J. S. UNIVERSITY, SHIKOHABAD

B.TECH

3rd Semester& 4thSemester

(Mechanical Engineering)

SCHEME

&

SYLLABUS

[Effective from the session 2015-16]

STUDY AND EVALUATION SCHEME FOR

B.Tech (Mechanical Engineering).

SEMESTER - THIRD

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTAS-31	Engg Mathematics-III	4	1	-	-	50	100	150	3
2	BTCE-31	Fluid Mechanics	4	1	-	-	50	100	150	3
3	BTME-31	Mechanics of Solids	4	1	-	-	50	100	150	3
4	BTME-32	Material Science	4	1	-	-	50	100	150	3
5	BTME-33	Thermodynamics	4	1	-	-	25	50	75	2
6	BTIP-31	Industrial Psychology	4	1	-	-	25	50	75	2
7	BTAC-31	Human Value & Professional Ethics*	2	-	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTCE-31P	Fluid Mechanics Lab.	-	-	2	-	20	30	50	3
9	BTME-32P	Material Science & Testing Lab.	-	-	2	-	20	30	50	3
10	BTME-34P	Machine Drawing-I	-	-	-	3	20	30	50	3
11	BTME-33P	Thermodynamics Lab.	-	-	2	-	20	30	50	3
12	BTGD-30	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

*Human values & Professional Ethics will be offered as a compulsory audit course for which passing marksare 30% in End Semester Examination and 40% in aggregate.

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

STUDY AND EVALUATION SCHEME FOR

B.Tech (Mechanical Engineering).

SEMESTER - FOURTH

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTOE-41-BTOE-49	Science Based Open Elective	4	1	-	-	50	100	150	3
2	BTEE-45	Electrical Machines & Controls	4	1	-	-	50	100	150	3
3	BTME-41	Applied Thermodynamics	4	1	-	-	50	100	150	3
4	BTME-42	Manufacturing Science & Technology-I	4	1	-	-	50	100	150	3
5	BTME-43	Measurement and Metrology	4	1	-	-	25	50	75	2
6	BTIS-41	Industrial Sociology	4	1	-	-	25	50	75	2
7	BTAC-41	Cyber Security*	2	-	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTEE-45P	Electrical Machines & ControlsLab.	-	-	2	-	20	30	50	3
9	BTME-44P	Machine Drawing II	-	-	-	2	20	30	50	3
10	BTME-45P	Manufacturing Technology I Lab.	-	-	3	-	20	30	50	3
11	BTME-43P	Measurement and Metrology Lab.	-	-	2	-	20	30	50	3
12	BTGD-40	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

*Cyber Security will be offered as a compulsory audit course for which passing marksare 30% in End Semester Examination and 40% in aggregate.

List of Open Electives for B. Tech. Courses

SCIENCE BASED OPEN ELECTIVE

BTOE-041	Introduction to Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
BTOE-042	Nano Sciences
BTOE-043	Laser Systems and Applications
BTOE-044	Space Sciences
BTOE-045	Polymer Science & Technology
BTOE-046	Nuclear Science
BTOE-047	Material Science
BTOE-048	Discrete Mathematics
BTOE-049	Applied Linear Algebra

[BTAS-31] Engg Mathematics-III

Unit – I: Function of Complex variable

Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy'sintegral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities,Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type

Unit – II: Integral Transforms

Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems,Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensionalheat transfer equations, wave equations and Laplace equationsZ- transform and its application to solve difference equations.

Unit – III: Statistical Techniques

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of leastsquares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non –linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests ofsignifications: Chi-square test, t-test

Unit – IV: Numerical Techniques – I

Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi methodand Newton-Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's andNewton's divided difference formula for unequal intervals**.**

Unit – V: Numerical Techniques –II

Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss-Seidal method.Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third andthree-eight rules,Solution of ordinary differential equations (first order,second order and simultaneous) byEuler's, Picard's and fourth-order Runge- Kutta methods.

Test Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.

2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi

Reference Books:-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House,.

2. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.

[BTCE-31] Fluid Mechanics

Unit - I

Fluid and continuum, Physical properties of fluids, Rheology of fluids.

Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and nonuniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance,

Unit - III

Potential Flow: source, sink, doublet and half-body.

Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.

Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies.

Unit - IV

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

Unit - V

Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

Introduction to compressible flow

References :

1. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley &Sons Pvt Ltd,
2. Cengel&Cimbala, "Fluid Mechanics" TMH, New Delhi.

[BTME-31] Mechanics of Solids

UNIT-I

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

UNIT –II

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

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

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

UNIT-III

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

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

UNIT-IV

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

Thick cylinders:

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

UNIT-V

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

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

Books and References :

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of Materials by.Beer, Jhonston, DEwolf and Mazurek, TMH
3. Strength of Materials by Pytel and Singer, Harper Collins
4. Strength of Materials by Ryder, Macmillan.
5. Strength of Materials by Timoshenko and &Yσungs, East West Press.

[BTME-32] Material Science

Unit-I

Introduction : Importance of materials. historical perspective, Brief review of modern & atomic conceptsin Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

Crystallography and Imperfections : Concept of unit cell space lattice, Bravais lattices, common crystalstructures, Atomic packing factor and density. Miller indices.Xray crystallography techniques.Imperfections, Defects & Dislocations in solids.

Unit-II

Mechanical properties and Testing : Stress strain diagram, Ductile & brittle material, Stress vs strength.Toughness, Hardness, Fracture, Fatigue and Creep. Testing of material such as Strength tests, Hardnesstests, Impact tests, Fatigue tests, Creep tests, and Non-destructive testing (NDT).

Microstructural Exam : Microscope principle and methods. Preparation of samples and Microstructureexam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

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

Unit-III

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

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

Diffusion: Diffusion of Solids, Ficks I and II law.

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

Unit-IV

Dielectric Materials: Dielectric Materials and their applications.

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

Electric properties, Semi conductors and Super conductors: Energy band concept of conductor,insulator and semi-conductor. Intrinsic & extrinsic semi-conductors.P-n junction and transistors.Basicdevices and its application.Super conductivity and its applications.Messier effect. Type I& IIsuperconductors. High Tc superconductors.

Unit-V

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

Plastics : Various types of polymers/plastics and its applications. Mechanical behaviour and processingof plastics.Future of plastics.

Other materials : Brief description of other material such as optical and thermal materials, CompositeMaterials and its uses. Introduction to Smart materials & Nano-materials and their potential applications

Performance of materials in service: Brief theoretical consideration of Fracture, Fatigue, and Corrosion and its control.

Books and References:

1. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R. Balasubramaniam), Wiley India Pvt. Ltd.
2. Elements of Material Science & Engineering by Van Vlack, Pearson
3. Materials Science and Engineering - A First Course by Raghavan, PHI

[BTME-33] Thermodynamics

Unit – I:

Fundamental Concepts and Definitions: Introduction- Basic Concepts: System, Control Volume,Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints,Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & InexactDifferentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of IrreversibilityEnergy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law ofcorresponding states, Dalton's law, Amagat's law, Property of mixture of gases.

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

First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work, Displacement work for various non flow processes, Joules' experiment, First law analysis for closedsystem (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I.

Unit – II:

First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steadyflow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. Analysis of unsteadyprocesses such as filling and evacuation of vessels with and without heat transfer.

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency,Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausiusstatement of second law of thermodynamics, Equivalence of the two statements. Reversible andirreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries,Thermodynamic Temperature Scale, PMM-II.

Unit – III

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

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

Unit – IV

Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam), Triplepoint, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phasetransformation process of water, Graphical representation of pressure, volume and temperature, P-T & PVdiagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier chart, Drynessfactor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

Introduction to IC engines: Compression Ignition engines, Spark Ignition engines, 2 stroke and 4 strokeengines, Performance parameters of IC engine, Heat balance sheet.

Books and References:

1. Engineering Thermodynamics by P.K.Nag, TMH
2. Thermodynamics by Shavit and Gutfinger, CRC Press.
3. Thermodynamics- An Engineering Approach by Cengel& Boles, TMH.

[BTCE-31P] Fluid Mechanics Lab

Note: Ensure to conduct at least 10 experiments from the list:

1. To verify the momentum equation using the experimental set-up on impact ofjet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also todetermine the coefficient of velocity and the coefficient of contraction of theorifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient ofdischarge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient ofdischarge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of dischargewith the Reynolds number.
6. To draw a flow-net using Electrical Analogy Method.
7. To study the transition from laminar to turbulent flow and to determine thelower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge byintegrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determinethe boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement
13. To determine the head loss for a sudden Contraction.

[BTME-32P] Material Science & Testing Lab.

(A) Experiments on Material Science (at least 5 of the following):

1. Preparation of a plastic mould for small metallic specimen.
2. Preparation of specimen for micro structural examination-cutting, grinding, polishing, etching.
3. Determination of grain size for a given specimen.
4. Comparative study of microstructures of different specimens of different materials (mild steel, grayC.I., brass, copper etc.)
5. Experiments on heat treatment such as annealing, normalizing, quenching, case hardening andcomparison of hardness before and after heat treatment.
6. Material identification of, say, 50 common items kept in a box.
7. Experiment on Faraday's law of electrolysis.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro & micro examination of the weldedspecimen.
10. Study of Magnetic/ Electrical/Electronic materials.

(B). Experiments on Material Testing (at least 5 of the following):

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot onthe machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge tothe calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector,eddy current testing machine, dye penetrant tests.

[BTME-34P] Machine Drawing-I

Introduction (1 drawing sheets)
Introduction, classification of machine drawings, principles of drawing, conventional representation ofmachine components and materials, lines, types of lines, dimensioning types, lines and rules of dimensioning.
Orthographic Projections (3 drawing sheets)
Introduction to orthographic projection, concept of first angle and third angle projection, drawing ofsimple machine elements in first angle projection, missing line problems, principle of visualization ofobjects, sectional views, full and half sectional views, auxiliary views.
Fasteners (2 drawing sheets)
Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation,representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation boltsetc., keys, types of keys, cotter and knuckle joints.
Riveted joints (1 drawing sheet)
Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boiler joints etc.
Assembly drawing (2 drawing sheets)
Introduction to assembly drawing, drawing assembly drawing of simple machine elements like rigid orflexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.
Free hand sketching (1 drawing sheet**)**
Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.
Computer aided drafting (1 drawing**)**
Introduction to computer aided drafting; advantages and applications of CAD, concepts of computeraided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw andmodify commands, making 2D drawings of simple machine parts.
Books and References:
1. Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI
2. Engineering Drawing by Bhat, & Panchal, Charotar Publishing House
3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age
5. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill

[BTME-33P] Thermodynamics Lab.

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

[BTIP-31] Industrial Psychology

Unit-I

Introduction to Industrial Psychology – Definitions & Scope. Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments

Unit-II

Individual in Workplace Motivation and Job satisfaction , stress management. Organizational culture, Leadership & group dynamics.

Unit-III

Work Environment & Engineering Psychology-fatigue. Boredom, accidents and safety.Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

Unit –IV

Performance Management : Training & Development.

References :

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.

2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.

3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach (5th edition) Wadsworth/Thompson : Belmont, C.A

. 4. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi : Tata McGraw Hill

[BTAC-31] Human Value & Professional Ethics

Module-1

Course introduction, Needs Basic guidelines

1 Understand the need , basic , guidelines content for process value education.
2. Self Exploration what is it? It content and process, Natural Acceptence and experiential Validation as the mechanism for self exploration.
3 Continues happiness and Prosperty- A look at continues human Aspiration.
4 Understanding Happiness and Prosperty correctly- A critical appraisal of the current senerio.
5 Method to fulfilled the human aspiration

Module -2

Understanding Harmony in human Being (Harmony in Myself)

1. Understanding Harmony as a co – existence of the sentient I and the Material Body.
2. Understanding the need of self (I) and body sukh and suvidha.

3. Understanding the body of an instrument of I (being Doar, seer and enjoyer.
4. Understanding the Charactersticks and activities of (I)

Module -3

Understanding harmony in the Family and Society

1. Understanding harmony in the Family and basic unit of Human interaction.
2. Understanding values in human – Human relationship meaning of nayaya and program for the fulfillment of ensure abhay and tripti.
3. Understanding the meaning of Vishvas difference between intension and competence.
4. Understanding the Harmony in the society (society being an Extension of family - samadhan , Samriddi , Abhay,sahastitva and comprehension of Human goals.

Module -4

Understanding the harmony in the Nature and existence – whole Existence as Co- existence.

1 Understanding the harmony in the Nature.
2 Interconnectedness and mutual fulfillment among the four order of Nature –recyclability ,andself regulation in nature.
3 Holistic prception of Harmony at all levels of existence.

Module – 5 Implication of the above Holistic understanding of Harmony on professional ethics.

1 Natural acceptance of human values.
2 Deffinativeness of ethical human conduct.
3 Basic for humanistic education. Humanstick constitution and human universal order.
4 Case studies of typical holistic technologies , Management model and Production system.
5 Strategy for transition from the presnt stage of universal order.
A - At the level of individual : as socialy and ecologically responsible engineers technologist and manager.
B- At the Level of Society as mutually enriching institution and organisations

SCIENCE BASED OPEN ELECTIVES
[BTOE-41] INTRODUCTION TO SOFT COMPUTING
(Neural Networks, Fuzzy Logic and Genetic Algorithm)

Unit-I : Neural Networks-1(Introduction & Architecture)
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions,Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.
Unit-II : Neural Networks-II (Back propogation networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back opogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.
Unit-III : Fuzzy Logic-I (Introduction)
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV : Fuzzy Logic –II (Fuzzy Membership, Rules)
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications&Defuzzificataions, Fuzzy Controller, Industrial applications.
Unit-V : Genetic Algorithm(GA)
Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.
Text Books:
1. S. Rajsekaran& G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.
Reference Books:
3. SimanHaykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

[BTOE-42] NANO SCIENCES

UNIT -1 :
Introduction:
Difinition of Nano-Science and Nano Technology, Applications of Nano-Technology.
Introduction to Physics of Solid State:
Structure: Size dependence of properties; crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations.
Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.
Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT-2
Quantum Theory For Nano Science:
Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step: Refelection and tunneling(Quantum leak). Penetration of Barrier, Potential box(Trapped particle in 3D:Nanodot), Electron trapped in 2D plane(Nano sheet), Quantum confinerment effect in nano materials.
Quantum Wells, Wires and Dots
Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermigas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared etectors; Quantum dot laser Superconductivity.
Properties of Individual Nano particles
Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nanopraticles; geometric structure; electronic structure; Reactivity; Fluctuations Magnetic Clusters; Bulle to Nano structure.
Semi conducting Nanoparticles: Optical Properties; Photofragmentation; Coulmbic explosion.
Rare Gas & Molecular Clusters: Inert gas clusters; Superfluid clusters molecular clusters.

UNIT-3
Growth Techniques of Nanomaterials:
Lithograpahic and Nonlithograpahic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique(p-$CuAlO_2$ deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nanotubes, Pulsed Laser Deposition, Molecular beam Epitoxy, Sol-Gel Techniuqe (No chemistry required), Synthesis of nanowires/rods, Electrodeposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid–Solid (VLS) method of nanowires.
UNIT -4
Methods of Measuring Properties:
Structure: Crystallography, particle size determination, surface structure,

Microscopy: Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Elecrtron Microscopy (TEM)
Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luninscence.
UNIT-5
Buckey Ball:
Nano structuresofcarbon(fullerene):
Carbon nano-tubes: Fabrication , structure. electrical, mechanical, and vibrational properties and applications. Nano diamond, Boron Nitride Nano-tubes, single elecron transistors, Moelcular machine, Nano-Biometrics, Nano Robots.

Text/Reference Books:
1. C.P.Poole Jr F.J. Owens, "Introduction to Nanotechnology".
2. "Introduction to S.S. Physics" - (7th Edn.) Wiley 1996.

[BTOE-43] LASER SYSTEMS AND APPLICATIONS

UNIT-I & II
Introduction:
Review of elementary quantum physics, Schrodinger equation, concept of coherence, absorption, spontaneous emission and stimulated emission processes, relation between Einstein's A and B coefficients, population inversion, pumping, gain, optical cavities.
UNIT-III & IV
Lasers & Laser Systems:
Main components of Laser, principle of Laser action, introduction to general lasers and their types. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular, excimer, liquid and solid state Lasers and systems, short pulse generation and Measurement.
UNIT-V
Applications:
Laser applications in medicine and surgery, materials processing, optical communication, metrology and LIDAR and holography.
Text/ Reference Books:
1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International.
2. S. A. Ahmad, "Laser concepts and Applications" New Age Internati

[BTOE-44] SPACE SCIENCES

1. Introduction:
Introduction to space science and applications, historical development
2. Solar System:
Nebular theory of formation of our Solar System.Solar wind and nuclear reaction as the source of energy.
Sun and Planets: Brief description about shape size, period of rotation about axis and period of revolution, distance of planets from sun, Bode's law, Kepler's Laws of planetary motion, Newton's deductions from Kepler's Laws, Newton's Law of gravitation, correction of Kepler's third law, determination of mass of earth, determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets.
3. Stars:
Stellar spectra and structure, stellar evolution, nucleo-synthesis and formation of elements.
Classification of stars: Harvard classification system, Hertzsprung-Russel diagram,
Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars); Chandrasekhar limit.
4. Galaxies:
Galaxies and their evolution and origin, active galaxies and quasars.

5. Creation of Universe:
Early history of the universe, Big-Bang and Hubble expansion model of the universe,cosmic microwave background radiation, dark matter and dark energy.

Text Books / Reference Books:

1. K. S. Krishnaswami, "Astrophysics: A modern Perspective" New Age International.
2. K. S. Krishnaswami, "Understanding cosmic Panorama" New Age International.

[BTOE-45] POLYMER SCIENCE AND TECHNOLOGY

UNIT –I & II

POLYMERS:

Introduction, chemistry of polymer synthesis, polymer reaction kinetics, physical properties and characterization of polymers, effect of structure on properties of polymers, organic polymers.Introduction to high performance polymers and composites and their processing.

UNIT –III & IV

POLYMERIZATION:

Introduction, step-growth polymerization, free radical chain growth polymerization, emulsion polymerization, ionic and cationic polymerization, chain statistics and rubber elasticity.

UNIT – UNIT –V & VI

PREPARATION AND APPLICATIONS:

Preparation, properties and technical applications of thermo-plastics (PVC, PVA), thermostats (PF, UF) and elastomers (SBR, GR-N), silicones.Application of polymers in space, ocean, electronics, medical, agriculture, automobile, sports and building construction.

[BTOE-46] NUCLEAR SCIENCE

UNIT-I

Nucleus and Its Basic Features:

Nuclear structure; nuclear forces and their properties, nuclear stability, nuclear radius and its meassurement, nuclear spin, nuclear magnetic and electrical moments.

UNIT-II

Nuclear Models:

Single particle model, liquid drop model and semi-emperical mass formula, nuclear potential and shell model, collective model.

UNIT-III

Nuclear Reaction:

Nuclear reaction and laws of conservation, types of nuclear reaction, mechanism of nuclear reaction, nuclear fission & binuclear fusion and their explanation by liquid drop model.

UNIT-IV

Nuclear Decay:

Decay constant, half life period and mean life, alpha decay, beta decay, gamma decay, interaction of nuclear radiation with matter.

Nuclear Instruments-I

Mass spectrograph,: General principle, Aston's Mass Spectrograph.

UNIT-V

Nuclear Instruments-II

Accelerators: Van de Graph Generator, Cyclotron, Synchrotron.

Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon.

Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture.

Text Books:

1. Tayal, “Nuclear Physics” Himalaya Publishing House.
2. S.N. Ghosal, “Nuclear Physics” S. Chand & Co.

Reference Books:

6. Roy & Nigam, “Nuclear Physics” John Wiley & sons.
7. W.E. Burcham, “Nuclear Physics” Longmans Publications.

[BTOE-47] MATERIAL SCIENCE

UNIT-I

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

Crystallography and imperfections:

Concept of unit cell, space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices.X-ray crystallography techniques, imperfections, Defects & Dislocations in solids. .

UNIT-II

Mechanical Properties and Testing: Stress strain diagram, Ductile and brittle materials, stress Vs strength, toughness, hardness, fracture, fatigue and creep. Testing, such as Strength testing, Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT)

Micro Structural Exam: Microscope principle and methods, Preparation of samples and microstructure exam and grain size determination, comparative study of microstructure of various metals and alloys, such as Mild steel, CI, Brass.

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

UNIT-III

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

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

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

UNIT-IV

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

Electric Properties: Energy band, concept of conductor, insulator and semi conductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors, Basic devices and their applications.diffusion of Solid

Super conductivity and its applications, Messier effect. Type I& II superconductors. High Temp. superconductors.

UNIT-V

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

Plastics: Various types of polymers/plastics and their applications. Mechanical behaviour and processing of plastics, Future of plastics.

Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.

Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.

Performance of materials in service: Brief theoretical consideration of fracture, fatigue, and corrosion and its control.

Text / Reference Books:

1. W.D. Callisster Jr. “Material Science & Engineering Addition” - Wesly Publishing Co.
2. Van Vlash, “Elements of Material Science & Engineering”, John Wiley & Sons

[BTOE-48] DISCRETE MATHEMATICS

UNIT-I

Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identitites on sets, pigeonhole principle.

Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation.

Function: Definition and types of function, composition of functions, recursively defined functions.

UNIT-II

Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

Notion of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.

UNIT-III

Combinatories: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (n_{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.)

Unit-IV

Algebraic Structure: Binary composition and its properties definition of algebraic structure; Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).

UNIT-V

Graphs:

Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree(rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).

Finite Automata: Basic concepts of Automation theory, Deterministic finite Automation(DFA), transition function, transition table, Non Deterministic Finite Automata (NDFA), Mealy and Moore Machine, Minimization of finite Automation.

Text/Reference Books:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Mc.Graw Hill, 2002.
2. V. Krishnamurthy, “Combinatories:Theory and Applications”, East-West Press.

[BTOE-49] APPLIED LINEAR ALGEBRA

UNIT-1

Fields, Vector-spaces, sub-spaces, linear-combination, linear-dependence and independence.Basis, dimensions and coordinates (each and every fact to be illustrated by suitable examples).

UNIT-2

Linear-transformation, definition and examples, matrix representation, similarity, range and kernel, rank-nullity theorem and its consequences.

UNIT-3

Singular and non singular linear transformations, sum and product of linear transformations, vector space of linear transformations, nilpotent linear transformations.

UNIT-4

Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inquality, Minkowski Inequality, polarization Identity, complete ortho normal set, Bessel’s Inequality, Gram-Schmidt’s orthogonalization process.

UNIT-5

Linear functional, definition and examples, vector space of linear functional, dual vector spaces, adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values and eigen vectors, diagonalisation of linear operators, quadratic forms, principle axis theorem(without proof), some applications to engineering problems.

TEXT/REFERENCE BOOKS

1. Dym, H. Linear Algebra in action, University Press.2012
2. Halmos, P.R.: Finite Dimensional Vector Spaces (1990) Narosa.