communication	3	0	0	3
MA 101	Mathematics - I	3	1	0	4
PH 101	Physics – I (Theory & Lab)	2	0	3	3
CH 101	Chemistry – I (Theory & Lab)	2	0	3	3
CS 101	Basics of Programming (Theory & Lab)	2	0	2	3
BS 101	Branch Specific Course	2	0	0	2
BE I 101	Basics of Civil Engineering (All Branches except CE)	2	0	0	2
BE II 101	Basics of Mechanical Engineering (For CE, EEE, ECE, ICE & CSE)	2	0	0	2
BE III 101	Basics of Electrical and Electronics Engineering (For PE, ME, MME, CE, Ch.E)	2	0	0	2
MP 101/ PR 101	Engineering Graphics/ Engineering Practice	1 0	0 0	4 4	3 2
	TOTAL	**20/21**	**1**	**12**	**26/27**

B.Tech. II – Semester Courses

CODE	COURSE	L	T	P	Credits
HM 102	Professional Communication	3	0	0	3
MA 102	Mathematics – II	3	1	0	4
PH 102	Physics – II (Theory & Lab)	3	0	3	4
CH 102	Chemistry – II (Theory & Lab)	3	0	3	4
CC 102	Energy and Environmental Engineering	2	0	0	2
** 102	Departmental Core (Next Table)	3	1/0	0	4/3
MP 101/ PR 101	Engineering Graphics/ Engineering Practice	1 0	0 0	4 4	3 2
	TOTAL	**18/17**	**2/1**	**10**	**24/23 or 23/22**

Department Core Course

Sl.NO	Department	Core Course	L	T	P	Credits
1	CE	CE 102 Engineering Mechanics	3	1	0	4
2	Ch.E	CL 102 Strength of materials	3	1	0	4
3	CSE	CS 102 Discrete Structures	3	1	0	4
4	ECE	ME 102 Engineering Mechanics	3	1	0	4
5	EEE	EE 102 Electron Devices	3	1	0	4
6	ICE	IC 102 Engineering Mechanics	3	1	0	4
7	ME	ME 102 Engineering Mechanics	3	1	0	4
8	MME	ME 102 Engineering Mechanics	3	1	0	4
9	PE	PR 102 Engineering Mechanics	3	1	0	4

HM 101 ENGLISH FOR COMMUNICATION

Objective

The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for academic and social needs.

Course Material

Instruction will be provided through appropriate material – articles from popular magazines, newspapers, technical journals, samples from industries and also text books. Practice in the four language skills necessary for their specific technical requirements will be provided in an integrated manner.

Course Content

Communication An introduction - Its role and importance in the corporate world – Tools of communication – Barriers – Levels of communication – English for Specific purposes and English for technical purposes.

Listening Listening process & practice – Exposure to recorded & structured talks, class room lectures – Problems in comprehension & retention – Note-taking practice – Listening tests- Importance of listening in the corporate world.

Reading Introduction of different kinds of reading materials: technical & non-technical – Different reading strategies: skimming, scanning, inferring, predicting and responding to content – Guessing from context – Note making – Vocabulary extension.

Speaking Barriers to speaking – Building self-confidence & fluency – Conversation practice- Improving responding capacity - Extempore speech practice – Speech assessment.

Writing Effective writing practice – Vocabulary expansion - Effective sentences: role of acceptability, appropriateness, brevity & clarity in writing – Cohesion & coherence in writing –Writing of definitions, descriptions & instructions - Paragraph writing - Introduction to report writing.

Outcome

The students will be able to express themselves in a meaningful manner to different levels of people in their academic and social domains.

Text Books

1. *Krishna Mohan and Meenakshi Raman 'Effective English Communication', Tata McGraw Hill, New Delhi, 2000.*
2. *Meenakshi Raman and Sangeetha Sharma 'Technical Communication', Oxford University Press, New Delhi, 2006.*

Reference Books

1. *M. Ashraf Rizvi 'Effective Technical Communication', Tata McGraw-Hill, New Delhi, 2005.*
2. *Golding S.R. 'Common Errors in English Language', Macmillan, 1978.*
3. *Christopher Turk 'Effective Speaking', E & FN Spon, London, 1985.*

MA 101 MATHEMATICS - I

Objective

To acquire fundamental knowledge and apply in engineering disciplines.

Course Content

Characteristic equation of a matrix –Eigen values and Eigen vectors – Properties of Eigen values – Diagonalization of matrix – Cayley-Hamilton Theorem (without proof) verification – Finding Inverse and Power of a matrix using it – Quadratic form – Definite and indefinite forms – Orthogonal reduction of quadratic form to canonical form.

Sequences of real numbers – Limit of a sequence – Convergent and divergent sequences– sub sequence- Cauchy's sequence – monotone convergence theorem (without proof)- Sequence with recurrence relations.

Infinite series-Convergence Tests for positive term series – Comparison, Root, Ratio and Raabe's tests - Alternating series – Leibnitz's rule – Absolute and Conditional Convergence. Riemann rearrangement theorem (without proof).

Functions of several variables – Partial derivatives and Transformation of variables – Jacobian and its Properties- Maxima and Minima of function of two variables.

Double integral – Changing the order of Integration – Change of variables from Cartesian to Polar Coordinates – Area using double integral in Cartesian and Polar Coordinates – Triple integral – Change of Variables from Cartesian to Spherical and Cylindrical Coordinates – Volume using double and triple integrals.

Outcome

After the completion of the course, students would be able to solve curriculum problems.

Text Books

1. *Kreyszig, E., 'Advanced Engineering Mathematics', 9th edition, John Wiley Sons, 2006.*
2. *Grewal, B.S., 'Higher Engineering Mathematics', 42nd edition, Khanna Publications, Delhi, 2012.*
3. *M K Venkataraman, 'Engineering mathematics', Volume I, 2nd ed., National Publishing Co, 2003.*

Reference Books

1. *Apostol, T.M. 'Calculus' Volume I & II Second Edition, John Wiley & Sons (Asia) 2005.*
2. *Greenberg, M.D. 'Advanced Engineering Mathematics', Second Edition, Pearson Education Inc. (First Indian reprint), 2002*
3. *Strauss. M.J, Bradley, G.L. and Smith, K.J. 'Calculus', 3rd Edition, Prentice Hall, 2002.*
4. *T Veerarajan, 'Engg Mathematics' McGraw-Hill Education (India) Pvt Limited, 2007*

PH 101 PHYSICS - I

(Common to all branches)

Objectives

- To make a bridge between the physics in school and engineering courses.
- To introduce the basic concepts of modern science like Photonics, Engineering applications of acoustics, fundamentals of crystal physics and materials science.

Course Content

Lasers

Introduction to Laser-characteristics of Lasers-Spontaneous and stimulated emissions – Einstein's coefficients – population inversion and lasing action – laser systems: Ruby laser, He-Ne Laser, semiconductor laser-applications:–Holography- CD-drive – industrial and medical applications.

Fiber Optics

Fermat's principle and Snell's law-optical fiber – principle and construction – acceptance cone - numerical aperture - V-Number - types of fibers, Fabrication: Double Crucible Technique, Vapour phase Oxidation Process – fiber optic communication principle – fiber optic sensors-other applications of optical fibers.

Acoustics

Characteristics of musical sound – loudness – Weber-Fechner law – decibel – absorption coefficient – reverberation – reverberation time – Sabine's formula – acoustics of buildings – ultrasonics – production of ultrasonics using piezoelectric method –magnetostriction method- applications.

Crystallography

Crystalline and amorphous solids – lattice and unit cell – seven crystal system and Bravais lattices – symmetry operation – Miller indices – atomic radius – coordination number – packing factor calculation for sc, bcc, fcc – Bragg's law of X-ray diffraction –Laue Method-powder crystal method.

Magnetic materials, conductors and superconductors

Magnetic materials: Definition of terms – classification of magnetic materials and properties – Domain theory of ferromagnetism- hard and soft magnetic materials – applications.
Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity
Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory (qualitative) – high temperature superconductors – Josephson effect – quantum interference (qualitative) – SQUID – applications.

Outcome

The student will be able to understand many modern devices and technologies based on lasers and optical fibers. Student can also appreciate various material properties which are used in engineering applications and devices.

Text Books

1. *'A text book of Engineering Physics', M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi (2009).*
2. *'Engineering Physics', R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8^{th} edn., New Delhi (2001).*

Reference Books

1. *Laser Fundamentals, William T. Silfvast, 2^{nd} edn, Cambridge University press, New York (2004)*
2. *Fundamentals of Physics, 6^{th} Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York (2001).*
3. *Introduction to solid state physics,7^{th} Edn, Charls Kittel, Wiley, Delhi (2007)*

Laboratory Experiments

1. Torsional pendulum
2. Numerical aperture of an optical fiber
3. Temperature measurement - Thermocouple
4. Specific rotation of a liquid – Half Shade Polarimeter
5. Thickness of a thin wire – Air Wedge
6. Conversion of galvanometer into ammeter and voltmeter
7. Dispersive power of a prism – Spectrometer
8. Superconductivity- measurement of transition temperature
9. Absorption spectrometer
10. Brewster's Angle measurement
11. Measurement of Young's modulus

Reference Books

1. *'Practical Physics', R.K. Shukla, Anchal Srivastava, New age international (2011)*
2. *'B.Sc. Practical Physics', C.L Arora, S. Chand &Co. (2012)*

CH 101 CHEMISTRY - I

(Common to all branches)

Objectives

To introduce students to water chemistry, bonding concepts, entropy and basic organic chemistry.

Course Content

Water

Sources, hard & soft water, estimation of hardness by EDTA method, softening of water, zeolite process & demineralization by ion exchangers, boiler feed water, internal treatment methods, specifications for drinking water, BIS & WHO standards, treatment of water for domestic use, desalination - Reverse osmosis & Electrodialysis.

Chemical Bonding

Basic concepts, bonding in metals, electron gas theory, physical properties of metals (electrical & thermal conductivity, opaque & lusture, malleability & ductility), Alloy-substitutional alloys, interstitial alloys.

Coordinate bond, EAN rule, 16 & 18 electron rule, crystal field theory, splitting of 'd' orbitals in octahedral, tetrahedral and square planar complexes.

Shape & Intermolecular Interactions

Shape-Lewis dot structures, formal charge, VSEPR method, consequences of shape, dipole moment, valence bond theory; Intermolecular interactions-ion ion interactions, ion-dipole interactions, hydrogen bonding, dipole-dipole interactions, London / dispersion forces, relative strength of intermolecular forces; Consequences-surface tension.

Thermodynamics

Entropy as a thermodynamic quantity, entropy changes in isothermal expansion of an ideal gas, reversible and irreversible processes, physical transformations, work & free energy functions, Helmholtz and Gibbs free energy functions, Gibbs-Helmholtz equation, Gibbs-Duhem equation, Clapeyron-Clausius equation & its applications, Van't Hoff isotherm and applications.

Fuels & Lubricants

Fuels - Classification, examples, relative merits, types of coal, determination of calorific value of solid fuels, Bomb calorimeter, theoretical oxygen requirement for combustion, proximate & ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems. Lubricants - Definition, theories of lubrication, characteristics of lubricants, viscosity, viscosity index, oiliness, pour point, cloud point, flash point, fire point, additives to lubricants, Solid lubricants.

Outcome

Students will learn about quality of water, bonding theories, entropy change for various processes and basic stereo chemical aspects.

Text Books

1. *'Engineering Chemistry', P.C. Jain, M. Jain, Dhanpat Rai Publishing Company, New Delhi, 2005.*
2. *'Physical Chemistry', P. Atkins, J.D. Paula, Oxford University Press, 2002.*

Reference Books

1. *'Modern Inorganic Chemistry', R.D. Madan, S. Chand & Company Ltd., New Delhi, 2012.*
2. *'Engineering Chemistry', M.J. Shultz, Cengage Learning, New Delhi, 2007.*

Laboratory Experiments

1. Estimation of total alkalinity in the given water sample.
2. Estimation of carbonate, non-carbonate and total hardness in the given water sample.
3. Estimation of dissolved oxygen in the given water sample.
4. Determination of the percentage of Fe in the given steel sample.
5. Estimation of Ca in limestone.
6. Estimation of Fe^{3+} by spectrophotometer.

Reference Books

1. *Laboratory Manual, Department of Chemistry, NITT*
2. *Laboratory Manual on Engineering Chemistry, S.K. Bhasin, S. Rani, Dhanpat Rai Publishing Company, New Delhi, 2011.*

CS 101 BASICS OF PROGRAMMING

Objectives

- To learn the fundamentals of computers.
- To learn the problem solving techniques writing algorithms and procedures.
- To learn the syntax and semantics for C programming language
- To develop the C code for simple logic
- To understand the constructs of structured programming including conditionals and iterations

Course Content

Introduction to computers – Computer Organization – Characteristics – Hardware and Software – Modes of operation – Types of programming languages – Developing a program.

Algorithms – Characteristics – Flowcharts - Principles of Structured programming – Sequential, selective structures - Repetitive structures –Bounded , Unbounded and Infinite iterations – Examples for each.

Introduction to C – C character set – Identifiers and Keywords – Datatypes – Constants – Variables – Declarations – Expressions – Statements – Symbolic constants – Operators– Library functions – Data input and output: Single character input and output – Entering input data – Writing output data – gets and puts functions. Control statements – Branching: if-else – Looping: while – do-while – for; Nested control structures – switch statement – break statement – continue statement – comma operator – goto statement.

Modular Programming – Functions and Procedures – Examples – Parameter passing methods.

Arrays – Defining an array – Processing an array – Multidimensional arrays-Pointers – Variable definitions and initialization – Pointer operators – Pointer expressions and arithmetic – Pointers and one-dimensional arrays- Functions – Defining a function – Accessing a function – Function prototypes – Passing arguments to a function –Passing arrays to a function – Passing pointers to a function – Recursion.

Outcome

1. Ability to write algorithms for problems
2. Knowledge of the syntax and semantics of C programming language
3. Ability to code a given logic in C language
4. Knowledge in using C language for solving problems

Text Books

1. *Byron Gottfried, 'Programming with C', Third Edition, Tata McGraw Hill Education, 2010.*
2. *R.G.Dromey, 'How to Solve it By Computers?', Prentice Hall, 2001*

Reference Books

1. *J.R. Hanly and E.B. Koffman, 'Problem Solving and Program Design in C', 6th Edition, Pearson Education, 2009.*
2. *Paul Deital and Harvey Deital, 'C How to Program', Seventh Edition, Prentice Hall, 2012.*
3. *Yashavant Kanetkar, 'Let Us C', 12th Edition, BPB Publications, 2012.*

Laboratory Experiments

1. Programs using sequence construct
2. Programs using selection construct
3. Programs using Iterative construct
4. Programs using nested for loops
5. Programs using functions with Pass by value
6. Programs using functions with Pass by reference
7. Programs using recursive functions
8. Programs using one dimensional Array
9. Programs using two dimensional Arrays
10. Programs using Pointers and functions
11. Programs using Pointers and Arrays

BS 101 BRANCH SPECIFIC COURSE

Curriculum and Assessments will be decided by the respective departments

BE I 101 BASIC CIVIL ENGINEERING

(All Branches except CE)

Objectives

- To give an overview of the fundamentals of the Civil Engineering fields to the students of all branches of Engineering
- To realize the importance of the Civil Engineering Profession in fulfilling societal needs

Course Content

Properties and uses of construction materials - stones, bricks, cement, concrete and steel.

Site selection for buildings - Component of building - Foundation- Shallow and deep foundations - Brick and stone masonry - Plastering - Lintels, beams and columns - Roofs.

Roads-Classification of Rural and urban Roads- Pavement Materials-Traffic signs and road marking-Traffic Signals.

Surveying - Classification-Chain Survey-Ranging-Compass Survey-exhibition of different survey equipment.

Sources of Water - Dams- Water Supply-Quality of Water-Wastewater Treatment – Sea Water Intrusion – Recharge of Ground Water.

Outcome

1. The students will gain knowledge on site selection, construction materials, components of buildings, roads and water resources
2. A basic appreciation of multidisciplinary approach when involved in Civil Related Projects.

Reference Books

1. *Punmia, B.C, Ashok Kumar Jain, Arun Kumar Jain, 'Basic Civil Engineering', Lakshmi Publishers, 2012.*
2. *Satheesh Gopi, 'Basic Civil Engineering', Pearson Publishers, 2009.*
3. *Rangwala, S.C, 'Building materials', Charotar Publishing House, Pvt. Limited, Edition 27, 2009.*
4. *Palanichamy,M.S, 'Basic Civil Engineering', Tata Mc Graw Hill, 2000.*
5. *Lecture notes prepared by Department of Civil Engineering, NITT.*

BE II 101 BASIC MECHANICAL ENGINEERING

(For CE, EEE, ECE, ICE & CSE)

Objectives

- To explain the importance of concepts of mechanical engineering and conservation equations.
- To introduce the techniques for analyzing the forces, momentum and power.
- To introduce the various properties of materials, and the techniques of selection of materials.
- To identify the basic elements of a mechanical system and write their constitutive equations and performance analysis techniques.

Course Content

Fundamentals Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

Thermal Engineering Laws of thermodynamics, types of systems, concepts and types of I.C. engine, air compressors, principle of turbomachines, properties of steam and steam generators, automobile engineering, introduction to gas turbines and refrigeration & air-conditioning.

Engineering Materials Types of materials, selection of materials, material properties, introduction to materials structure, machine elements, transmission, fasteners, and support systems.

Manufacturing Technology Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

Outcome

The terminal objectives of the course is that, on successful completion of teaching-learning and evaluation activities, a student would be able to identify, appreciate and analyze the problems by applying the fundamentals of mechanical engineering and to proceed for the development of the mechanical systems.

Reference Books

1. *Lecture notes prepared by Department of Mechanical Engineering, NITT.*
2. *K. Venugopal, 'Basic mechanical Engineering'.*

BE III 101 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

(For PE, ME, MME, CE,Ch.E)

Objectives

This course aims to equip the students with a basic understanding of Electrical circuits and machines for specific types of applications. The course gives a comprehensive exposure to house wiring. This course also equips students with an ability to understand basics of analog and digital electronics.

Course content

DC & AC Circuits: Current, voltage, power, Kirchhoff's Laws - circuit elements R, L and C, phasor diagram, impedance, real and reactive power in single phase circuits.

DC & AC Machines: DC Motor, Induction motor, Synchronous motor, Synchronous generator and Transformers- construction, principle of operation, types and applications.

House wiring & safety: Single phase and three phase system – phase, neutral and earth, basic house wring - tools and components, different types of wiring – staircase, florescent lamp and ceiling fan, basic safety measures at home and industry.

Analog Electronics: semiconductor devices – p-n junction diode, Zener diode, BJT, operational amplifier – principle of operation and applications – Introduction to UPS.

Digital Electronics: Introduction to numbers systems, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.

Outcome

The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines, house wiring and basics of electronics and be able to apply them in practical situation.

Text Books

1. *Hughes revised by Mckenzie Smith with John Hilcy and Keith Brown, 'Electrical and Electronics Technology', 8^{th} Edition, Pearson, 2012.*

Reference Books

1. *R.J. Smith, R.C. Dorf, 'Circuits Devices and Systems', 5^{th} Edition, John Wiley and sons, 2001.*
2. *P. S. Dhogal, ' Basic Electrical Engineering – Vol. I & II', 42^{nd} Reprint, Mc Graw Hill, 2012.*
3. *Malvino, A. P., Leach D. P. and Gowtham Sha, 'Digital Principles and Applications', 6^{th} Edition, Tata Mc Graw Hill, 2007.*
4. *Vincent Del Toro, 'Electrical Engineering Fundamental', Prentice Hall India, 2002.*

MP 101 ENGINEERING GRAPHICS

Objectives

- Irrespective of engineering discipline, it has become mandatory to know the basics of Engineering graphics. The student is expected to possess the efficient drafting skill depending on the operational function in order to perform day to day activity.
- Provide neat structure of industrial drawing
- Enables the knowledge about position of the component and its forms Interpretation of technical graphics assemblies
- Preparation of machine components and related parts

Course Content

Fundamentals Drawing standard - BIS, dimensioning, lettering, type of lines, scaling-conventions.

Geometrical constructions Dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and hexagon – conic sections – ellipse – parabola – hyperbola - cycloid – trochoid.

Orthographic projection Introduction to orthographic projection, drawing orthographic views of objects from their isometric views - Orthographic projections of points lying in four quadrants, Orthographic projection of lines parallel and inclined to one or both planes Orthographic projection of planes inclined to one or both planes. Projections of simple solids - axis perpendicular to HP, axis perpendicular to VP and axis inclined to one or both planes.

Sectioning of solids Section planes perpendicular to one plane and parallel or inclined to other plane.

Intersection of surfaces Intersection of cylinder & cylinder, intersection of cylinder & cone, and intersection of prisms.

Development of surfaces Development of prisms, pyramids and cylindrical & conical surfaces.

Isometric and perspective projection Isometric projection and isometric views of different planes and simple solids, introduction to perspective projection.

Computer aided drafting Introduction to computer aided drafting package to make 2-D drawings.

Self-study only, not to be included in examinations. Demonstration purpose only, not to be included in

Outcome

Towards the end of the course it is expected that the students would be matured to visualize the engineering components. A number of chosen problems will be solved to illustrate the concepts clearly.

Text Books

1. *Bhatt, N. D. and Panchal, V.M., 'Engineering Drawing', Pub.: Charotar Publishing House, 2010.*
2. *Natarajan, K. V., 'A text book of Engineering Graphics', Pub.: Dhanalakshmi Publishers, Chennai, 2006.*

Reference Books

1. *Venugopal, K. and Prabhu Raja, V., 'Engineering Drawing and Graphics + AutoCAD', Pub.: New Age International, 2009.*
2. *Jolhe, D. A., 'Engineering drawing', Pub.: Tata McGraw Hill, 2008*
3. *Shah, M. B. and Rana, B. C., 'Engineering Drawing', Pub.: Pearson Education, 2009.*
4. *Trymbaka Murthy, S., 'Computer Aided Engineering Drawing', Pub.: I.K. International Publishing House, 2009.*

PR 101 ENGINEERING PRACTICE

Objectives

Introduction to the use of tools and machinery in Carpentry, Welding, Foundry, Fitting and Sheet Metal Working.

Carpentry

Wood sizing exercise in planning, marking, sawing, chiseling and grooving to make

1. Half lap joint
2. Cross lap joint

Welding

Exercise in arc welding for making

1. Lap joint
2. Butt joint

Foundry

Preparation of sand mould for the following

1. Flange
2. Anvil

Fitting

Preparation of joints, markings, cutting and filling for making

1. V-joint
2. T-joint

Sheet metal

Making of small parts using sheet metal

1. Tray
2. Funnel

HM 102 PROFESSIONAL COMMUNICATION

Objectives

The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs.

Course Material

Instruction will be provided through appropriate material – articles from popular magazines, newspapers, technical journals, samples from industries and also text books. Practice in the four language skills will be provided in an integrated manner.

Course Content

Listening Barriers to listening: Physical & psychological – Steps to overcome them – Purposive listening practice – Active listening and anticipating the speaker – Use of technology in the professional world.

Speaking Fluency & accuracy in speech – Positive thinking – Kinds of thinking -Improving self-expression – Tonal variations – Listener oriented speaking -Group discussion practice – Interpersonal Conversation -Developing persuasive speaking skills.

Reading Speed reading practice – Use of extensive readers –Trans-coding: verbal and non-verbal – Eye-reading practice – Analytical and critical reading practice- Introduction to ethics & values through case-study materials.

Writing Professional Correspondence – Formal and informal letters – Argument Writing practice – Perspectives in writing – Narrative writing -Different registers - Tone in formal writing – Summary writing practice- Introduction to reports.

Study Skills Reference Skills - Use of dictionary, thesaurus etc – Importance of contents page, cover & back pages – Bibliography.

Outcome

The students will have knowledge of the various uses of English in their professional environment and they will be able to communicate themselves effectively in their chosen profession.

Reference Books

1. *Shirley Taylor (1999), 'Communication for Business', Longman, New Delhi.*
2. *Robert Gannon (2000), 'Best Science Writing: Readings and Insights', University Press, Hyderabad.*
3. *Richard A. Boning (1990), 'Multiple Reading Skills', McGraw Hill, Singapore.*
4. *Albert J. Harris, Edward R.Sipay (1990), 'How to Increase Reading Ability', Longman.*
5. *David Martin (1994), 'Tough Talking', University press, Hyderabad.*

MA102 MATHEMATICS- II

Objectives To learn mathematical concepts and methods.

Course Content

Vector space – Subspaces – Linear dependence and independence – Spanning of a subspace – Basis and Dimension. Inner product – Inner product spaces – Orthogonal and orthonormal basis – Gram- Schmidt orthogonalization process.

Basic review of first order differential equation - Higher order linear differential equations with constant coefficients –Particular integrals for $x^n e^{ax}$, $e^{ax}\cos(bx)$, $e^{ax}\sin(bx)$ –

Equation reducible to linear equations with constant coefficients using $x\,e^t$ - Simultaneous linear equations with constant coefficients – Method of variation of parameters – Applications – Electric circuit problems.

Gradient, Divergence and Curl – Directional Derivative – Tangent Plane and normal to surfaces – Angle between surfaces –Solenoidal and irrotational fields – Line, surface and volume integrals – Green's Theorem, Stokes' Theorem and Gauss Divergence Theorem (all without proof) – Verification and applications of these theorems.

Analytic functions – Cauchy – Riemann equations (Cartesian and polar) –Properties of analytic functions – Construction of analytic functions given real or imaginary part –

Conformal mapping of standard elementary functions (z^2, e^z, sin z, cos z, z+ $\frac{k^2}{z}$) and bilinear transformation.

Cauchy's integral theorem, Cauchy's integral formula and for derivatives– Taylor's and Laurent's expansions (without proof) – Singularities – Residues – Cauchy's residue theorem – Contour integration involving unit circle.

Outcome

After the completion of the course, students are able to solve industrially applicable problems.

Text Books

1. *Kreyszig, E., Advanced Engineering Mathematics, 9th edition, John Wiley Sons, 2006.*
2. *Grewal, B.S., 'Higher Engineering Mathematics', 42nd edition, Khanna Publications, Delhi, 2012.*
3. *Hsiung, C.Y. and Mao, G. Y. 'Linear Algebra', World Scientific Pub Co Inc., 1999.*

Reference Books

1. *Apostol, T.M. 'Calculus', Volume I & II, 2nd Edition, John Wiley & Sons (Asia), 2005.*
2. *Greenberg, M.D. 'Advanced Engineering Mathematics', 2nd Edition, Pearson Education Inc. (First Indian reprint), 2002.*
3. *Strauss. M.J, Bradley, G.L. and Smith, K.J. 'Calculus', 3rd Edition, Prentice Hall, 2002.*
4. *Venkataraman, M. K. 'Linear Algebra', The National Publishing Co, 1999*

PH 102(A) PHYSICS - II
(Circuit Branches)

Objectives

- To make a bridge between the physics in school and engineering courses.
- To introduce the basic concepts of modern physics like fundamentals of quantum mechanics, nuclear physics and advanced materials.
- To introduce fundamental physics like electrodynamics and semiconductor physics for circuit branch students.

Course Content

Quantum Mechanics

Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigenfunctions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics

Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-lives - application in determining the age of rock and fossils- Stellar nucleosynthesis. Fundamental forces - Particle physics - classification of matter - quark model - neutrino properties and their detection.

Advanced Materials

Nanomaterials: Introduction and properties – synthesis – chemical vapour deposition – ball milling – applications. Carbon nanotubes: structure and properties – synthesis– arc method – Pulsed laser deposition- applications.

Liquid Crystals: Types – Nematic, Cholesteric, Smectic – Modes: Dynamic scattering, Twisted nematic – Display systems.

Shape memory alloys one way and two way memory effect- pseudoelasticity- applications

Electrodynamics

Electrostatics: Coulomb's law - Gauss's law – proof of Gauss's law- Electrostatic filed in matter - dielectric polarization, polarizability and susceptibility - types of polarization – internal field and Claussius-Mosotti equation. Magetostatics: Lorentz force -Steady current and equation of continuity - Biot-Savart law – Ampere's law –Magnetostatic field in matter: torques and forces on magnetic dipoles-Magnetization-Faraday's law of induction – Maxwell's equations: generalization of Ampere's law –– propagation of EM waves in free space.

Semiconductor Physics

Introduction-Direct and indirect band gap semiconductors - Intrinsic semiconductor at 0 K-Intrinsic semiconductor at room temperature-Intrinsic carriers- Electron and Hole concentrations-doping-n-type – p-type-temperature variation of carrier concentration in extrinsic semiconductor-Extrinsic conductivity-Law of Mass action-Charge neutrality-Fermi level in extrinsic semiconductors-Electrical conduction in extrinsic semiconductors-Hall effect.

Outcome

The student will be able to understand fundamentals of electrodynamics and semiconductor physics which is base of many modern devices and technologies. Student will also get an exposure to modern physics topics like nuclear physics, nanotechnology and advanced materials.

Text Books

1. *'A text book of Engineering Physics', M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi 2009.*
2. *'Engineering Physics', R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8^{th} ed., New Delhi 2001.*

Reference Books

1. *'Concepts of Modern Physics'. Arthur Beiser, Tata McGraw-Hill, New Delhi 2010.*
2. *'Semiconductor Physics and Devices: Basic principle', Donald A. Neamen 4^{th} ed,, McGraw-Hill, New York 2012.*
3. *'Introduction to Electrodynamics', David J. Griffiths, 3^{rd} ed, Printice Hall of India, New Delhi 2012.*
4. *'Introduction to Nanotechnology', C.P. Poole and F.J. Owens, Wiley, New Delhi 2007.*
5. *'Introduction to Liquid Crystals Chemistry and Physics',* 2^{nd} ed, *Peter J. Collings, Princeton University Press, New Jersey, 2002.*
6. *'Shape memory alloys-modeling and engineering applications', Ed. D. C. Lagoudas, Springer, New York 2008.*

PH 102(B) PHYSICS - II

(Non-Circuit Branches)

Objectives

- To make a bridge between the physics in school and engineering courses
- To introduce the basic concepts of modern physics like fundamentals of quantum mechanics, nuclear physics and advanced materials.
- To introduce the concepts of NDT and Vacuum Technology.

Course content

Quantum Mechanics

Inadequacy of classical mechanics (black body radiation, photoelectric effect) – wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction –

Heisenberg's uncertainty principle – Schrodinger's wave equation – eigenvalues and eigen functions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics

Fundamental forces - Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half lives - application in determining the age of rock and fossils- Neutrons and its applications (neutron diffraction, nuclear reaction etc)- Stellar nucleosynthesis. Particle physics - classification of matter - quark model-neutrino properties and their detection.

Advanced Materials

Nanomaterials - Introduction and properties – synthesis – chemical vapour deposition – ball milling – applications. Carbon nanotubes: structure and properties – synthesis– arc method – pulsed laser deposition- applications.

Liquid Crystal types – nematic, cholesteric, smectic – modes: dynamic scattering, twisted nematic – display systems.

Shape memory alloys-one way and two way memory effect- pseudoelasticity-applications

Non-Destructive Testing

Principle of ultrasonic testing – inspection methods – different types of scans – liquid penetrant testing – magnetic particle inspection – principle and types of radiography – exposure factor – attenuation of radiation – real time radiography – principle of thermography – thermographic camera – advantages and limitations of all methods.

Vacuum Technology

Introduction-Exhaust pump and their characteristics-different types of pumps-rotary vane pump-roots pump-diffusion pump-turbo-molecular pump-measurement of low pressure-pirani gauge-penning guage - applications of vacuum technology - thin film deposition: thermal evaporation-sputtering.

Outcome

Student will get an exposure to most modern and advanced concepts in nuclear physics, nanotechnology and advanced materials. Study of basic concept of NDT is very important for a modern engineer.

Text Books

1. *'A text book of Engineering Physics', M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, New Delhi 2009.*

2. *'Engineering Physics', R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8^{th} ed., New Delhi 2001.*

Reference Books

1. *'Concepts of Modern Physics. Arthur Beiser', Tata McGraw-Hill, New Delhi 2010.*
2. *'Hand Book of Non-destructive evaluation', C.J. Hellier, McGraw-Hill, New York 2001.*
3. *'Vacuum Science and Technology', V.V. Rao, T.B. Ghosh, K.L. Chopra, Allied Publishers, New Delhi 2008.*
4. *'Introduction to Nanotechnology', C.P. Poole and F.J. Owens, Wiley, New Delhi 2007.*
5. *'Introduction to Liquid Crystals Chemistry and Physics',* 2^{nd} Ed, *Peter J. Collings, Princeton University Press, New Jersey, 2002.*
6. *D. C. Lagoudas 'Shape memory alloys - modeling and engineering applications', Ed., Springer, New York 2008.*

Laboratory Experiments

1. Wavelength of sodium light – Newton's rings
2. Thermal conductivity –Lee's Disc
3. Wavelength of mercury spectrum – Spectrometer
4. Calibration of Voltmeter – Potentiometer
5. Wavelength of laser using diffraction grating
6. Field along the axis of a Circular coil
7. Non-destructive testing by ultrasonic flaw detector.
8. GM counter experiment
9. Zeeman effect experiment
10. Millikan's oil drop experiment
11. Kunds tube experiment

Reference Books

1. *R.K. Shukla, Anchal Srivastava ,'Practical Physics' , New age international 2011.*
2. *C.L Arora 'B.Sc. Practical Physics', S. Chand &Co, 2012.*

CH 102(A) CHEMISTRY - II

(For CSE, ECE, EEE and ICE)

Objectives

To introduce the students to basic principles of electrochemistry, cell construction and evaluation, electrochemical power sources, the importance of corrosion in metal/alloy and polymer.

Course Content

Electrochemistry

Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, Weston standard cell, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference.

Corrosion

Dry corrosion and wet corrosion, mechanisms, types of corrosion, DMC, DAC, stress, inter granular, atmospheric and soil corrosion, Passivity, Polarization, over potential and its significance, Factors affecting corrosion, protection from corrosion by metallic coatings, electroplating, electroless plating and cathodic protection, Chemical conversion coatings and organic coatings- Paints, enamels.

Batteries

Different types of batteries-Primary, Secondary & Flow battery and Fuel cell. Working principle and uses-Laclanche cell, alkaline battery, nicad battery, lithium battery & Mercury battery. Fuel cell- Theory, working and application. Different types of fuel cells-H2/O2, propane-oxygen, PEFC and SOFC. Lead Acid storage cell-charging & discharging principle, operation and uses. Solar battery- its working principle.

Solid State

Types of solids - close packing of atoms and ions - bcc , fcc structures of rock salt - cesium chloride- spinel - normal and inverse spinels, Stoichiometric Defect, controlled valency & Chalcogen semiconductors, Non-elemental semiconducting Materials, Preparation of Semiconductors-steps followed during the preparation of highly pure materials and further treatments. Semiconductor Devices-p-n junction diode.

Polymer

Nomenclature, functionality, classification, methods of polymerization, mechanism of polymerization, molecular weight determination-Viscometry, light scattering methods. Plastics-Moulding constituents of a plastics and moulding of plastics into articles. Important thermoplastics and thermosetting resins- synthesis & applications of PVA,

FLUON, PC, Kevlar, ABS polymer, phenolic & amino resins, epoxy resins and polyurethanes. Conductive polymers.

Outcome

Students would become familiar with the important practical applications of electrochemistry, solids, their properties and applications, and the polymer materials.

Text Books

1. *P. C. Jain and M. Jain, 'Engineering Chemistry', Dhanpat Rai Publishing Company, New Delhi, 2005.*
2. *B.R. Puri, L.R. Sharma, M.S. Pathania, 'Principles of Physical Chemistry', Vishal Publishing Company, 2008.*
3. *J. D. Lee, 'Concise Inorganic Chemistry', 5th Edn., Chapman and Hall, London, 1996.*

Reference Books

1. *S. S. Dara, S. S. Umare, 'A Text Book of Engineering Chemistry', S. Chand Publishing, 2011.*
2. *F.W. Billmayer. 'Textbook of Polymer Science', 3^{rd} Edn, Wiley. N.Y. 1991.*
3. *A.R. West, 'Basic Solid State Chemistry', 2^{nd} edition, John Wiley and Sons, 1999.*

CH 102(B) CHEMISTRY - II

(For Civil, Mechanical and Production)

Objectives

To introduce the students to basic principles of electrochemistry, cell construction and evaluation, corrosion, adsorption, phase equilibrium and engineering materials of importance

Electrochemistry

Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, Weston standard cell, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference, fuel cells, hydrox fuel cell.

Corrosion

Dry corrosion and wet corrosion, mechanisms, types of corrosion, DMC, DAC, stress, inter granular, atmospheric and soil corrosion, Passivity, Polarization, over potential and its significance, Factors affecting corrosion, protection from corrosion by metallic coatings, electroplating, electroless plating and cathodic protection, Chemical conversion coatings and organic coatings- Paints, enamels.

Surface Chemistry

Adsorption – types – adsorption of gases on solids – adsorption isotherm – Freundlich and Langmuir isotherms – adsorption of solutes from solutions – role of adsorbents – activated carbon in pollution abatement of air and waste water. Phase rule: Statement and explanation of the terms involved – one component water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (Pb - Ag system only) – alloys – importance, ferrous alloys – nichrome, and stainless steel, non-ferrous alloys – brass and bronze – heat treatment of alloys.

Engineering Materials

Abrasives – Moh's scale of hardness – natural abrasives (diamond, corundum, emery, garnets and quartz) – synthetic abrasives (silicon carbide, boron carbide) – refractories – characteristics – classification (acidic, basic and neutral refractories) – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling)

– manufacture of alumina magnesite and zirconia bricks. Cement - Important Parameters for Manufacturing Cement Clinkers. Chemical Constituents and Composition of Cement. Methods of Manufacture of Cement - Wet and Dry Processes. Additives for Cement. Properties of Cement - Setting and Hardening. Types of Portland Cement.

Polymers and Composites

Concept of macromolecules-Nomenclature of polymers-Tacticity- Polymerization processes- Mechanism-Types of Polymerization-Classification of Polymers-Effect of Polymer structure on properties-Moulding of plastics into articles-Important addition and condensation polymers –synthesis and properties – Molecular mass determination of polymers- Static and dynamic methods, Light scattering and Gel Permeation Chromatography-Rubbers –Vulcanization – Synthetic rubbers – Conducting polymers-Composite materials – Reinforced composites and processing.

Outcome

Students would have learnt the significance of electrochemistry and its application, corrosion, adsorption, engineering materials of importance and polymer.

Text Books

1. *P. C. Jain & M. Jain, 'Engineering Chemistry', Dhanpat Rai Publishing Company, New Delhi, 2005.*
2. *B.R. Puri, L.R. Sharma, M.S. Pathania, 'Principles of Physical Chemistry', Vishal Publishing Company, 2008.*

Reference Books

1. *F.W. Billmayer. 'Textbook of Polymer Science', 3rd Edn, Wiley. N.Y. 1991.*
2. *S. S. Dara, S. S. Umare, 'A Text Book of Engineering Chemistry', S. Chand Publishing, 2011*

CH 102(C) CHEMISTRY - II

(For CHL and MME)

Objectives

To introduce the students to basic principles of electrochemistry, importance of corrosion, spectroscopic techniques, metals, alloys polymers and composites.

Electrochemistry

Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, Weston standard cell, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference, fuel cells, hydrox fuel cell.

Corrosion

Dry corrosion and wet corrosion, mechanisms, types of corrosion, DMC, DAC, stress, inter granular, atmospheric and soil corrosion, Passivity, Polarization, over potential and its significance, Factors affecting corrosion, protection from corrosion by metallic coatings, electroplating, electroless plating and cathodic protection, Chemical conversion coatings and organic coatings- Paints, enamels.

Spectroscopic Techniques

Interaction of Electromagnetic radiation with matter- Born–Oppenheimer approximation-IR Spectroscopy- Instrumentation and Applications-Franck–Condon Principle - Electronic Spectra-Theory of electronic transitions – Instrumentation- Beers Law- Applications – Woodward-Fieser rules for acyclic dienes and unsaturated ketones – NMR Spectroscopy – Shielding and deshielding-Chemical shift-Applications -Atomic absorption and Atomic Emission Fundamentals

Metals and Alloys

Physical Properties of Metals-Theories of Bonding in metals – Free Electron theory – Valance bond theory – MO theory -Metallurgy – different processes involved in isolation and purification of metals from ores-thermodynamics of reduction processes – Isolation of Nickel, Chromium, Tungsten, Uranium, and Iron- Heat Treatment of Steel-Powder metallurgy-Alloy steels –Thermal Analysis-Thermogravimetry-Differential Thermal Analysis-Differential Scanning Calorimetry

Polymers and Composites

Concept of macromolecules-Nomenclature of polymers-Tacticity- Polymerization processes- Mechanism-Types of Polymerization-Classification of Polymers-Effect of Polymer structure on properties-Moulding of plastics into articles-Important addition and condensation polymers –synthesis and properties – Molecular mass determination of polymers- Static and dynamic methods, Light scattering and Gel Permeation Chromatography-Rubbers –Vulcanization – Synthetic rubbers – Conducting polymers-Composite materials – Reinforced composites and processing.

Outcome

Students would become familiar with the importance of electrochemistry, its applications, corrosion, spectroscopic techniques for characterization, importance of properties of metals, alloys polymers and composites.

Text Books

1. *P. C. Jain & M. Jain, 'Engineering Chemistry', Dhanpat Rai Publishing Company, New Delhi, 2005.*
2. *B.R. Puri, L.R. Sharma, M.S. Pathania, 'Principles of Physical Chemistry', Vishal Publishing Company, 2008.*

Reference Books

1. *F.W. Billmayer. 'Textbook of Polymer Science'. 3rd Edn, Wiley. N.Y. 1991.*
2. *C. N. Banwell & E.M. McCash, 'Fundamentals of Molecular Spectroscopy', 4th Edn, Tata Mc Graw-Hill Edition, 1995.*
3. *S. S. Darer, S. S. Umare, 'A Text Book of Engineering Chemistry', S. Chand Publishing, 2011.*

Laboratory Experiments **(for all Branches)**

1. Corrosion rate by polarization technique
2. Conductometric titration
3. Potentiometric titration
4. pH metric titration
5. Percentage purity of bleaching powder
6. Percentage purity of washing soda
7. Determination of molecular weight of polymer by viscometry
8. Demonstration of sophisticated instruments and assignments on them

Reference Books

1. *Laboratory Manual, Department of Chemistry, NITT*
2. *S.K. Bhasin, S. Rani, 'Laboratory Manual on Engineering Chemistry', Dhanpat Rai Publishing Company, New Delhi, 2011.*

CC 102 ENERGY AND ENVIRONMENTAL ENGINEERING

Objective

- To teach the principal renewable energy systems.
- To explore the environmental impact of various energy sources and also the effects of different types of pollutants.

Course Content

Present Energy resources in India and its sustainability - Different type of conventional Power Plant--Energy Demand Scenario in India-Advantage and Disadvantage of conventional Power Plants – Conventional vs Non-conventional power generation

Basics of Solar Energy- Solar Thermal Energy- Solar Photovoltaic- Advantages and Disadvantages-Environmental impacts and safety.

Power and energy from wind turbines- India's wind energy potential- Types of wind turbines- Off shore Wind energy- Environmental benefits and impacts.

Biomass resources-Biomass conversion Technologies- Feedstock preprocessing and treatment methods- Bioenergy program in India-Environmental benefits and impacts.
Geothermal Energy resources –Ocean Thermal Energy Conversion – Tidal.

Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Water pollution-Sources and impacts, Soil pollution-Sources and impacts, disposal of solid waste.

Greenhouse gases – effect, acid rain. Noise pollution. Pollution aspects of various power plants. Fossil fuels and impacts, Industrial and transport emissions- impacts.

Outcome

Students will be introduced to the Principal renewable energy systems and explore the environmental impact of various energy sources and also the effects of different types of pollutants.

Text Books

1. *Boyle, G. 2004.' Renewable energy: Power for a sustainable future'. Oxford University press.*
2. *B H Khan, 'Non Conventional Energy Resources'-The McGraw –Hill Second edition.*
2. *G. D. Rai, 'Non conventional energy sources', Khanna Publishers, New Delhi, 2006.*
3. *Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd Edition, Prentice Hall, 2003.*

References

1. *'Unleashing the Potential of Renewable Energy in India' –World bank report.*
2. *Godfrey Boyle, Bob Everett and Janet Ramage.2010.'Energy Systems and Sustainability. Power for a sustainable future'. Oxford University press.*

CE 102 Engineering Mechanics

Objectives

- To explain the importance of mechanics in the context of engineering and conservation equations
- To explain the significance of centroid, center of gravity and moment of inertia.
- To introduce the techniques for analyzing the forces in the bodies.
- To analyze the internal member forces acting on cables and trusses.
- To understand the basic principles of dynamics.

Course Content

Fundamentals: Mechanics and its relevance, concepts of forces, laws of mechanics – Lami's Theorem, Concept of free-body diagram, centroids, center of gravity, area moment of inertia, mass, moment of inertia.
Friction: Laws of friction, application of laws of friction, wedge friction, body on inclined planes.
Statics: Principles of statics, Types of forces, concurrent and non-concurrent forces, composition of forces, forces in a plane and space, simple stresses and strains, elastic constant.
Cables and Trusses: Cable subjected to concentrated loads, UDL with supports at different levels – analysis of Trusses – method of joints – method of sections.
Dynamics: Principles of dynamics, D'Alembert's principle, conservation of momentum and energy, vibrations of simple systems.

Outcome

The terminal objectives of the course is that, on successful completion of teaching-learning and evaluation activities, a student would be able to identify and analyze the problems by applying the fundamental principles of engineering mechanics and to proceed to research, design and development of various engineering systems.

Text Books

1. *Kumar K.L., Kumar V, 'Engineering Mechanics', Tata McGraw Hill, 2011.*
2. *Rajasekaran S and Sankarasubramanian G, 'Engineering Mechanics Statics and Dynamics', Third Edition, Vikas Publishing House Pvt.Ltd, 2005.*
3. *Timoshenko S, and Young D.H, 'Engineering Mechanics', Tata McGraw Hill, 2006.*

Reference Books

1. *Popov E.P, 'Engineering Mechanics of Solids', Prentice Hall, 1998.*
2. *Shames I.H, and Rao G.K.M, 'Engineering Mechanics – Static and Dynamics', Pearson Education, 2009.*
3. *Beer F.P and Johnson Jr.E.R, 'Vector Mechanics for Engineers', Tata McGraw Hill, 2009.*

CL 102 STRENGTH OF MATERIALS

Objective

To understand the fundamental principles of stress-strain relationship. To understand the estimation of various loads and load distributions on beams. To evaluate the principle stresses & Strains and use of Mohr's Circle. To learn the concepts in design of columns and pressure vessels.

Course Content

Stress (Axial Load): Normal Stress, Shear Stress, Factor of Safety, plane stress, stress components associated with arbitrary oriented faces in plane stress.
Stress Strain Relation : Hook's Law, Poissson's ratio, Strain components, Strain components associated with arbitrary sets of axes, tensile test and elastic stress-strain relation.
Torsion: Basic assumptions, Torsion formla, Hollow and Stepped circular shafts, Angular deflection.
Flexural Loading : Theory of pure bending, Flexural formula, Shear force and Bending moments diagram for different types of loading and support conditions on beams. Transverse shear stress distribution in circular hollow circular, I-box and T, angle sections.
Deflection of beams: Strain curvature and moment curvature relation, Solution of beam deflection problems by Direct integration method, Area moment method, Super position.
Principle Stresses and Strains: Normal and Shear stress, Concept of equivalent bending & equivalent twisting moment, Mohr's circle of Stress and Strain, Strain Rosette's.
Columns: Euler's formula for different end conditions, Concepts of equivalent length, Eccentric loading, Ranking formula.
Pressure Vessels: Thin Pressure vessel , Circumferential and longitudinal stresses in cylindrical shell, spherical shell under internal pressure. Introduction to thick Pressure vessel.

Outcomes

1. Learn fundamental concepts of stress-strain relationship.
2. Learn estimation of Torsion/ Flexural loading on beams.
3. Learn to use the concepts in design of columns and pressure vessels

Text Books & References

1. *Ramamurtham.S, 'Strength of Materials', Dhanpat Rai & Sons, 1991.*
2. *Popov E.P, 'Mechanics of materials' ,Prentice Hall Inc.1984*
3. *Andrew.P and Singer.F.L, 'Strength of materials', Happer & Row Publishers, New York, 1987.*

CS 102 DISCRETE STRUCTURES

Objectives

To get familiar and understand the fundamental notions in discrete mathematics. To understand and demonstrate the basic concept of an algorithm and its application in combinatorial mathematics. To identify the basic properties of graphs and trees and model simple applications

Course Content

Set Theory and Logic- Sets, Functions Relations, Equivalence Relation , Poset. Functions Logic: Propositional Logic, Truth Tables, Tautologies, Resolution Proof System, Predicate Logic.

Induction and Combinatorics- Peano's Axioms – Mathematical Induction – Pigeon Hole Principle – Principle of Inclusion and Exclusion – Review of Permutations and Combinations – Distribution Problems – Derangements – Bijection Principle.

Algebraic Structures – Semi-Groups, Monoids, Groups, Subgroups and their properties – Cyclic groups – Cosets – Permutation Groups – Lagrange's Theorem – Cayley's Theorem – Normal Subgroups – Homomorphism of Groups – Quotient Groups – Introduction to Rings and Fields.

Linear Algebra and Recurrence relations – Linear Algebra: Vector space, Basis, Dimension, Orthogonally, Recurrence Relations: Homogenous and Inhomogenous Recurrences and their solutions – Solving Recurrences using Generating functions.

Graph Theory- Definitions and basic results – Representation of a graph by a matrix and Adjacency list – Trees – Cycles – Properties – Paths and Connectedness – Subgraphs – Graph Isomorphism – Operations on Graphs – Vertex and Edge cuts – Vertex and Edge connectivity.

Outcomes

1. Ability to distinguish between the notion of discrete and continuous mathematical structures
2. Ability to construct and interpret finite state diagrams and DFSA
3. Ability to apply induction and other proof techniques towards problem solving

Text Books

1. *C.L.Liu and D.P.Mohapatra, 'Elements of Discrete Mathematics: A Computer oriented Approach', McGraw Hill, Third Edition, 2012.*
2. *Kenneth H.Rosen, 'Discrete Mathematics and its Applications', McGraw Hill, Seventh Edition, 2012 (Indian Adaptation by Kamala Krithivasan, IIT Madras)*

EE 102 ELECTRON DEVICES

Objective

To educate on the construction and working of common electronic devices and to prepare for application areas.

Course Content

Semiconductor Materials- Semiconductors – Charge carriers, electrons and holes in intrinsic and extrinsic Semiconductors – Hall effect.

Diodes – PN junction – current equation – junction capacitance – breakdown characteristics, Zener, Tunnel, Schottky Diodes

Bipolar Junction Transistors – Characteristics – analysis of CB, CE, CC amplifier configurations.

Unipolar devices – FET, MOSFET, UJT and Opto-Electronic devices – theory and characteristics

Rectifiers and Switched mode power supplies – theory and design, filter circuits, applications.

Outcomes

1. Understanding the semiconductor physics of the intrinsic p and n type materials and various devices and characteristics.
2. Analyze simple diode circuits under DC and AC excitation.
3. Analyze and Design simple amplifier circuits using BJT in CE, CC and CB configurations.
4. Understand the analysis and salient features of CE, CC and CB amplifier circuits.
5. Understand the construction and characteristics of FET, MOSFET and UJT.

Text Books

1. *David, A.Bell, 'Electronic Devices and Circuits', 5th Edition, Prentice Hall Inc, 2008*
2. *Millman and Halkias, 'Electronic Devices and Circuits', McGraw Hill International Student Edition, 5th Reprint, 1993.*
3. *Allen M.Heishead, 'Electronic Devices and Circuits – An Introduction', Prentice Hall Inc, 18th Reprint, 2006.*
4. *Maliro, 'Electronic Principles', PHI*

ME 102 ENGINEERING MECHANICS

(ECE, ME, MME)

Objectives

- To explain the importance of mechanics in the context of engineering and conservation equations.
- To explain the significance of centroid, centre of gravity and moment of inertia. To introduce the techniques for analyzing the forces in the bodies.
- To apply the different principles to study the motion of a body, and concept of relative velocity and acceleration.
- To describe the trajectory of a particle under projectile motion.
- To identify the basic elements of a mechanical system and write their constitutive equations.

Course Content

Fundamentals Mechanics and its relevance, concepts of forces, laws of mechanics - parallelogram law, Lami's theorem, law of polygon, concept of free-body diagram, centroids, center of gravity, area moment of inertia, mass moment of inertia – simple and composite planes, Numerical.

Friction Laws of friction, static friction, rolling friction, application of laws of friction, ladder friction, wedge friction, body on inclined planes, simple screw jack – velocity ratio, mechanical advantage, efficiency, Numerical.

Statics Principles of statics, types of forces, concurrent and non-concurrent forces, composition of forces, forces in a plane and space, simple stresses and strains, elastic coefficients, Numerical.

Kinematics Fundamentals of rectilinear and curvilinear motion, application of general equations, concept of relative velocity, analytical and graphical techniques, Numerical.

Dynamics Principles of dynamics, D'Alembert's principle, conservation of momentum and energy, vibrations of simple systems, Numerical.

Outcome

The terminal objectives of the course is that, on successful completion of teaching-learning and evaluation activities, a student would be able to identify and analyze the problems by applying the fundamental principles of engineering mechanics and to proceed to research, design and development of the mechanical systems.

Text Books

1. *Kumar, K. L., Kumar, V. 'Engineering Mechanics', Pub.: Tata McGraw Hill, 2011.*
2. *Palanichamy, M. S., and Nagan, S., 'Engineering Mechanics – Statics & Dynamics', Pub.: Tata McGraw Hill, 2002.*
3. *Timoshenko, S. and Young, D. H.,' Engineering Mechanics', Pub.: McGraw Hill, 2006.*

Reference Books

1. *Popov, E. P., 'Engineering Mechanics of Solids', Pub.: Prentice Hall, 1998.*
2. *Shames, I. H. and Rao, G. K. M., 'Engineering Mechanics – Static and Dynamics', Pub.: Pearson Education, 2009.*
3. *Beer, F. P., and Johnson Jr. E. R.,' Vector Mechanics for Engineers', Pub.: McGraw Hill, Year of publication: 2009.*
4. *Rao, J. S. and Gupta, K., 'Introductory Course on Theory and Practice of Mechanical Vibrations', Pub.: New Age International, 1999.*

IC102 ENGINEERING MECHANICS

Course Objectives

- To introduce the fundamentals of mechanics and machines in engineering to the instrumentation and control engineering students.
- To explain the application of basic mechanical science concepts
- To apply different physical principles to the analysis of mechanics and machines
- To identify the different elements of a mechanical system and write the mathematical equations for them.

Course Content

Forces and equilibrium – Free body diagram – Forces in equilibrium. Stress and strain – Poisson's ratio – Bulk modulus. Beams – Types of beams – Bending moment and shearing force – Bending stresses. Torsion – Torsion of circular shafts – Transmission of power.
Strain energy – Dynamic loading – Strain energy due to shear – Impact torsional loading – Strain energy due to bending – Impact loading of beams.

Linear and angular motion – Linear motion – Curvilinear motion – Relative velocity – Angular motion – Torque and angular motion – Balancing of rotational masses – Momentum – Work and energy.

Mechanisms – Velocity diagrams – Acceleration diagrams. Flywheels. Machines – Transmission of rotational motion. Geared systems – Gear trains. Friction – Friction clutches. Bearings. Belt drives. Gyroscopic motion – Gyroscopic couple.

Free vibrations – Simple harmonic motion. Linear and torsional vibrations of an elastic system. Transverse vibrations of beams – Whirling of shafts.

Damped and forced oscillations – Free oscillations – Damped oscillations – Undamped forced oscillations – Damped forced oscillations – Degrees of freedom.

Outcomes

After successfully completing this course, the student will be able to

1. Identify simple mechanisms and their principles of operation.
2. Write the mathematical equations for static and dynamic loading in simple mechanical systems.
3. Write the equations for energy and power in simple mechanical systems.
4. Analyze free and forced oscillations in simple dynamic systems.

Textbook

1. *Bolton, W. 'Mechanical Science', 3rd edition. 2006, Wiley-Blackwell Publishing. ISBN:978-1-4051-3794-2*

Reference Books

1. *Shames, Irving H., 'Engineering Mechanics: Statics and Dynamics', 4th edition, Pearson Education, 2006 ISBN: 978-81-7758-123-2.*
2. *Beer, Ferdinand P., Johnston, E. Russel, Mazurek, David F., and Cornwell, Phillip J. 'Vector Mechanics for Engineers: Statics and Dynamics', McGraw- Hill Education (India), 10th edition. 2013, ISBN: 978-12-5906-291-9.*

PR 102 ENGINEERING MECHANICS

Objectives

- To provide a practice in the application of knowledge in science, mathematics and engineering so that students can expand this knowledge in the area of rigid body mechanics.
- To enable students to solve open ended problem in the design of complex system.
- To prepare students for higher level courses such as mechanics of materials, theory of machines, design of machine elements and numerical analysis.

Course Content

Point force and distributed forces- Equivalent systems of Forces – Equilibrium of Rigid Bodies – Free body Diagram – Centroids and Center of Gravity.

Dry Friction, Wedge Friction, Disk Friction (thrust bearing), Belt friction, Square of threaded screw, Journal bearings (Axle friction), Wheel friction, Rolling resistance, Moment of Inertia.

Moving particle in Cartesian, Cylindrical and Path Co-ordinate systems. Translation and Rotation of Rigid bodies. Motion of particles relative to rotating frame.

Newton's Laws of motion for a system of particles: Linear and angular momentum, Central force motion, Work Energy principle, Impulse momentum principles.

Plane motion of a rigid body – Work – Energy and Impulse – Momentum principle for rigid bodies – Applications method of Virtual work – Potential Energy and Equilibrium; Introduction to free vibration and force vibration problems.

Outcome

1. Students will be able to solve problems dealing with forces in plane or in space and equivalent forces systems .
2. An ability to identify, analyse and solve problems related to rigid body mechanics involving friction.
3. The student will understand the fundamentals of laws of motion and their application in the area of dynamics.

Reference Books

1. *Beer, Johnston, Mazurek, Cornwell and Sanghi 'Vector Mechanics for Engineers : Statics and Dynamics (in SI Units)', McGraw Hill Education, 10th edition, 2013.*
2. *Irving H.Shames, 'Engineering Mechanics – Statics and Dynamics', Fourth Edition, Prentice Hall of India PVT.Ltd Eastern Economy Edition, 2001.*
3. *J.L.Meriam and L.G.Kraige, 'Engineering Mechanics', Vol I – Statics, Vol II – Dynamics, 5th edition, John Wiley, 2002.*
4. *R.C.Hibbler, 'Engineering Mechanics', Vol I and II Pearson Press, 2002.*