SEMESTER – III

Sl No.	Course Code	Course Title	Hours Per Week			Total Credits	ESE	IA
			Lecture	Tutorial	Practical			
1.	102301	Engineering Mechanics	3	1	0	4	70	30
2.	102302	Material Science and Engineering	3	0	0	3	70	30
3.	102303	Engineering Mathematics-III (PDE, Prob/Stat)	3	1	0	4	70	30
4.	102304	Thermodynamics	3	0	0	3	70	30
5.	102305	Basic Electronics Engineering	3	0	0	3	70	30
6.	102306	Universal Human Values	3	0	0	3	70	30
7.	102307	Indian Knowledge System	3	0	0	0	-	-
8.	102301P	Engineering Mechanics Lab	0	0	2	1	30	20
9.	102305P	Basic Electronics Engineering Lab	0	0	2	1	30	20
10.	102308	Internship-I	2 Weeks			2	30	20
TOTAL						24	750	

SEMESTER-III

Course Code-102301 Engineering Mechanics 3 1 0 4

Unit- 1.0:

Fundamentals of Mechanics 7 hrs

Overview of engineering mechanics. Vector and scalar quantities. Units of physical quantities. Dimensions of physical quantities. Units and Dimensions. Dimensional analysis.

Unit- 2.0:

Force Systems and Equilibrium 7 hrs

Force Systems Basic Concepts, Particle Equilibrium in 2-D & 3-D, Rigid Body Equilibrium, System of Forces: oplanar Concurrent Forces, Components in Space, Resultant and Moment of Forces and its Application, Couples and Resultant of Force System, Free Body Diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

Unit- 3.0:

Friction and Structural Analysis 7 hrs

Types of Friction: Limiting, Static, and Dynamic, Laws of Friction, Motion of Bodies and Wedge Friction, Equilibrium in Three Dimensions, Method of Sections and Method of Joints, Tension and Compression in Members, Simple Trusses, Zero Force Members, Beams, Types of Beams, Frames and Machines.

Unit- 4.0:

Centroid, Centre of Gravity, and Moment of Inertia 7 hrs

Centroid of Simple Figures from First Principle, Centroid of Composite Sections, Centre of Gravity and Its Implications, Area Moment of Inertia: Definition and Theorems Moment of Inertia of Plane Sections, Standard Sections, and Composite Sections, Mass Moment Inertia of Circular Plate, Cylinder, Cone, Sphere, Hook.

Unit- 5.0:

Virtual Work, Energy Method, and Particle Dynamics 7 hrs

Virtual Displacements and Principle of Virtual Work, Degrees of Freedom and Active Force Diagram, Conservative Forces and Potential Energy, Energy Equation for Equilibrium, Applications of Energy Method for Equilibrium, Stability of Equilibrium, Review of Particle Dynamics: Rectilinear and Plane Curvilinear Motion, Relative and Constrained Motion, Newton's 2nd Law Work-Kinetic Energy, Power, Potential Energy Impulse-Momentum and Impact.

Unit- 6.0: Kinetics of Rigid Bodies 7 hrs

Introduction to Kinetics of Rigid Bodies Basic Terms and General Principles in Dynamics Types of Motion and Instantaneous Centre of Rotation in Plane Motion Simple Problems D'Alembert's Principle and Its Applications in Plane Motion and Connected Bodies Work-Energy Principle and Its Application in Plane Motion of Connected Bodies Kinetics of Rigid Body Rotation.

Text/ Reference:-

1. Engineering Mechanics statics and dynamics R. C. Hibbeler Pearson Publication, 12th Edition. ISBN-10: 0-13-814929-1 ISBN-13:978-0-13-814929-1
2. Engineering Mechanics statics and dynamics, J. L. Meriam and L. G. Craige, John Willey and Son's publication. 9th Edition. ISBN: 978-1-119-39098-5
3. Engineering Mechanics, S. P. Timoshenko, D. H. Young, J. V. Rao & S.Pati, McGraw- Hill publication, 5th Edition ISBN-10:9781259062667
4. Engineering Mechanics statics and dynamics,A. K. Dhiman, P. Dhiman & D. Kulshreshtha, McGraw-Hill publication ISBN-10:9789339219178

Course Code- 102302 Material Science and Engineering 3 0 0 3

Unit-1.0: 8**hrs**

Classification and Structure of Materials:

Classification of materials: metals, ceramics, polymers and composites. Nature of bonding in materials: metallic, ionic, covalent and mixed bonding; structure of materials: fundamentals of crystallography, symmetry operations, crystal systems, Bravais lattices, unit cells, primitive cells, crystallographic planes and directions; structures of metals, ceramics, polymers, amorphous materials and glasses. Defects in crystalline materials: 0-D, 1-D and 2-D defects; vacancies, interstitials, solid solutions in metals and ceramics, Frenkel and Schottky defects; dislocations; grain boundaries, twins, stacking faults; surfaces and interfaces.

Unit- 2.0: **7hrs**

Thermodynamics, Kinetics and Phase Transformations:

Extensive and intensive thermodynamic properties, laws of thermodynamics, phase equilibria, phase rule, phase diagrams (unary and binary), basic electrochemistry. Reaction kinetics, fundamentals of diffusion, Fick's laws, their solutions and applications.Solidification of pure metals and alloys, nucleation and growth, diffusional solid-state phase transformations (precipitation and eutectoid), martensitic transformation.

Unit-3.0: **9hrs**

Properties and Applications of Materials Mechanical properties:

Mechanical properties of metals, ceramics, polymers and composites at room temperature; stress-strain response (elastic, anelastic and plastic deformation). Electronic properties: free electron theory, Fermi energy, density of states, elements of band theory, semiconductors, Hall effect, dielectric modeling, piezo- and ferro-electric modeling. Magnetic properties: Origin of magnetism in materials, para-, dia-, ferro- and ferrimagnetism. Thermal properties: Specific heat, heat conduction, thermal diffusivity, thermal expansion, and thermoelectricity. Optical properties: Refractive index, absorption and transmission of electromagnetic radiation. Examples of materials exhibiting above properties, and their typical/common applications.

Unit-4.0: **6hrs**

Characterization and Measurements of Properties:

X-ray diffraction; spectroscopic techniques such as UV-Vis, IR, Fluorescence and Raman; optical microscopy, electron microscopy, composition analysis in electron microscopes.Tensile test, hardness measurement.Electrical conductivity, carrier mobility and concentrations. Thermal analysis techniques: thermogravimetry and calorimetry.

Unit-5.0: **6hrs**

Processing of Materials:

Heat treatment of ferrous and aluminium alloys; preparation of ceramic powders, sintering; thinfilm deposition: evaporation and sputtering techniques, and chemical vapour deposition, thin film growth phenomena.

Unit-6.0: 6**hrs**

Nanostructured Materials:

Top down and bottom up synthesis, Classification of nanomaterials, optical, thermal, magnetic and electronic properties of nanomaterials, Metallic and Carbon nanostructures, Applications of nanomaterials.

Texts/Reference:

1. Elements of Material Science and Engineering Van Vlack. Wesley Pub.
2. Material Science –Narula, Narula and Gupta, New Age Publishers.
3. Material Science and Engineering- V. Raghvan, Prentice Hall of India Pvt.
4. A test Book of Material Science & Metallurgy-O.P Khana, DhanpatRai.

5. Material Science and Engineering- an Introduction–Callister; W.D., John Wiley & Sons, Delhi.
6. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, and
7. Essentials of Materials Science & engineering–Donald R. Askeland, Pradeep P. Phale

Course Code-102303 Engineering Mathematics-III (PDE, Prob/stat) 3 1 0 4

Unit 1.0 **7hrs**

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method...

Unit 2.0 **8hrs**

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables

Unit 3.0 **8hrs**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Unit 4.0 **5 hrs**

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Unit 5.0 - **7hrs**

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal – evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Unit 6.0- **7hrs**

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

Text/ Reference:-

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India,2002.

Course Code-102304 Thermodynamics 3 0 0 3

Unit- 1.0 7hrs

Fundamentals –System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

Unit- 2.0 6hrs

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

Unit- 3.0 8 hrs

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems – Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

Unit- 4.0 8hrs

First Law for Flow Processes – Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady First law applications for system and control volume.

Second law – Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

Unit- 5.0 8hrs

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of Entropy for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy from steam tables-Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles-Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume.Exergy balance equation and Exergy analysis.

Unit- 6.0 5hrs

Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

Text/ Reference:-

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India.
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Yunus A. Cengel; Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill.
5. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Course Code-102305 Basic Electronics Engineering 3 0 0 3

Unit-1.0: Semiconductor Devices and Applications: 7 hrs

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

Unit-2.0: Operational amplifier and its applications 7 hrs

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

Unit-3.0: Timing Circuits 7 hrs

RC-timing circuits, IC 555 and its applications as table and mono-stable multi-vibrators, positive feedback.

Unit-4.0: Oscillators 7 hrs

Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Unit-5.0: Digital Electronics Fundamentals 7 hrs

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

Unit-6.0: Electronic Communication Systems 7 hrs

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

Text/ Reference:-

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

Course Code-102306 Universal Human Values 3 0 0 3

Unit- 1.0: 7hrs

Introduction to Value Education:

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education Sharing about Oneself, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Exploring Human Consciousness, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations,

Unit- 2.0: 7hrs

Harmony in the Human Being:

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Unit- 3.0: 7hrs

Harmony in the Family and Society:

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Unit- 4.0: 7hrs

Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Unit- 5.0: 7hrs

Implications of the Holistic Understanding – a Look at Professional

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order,

Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession .

Unit- 6.0: 7hrs

Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text /Reference:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-8703447.
2. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth – by Mohandas Karamchand Gandhi.
6. Small is Beautiful – E. F Schumacher.
7. Slow is Beautiful – Cecile Andrews.
8. Economy of Permanence – J C Kumarappa.
9. Bharat Mein Angreji Raj – Pandit Sunderlal.
10. Rediscovering India – by Dharampal.
11. Hind Swaraj or Indian Home Rule – by Mohandas K. Gandhi.
12. India Wins Freedom – Maulana Abdul Kalam Azad.
13. Vivekananda – Romain Rolland (English)
14. Gandhi – Romain Rolland (English)

Course Code- 102307 Indian Knowledge System 3 0 0 0

Unit-1.0 7 hrs

Introduction to Indian Knowledge Systems

Overview of IKS, Organization of IKS , Conception and constitution of knowledge in indian tradition, The oral tradition, Models and Strategies of IKS.

Unit-2.0 5 hrs

Overview of IKS Domains

The vedasas the basis of IKS, Overview of all the six vedāṅgas.

Unit-3.0 8 hrs

Relevance in Current Technical Education System I

Relevance of following IKS domains in present technical education system: Arthashastra (Indian economics and political systems), Ganitaand Jyamiti(indianmathematics, astronomy and geometry, Rasayana (indianchemical Sciences).

Unit-4.0 8 hrs

Relevance in Current Technical Education System II

Ayurveda (Indian Biological Sciences / Diet & Nutrition), JyotishVidya (observational astronomy and calendar systems), PrakritiVidya(indian system of terrestrial/ material sciences/ecology and atmospheric sciences).

Unit-5.0 7 hrs

Relevance in Current Technical Education System III

VastuVidya(indian system of aesthetics-iconography and built-environment /architecture), NyayaShastra(indian systems of social ethics, logic and law).

Unit-6.0 7 hrs

Shilpa andNatyaShastra (indian classical arts: performing and fine arts), Sankhyaand Yoga Darshna(indian psychology, yoga and consciousness studies), Vrikshayurveda(plant science/sustainable agriculture/food preservation methods).

Text/Reference:-

1. Introduction to Indian Knowledge System: Concepts and Applications, Archak, K.B. (2012)., Kaveri Books, New Delhi, ISBN-13:978-9391818203
2. Introduction To Indian Knowledge System: Concepts and Applications, Mahadevan, B. Bhat, VinayakRajat, NagendraPavana R.N., PHI, ISBN: 9789391818203.
3. Glimpse into Kautilya's ArthashastraRamachandrudu P. (2010) , Sanskrit Academy, Hyderabad, ISBN:9788380171074.
4. "Introduction" in Studies in Epics and Purāṇas, (Eds.), KM Munshi and N ChandrashekaraAiyer BhartiyaVidyaBhavan.

Course Code-102301P **Engineering Mechanics Lab** **0 0 2 1**
Perform any 10 Experiments

1. Practical based on mechanical advantage of different machines.
2. Verification of triangle law & parallelogram law of forces.
3. Verification of polygon law of forces.
4. Determination of moment of inertia of a flywheel.
5. Crank Lever apparatus.
6. Verification of support reactions of a simply supported beam.
7. Verification of condition of equilibrium of a system of forces.
8. Verification of axial forces in the members of a truss.
9. Verification of equilibrium of three dimensional forces.
10. Determination of coefficient of friction between two surfaces.
11. Verification of centroid of different laminae.
12. Verification of Newton's laws of motion.

Course Code-102305P **Basic Electronic Engineering Lab** **0 0 21**
Perform all Experiments

1. Measurement of different signal parameters using oscilloscope.
2. Lissajous pattern.
3. V-I characteristics of ordinary p-n junction diode.
4. Full wave rectifier –with and without filter.
5. Zener diode as a voltage regulator.
6. Input and output characteristics of BJT.
7. Input and output characteristics of FET.
8. Op-amp based inverting and non-inverting amplifier.
9. Op-Amp based differentiator and integrator.
10. Op-Amp based adder and subtractor.

Course Code- 102308 **Internship – I** **02 Weeks (2 Credits)**

Internship I Guidelines:

Internship I is of a minimum duration of two weeks which can be completed in an Industry/Institute in consultation with concerned Engineering College/Institute. After completion of Internship a detailed report of the Internship mentioning the training undertaken along with certificate should be submitted.

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