**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M.TECH. (ENGINEERING DESIGN)**

**EFFECTIVE FROM ACADEMIC YEAR 2022- 23 ADMITTED BATCH**

**R22 COURSE STRUCTURE AND SYLLABUS**

**I Year I Semester**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| Professional Core - I | Advanced Mechanics of Solids | 3 | 0 | 0 | 3 |
| Professional Core - II | Advanced Machine Design  | 3 | 0 | 0 | 3 |
| Professional Elective - I | 1. Advanced Mechanics of Machinery
2. System Design & Analysis
3. Mechatronics
 | 3 | 0 | 0 | 3 |
| Professional Elective - II | 1. Design for Process & Product Development
2. Optimization Techniques & Applications
3. Experimental Stress Analysis
 | 3 | 0 | 0 | 3 |
|  | Research Methodology and IPR | 2 | 0 | 0 | 2 |
| Lab - I | Advanced Dynamics Lab | 0 | 0 | 4 | 2 |
| Lab - II | Advanced Materials Lab | 0 | 0 | 4 | 2 |
| Audit - I | Audit Course- I | 2 | 0 | 0 | 0 |
|  | **Total** | **16** | **0** | **8** | **18** |

**I Year II Semester**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| Professional Core - III | Computer Aided Geometric Design | 3 | 0 | 0 | 3 |
| Professional Core - IV | Advanced Finite Element and Boundary Element Methods | 3 | 0 | 0 | 3 |
| Professional Elective - III | 1. Theory of Elasticity
2. Advanced Tool Design
3. Concurrent Engineering
 | 3 | 0 | 0 | 3 |
| Professional Elective - IV | 1. Hydraulic and Pneumatic Systems
2. Mechanical Behavior of Engineering Materials
3. Reliability Engineering
 | 3 | 0 | 0 | 3 |
|  | Mini Project with Seminar | 0 | 0 | 4 | 2 |
| Lab - III | Advanced Computer Aided Modelling Lab | 0 | 0 | 4 | 2 |
| Lab - IV | Advanced Computer Aided Analysis Lab | 0 | 0 | 4 | 2 |
| Audit - II | Audit Course- II | 2 | 0 | 0 | 0 |
|  | **Total** | **14** | **0** | **12** | **18** |

**II Year I Semester**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| Professional Elective - V | 1. Industry 4.0 and IoT2. Industrial Robotics3. Mechanics of Composite Materials | 3 | 0 | 0 | 3 |
| Open Elective | Open Elective | 3 | 0 | 0 | 3 |
| Dissertation | Dissertation Work Review – I & II | 0 | 0 | 12 | 6 |
|  | **Total** | **6** | **0** | **12** | **12** |

**II YEAR II SEMESTER**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **L** | **T** | **P** | **Credits** |
| Dissertation | Dissertation Work Review - III | 0 | 0 | 12 | 6 |
| Dissertation | Dissertation Viva-Voce | 0 | 0 | 28 | 14 |
|  | **Total** | **0** | **0** | **40** | **20** |

**\*For Dissertation Work Review, please refer R22 Academic Regulations.**

Students are advised to opt for an open elective course of their choice being offered by other Departments of the Institute

**Audit Course I & II:**

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

Open Elective

1. Business analytics
2. Waste to Energy
3. Industrial Safety
4. Principles of Automation

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**ADVANCED MECHANICS OF SOLIDS (Professional Core - I)**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Course Objectives:** This course is concerned with the development of analytical methods forsolving problems in mechanics of materials that are generally considered beyond the scope ofbasic course in the discipline.

**Course outcomes**: After completing this course, the student should be able to

* Determined the point of location of applied load to avoid twisting in thin sections used in aerospace applications.
* Understand the concept of distinguish between neutral and centroidal axes in curved beams.
* Understanding the analogy models developed for analyzing the non-circular bars subjected to torsion, and also analyzing the stresses developed between rolling bodies and stress in three dimensional bodies.

**UNIT–I:**

**Analysis of Stress:** The State of Stress at a Point,Stress Components on an Arbitrary Plane,Principal Stresses,Stress Invariants,Mohr’s Circle,Planes of Maximum Shear,Octahedral Stresses, The Plane State of Stress, Differential Equations of Equilibrium,Boundary Conditions.

**Analysis of Strain:** Deformation in the Neighborhood of a Point,The State of Strain at a Point,Interpretation of Shear Strain Components, Transformation of Strain, and Principal Strains,Compatibility Conditions. The Plane State of Strain.

**Linear Stress-Strain-Temperature Relations:** Internal-Energy Density, and Complementary Internal-Energy Density. Hooke’s Law for Anisotropic,Orthotropic and Isotropic Elasticity. Equations of Thermo elasticity for Isotropic Materials

**UNIT–II**

**Shear center:** Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections. Shear Stresses in Thin-Walled Sections,Shear Center of Box Beams

**Unsymmetrical bending:** Bending stresses in Beams subjected to Nonsymmetrical bending, Deflection of straight beams due to nonsymmetrical bending.

**UNIT–III:**

**Curved beam theory:** Winkler Bach formula for circumferential stress – Limitations – Correction factors –Radial stress in curved beams – closed ring subjected to concentrated and uniform loads-stresses in chain links.

**UNIT–IV:**

**Torsion:**  Linear elastic solution, General Prismatic Bars–Solid Sections like circular, elliptical, triangular and rectangular, Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section, Hollow thin wall torsion members, Multiply connected Cross Section.

**UNIT–V:**

**Contact stresses:** Introduction, problem of determining contact stresses, Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses, Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact) Loads normal to area, Stresses for two bodies in line contact, loads normal and Tangent to contact area.

**TEXT BOOKS:**

1. Advanced Mechanics of materials by Boresi & Sidebottom,Wiely International.
2. Advanced Mechanics of Solids by L S Srinath,Tata McGraw-Hill Publishing Company Limited

**REFERENCE BOOKS:**

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw, Hill Publishers.
3. Advanced Mechanics of Materials and Applied Elasticity by Ansel C. Ugural, Saul K. Fenster
4. Strength of materials by Sadhu singh

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**ADVANCED MACHINE DESIGN (Professional Core- II)**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Prerequisite:** Design of Machine Elements

**Course Objectives:**

* To study design concepts in order to enhance the basic design.
* To study behaviour of mechanical components under fatigue and creep.
* To study statistical techniques and its applications in mechanical design.

**Course outcomes:** After completing this course, the student should be able to

* Ability to analyze behaviour of mechanical elements under different loads
* Understand the design of different transmission elements of automobile
* Ability to analyze mechanical elements critically.

**UNIT-I:**

**Shafts and Axles:** Introduction, Causes of failure in Shafts and Axles and Stresses in Shafts, Materials for Shafts and Axles, Methods of Manufacturing of Shafts, Designing of Straight Shafts, Pure Torsional Load, Designing for Rigidity and Stiffness, Design of Axles, Flexible Shafts.

**UNIT-II:**

**Rope drive:** Fibre ropes, rope drives for power transmission, fibrous Ropes used in Hoisting Tackle, Wire Ropes, Materials, Wire Rope Construction, Applications of Ropes, properties of various types of Ropes, Approximate wire Diameters and Effective Cross- section of Ropes: Fiber cores for steel wire ropes, Working loads, Friction and Efficiency wire rope, sheaves and Drum, rope fasteners, Selection of wire rope, design procedure.

**UNIT-III:**

**Chain drives:** Types of Chain drives, construction of Chains, Roller Chains, Silent Chains, selection of a chain, Design of the chain Drive, Good design practice.

**UNIT-IV:**

**Gear drives:** Design calculations for helical gears, Definitions, double helical, Gear tooth proportions, Design calculations, forces acting in a Bevel gear, Worm gear drives, worm wheel, designation of a worm gear drive, Materials, efficiency of Drive, Heat Dissipation, Design of worm Gearing, Forces on worm gears, advantages and disadvantages of worm gear drives.

**UNIT-V:**

**Power screws:** Friction, Types of Power screws, Multiple threads, Comparison of square and trapezoidal threads, Power screw drive, Efficiency of screws, square threads, Trapezoidal Threads, stresses in screws design calculations, design procedure, other types of screws, differential and compounds screws, ball baring screws.

**TEXT BOOKS:**

1. Machine Design by Dr. P.C. Sharma, S.K.Kataria & sons
2. Machine Design by Maleev and Hartman, C.B.S Publishers

**REFERENCE BOOKS:**

1. Machine Design by Schaum series
2. Mechanical Engineering design by J.E. Shigley.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**ADVANCED MECHANICS OF MACHINERY (Professional Elective –I )**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Prerequisite:** Kinematics of machinery

**Course Objectives:** The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines. To find radius of curvature of polodes.

**Course outcomes:** After completing this course, the student should be able to

* Understand the kinematic analysis of rolling bodies based on graphical, geometrical and analytical methods.
* Design of mechanisms by using graphically and analytically by involving function generator, rigid body guidance and path generation (Coupler curve) methods

**UNIT–I:**

**Advanced Kinematics of plane motion- I:** Introduction to plane motion. Euler – Savary Equation, the Inflection circle, Analytical and graphical determination of di, Bobillier’s Construction, Collineation axis, Hartmann’s Construction, Inflection circle for the relative motion of two moving planes, Application of the Inflection circle to kinematic analysis.

**UNIT–II:**

**Advanced Kinematics of plane motion - II:** Polode curvature, Hall’s Equation, Polode curvature in the four bar mechanism, coupler motion, relative motion of the output and input links, Freudenstein’s collineation – axis theorem, Carter –Hall circle.

**UNIT–III:**

**Introduction to Synthesis-Graphical Methods - I:** The Four bar linkage, Guiding a body through Two distinct positions, Guiding a body through Three distinct positions, The Roto center triangle, Guiding a body through Four distinct positions: Burmester’s curve.

**UNIT–IV:**

**Introduction to Synthesis-Graphical Methods - II:** Function generation- General discussion, Function generation: Overlay’s method, Function generation- Velocity – pole method, Path generation: Hrones’s and Nelson’s motion Atlas, Roberts’s theorem.

**UNIT–V:**

 **Introduction to Synthesis - Analytical Methods:** Function Generation: Freudenstien’s equation, Precision point approximation. Path Generation: Synthesis of Four-bar Mechanisms for specified instantaneous condition, Method of components, Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link, Method of components.

**TEXT BOOKS:**

1. Kinematics and Dynamics of plane mechanisms by Jeremy Hirschhorn, McGraw-Hill, 1962.
2. Theory of Mechanisms and Machines by Amitabh Ghosh and Ashok Kumar Mallik, E.W.P. Publishers.

**REFERENCE BOOKS:**

1. Kinematics and Linkage Design by Allen S.Hall Jr., PHI, 1964.
2. Theory of Machines and Mechanisms by J.E Shigley and J.J. Uicker Jr., McGraw-Hill, 1995.
3. A Robot Engineering Text book, Mohsen Shahinpoor, Harper & Row Publishers, New York, 1987.
4. Analysis of mechanisms and Robot manipulators by Joseph Duffy, Edward Arnold, 1980

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**SYSTEM DESIGN AND ANALYSIS (Professional Elective - I)**

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| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**UNIT - I:**

**Fundamentals of Experimentation:** Role of experimentation in rapid scientific progress, historical perspective of experimental approaches, Steps in experimentation, principles of experimentation

**UNIT - II:**

**Simple comparative experiments:** Basic concepts of probability & statistics, comparison of two means and two variances, comparison of multiple (more than two) means and ANOVA

**UNIT- III:**

**Experimental designs**: Factorial designs, fractional factorial designs, orthogonal arrays, standard orthogonal arrays and interaction tables, modifying orthogonal arrays, selection of suitable orthogonal array design, analysis of experimental data

**UNIT- IV:**

**Response surface methodology:** Concept, linear model, steepest ascent, second order model, regression.

**UNIT - V:**

**Taguchi’s Parameter Design:** Concept of robustness, noise factor, objective function & S/N ratios, inner array& outer array design, data analysis

**REFERENCE BOOKS:**

1. Montgomery DC, Design and Analysis of Experiments, 7th Edition, John Wiley & Sons, NY, 2008.
2. Ross P J, Taguchi techniques for Quality Engineering, McGraw-Hill Book Company, NY, 2008

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**MECHANICAL VIBRATIONS (Professional Elective - I)**

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| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Prerequisite:** Basic concepts of Physics

**Course Objectives:**

* To understand the fundamentals of Vibration Theory
* To be able to mathematically model real-world mechanical vibration problems

**Course Outcomes:** At the end of the course the students will be able to

* To study the vibrations in machine elements and how to control them.
* Ability to analyze the mathematical model of linear vibratory system to determine its response
* Obtain linear mathematical models of real life engineering systems
* Determine vibratory responses of single and multi degree of freedom systems to harmonic, periodic and non-periodic excitation

**UNIT-I:**

**Free Vibration of Single Degree of Freedom Systems:** Introduction, Free Vibration of an Undamped Translational System, Equation of Motion using Newton’s second law of motion, Equation of motion using other methods, Equation of motion of a spring, mass system in vertical position, solution, Harmonic Motion Free Vibration of an Undamped Torsional System- Equation of motion. Free Vibration with Viscous Damping- Equation of motion.

**UNIT-II:**

**Forced Vibration of Single Degree of Freedom Systems:** Introduction, Response of an Undamped system under harmonic force, Total response, Beating Phenomenon. Response of a Damped System under Harmonic Force- Total Response, Quality Factor and Bandwidth, Response of a Damped system under the Harmonic Motion of the base, Fore Transmitted, Relative Motion.

**UNIT- III:**

**Two Degree of Freedom Systems:** Introduction, Equations of Motion for forced Vibration, Free Vibration Analysis of and undamped system, Torsional system, Coordinate Coupling and Principal Coordinates, forded Vibration Analysis, Semi definite Systems, Self- Excitation and stability Analysis.

**UNIT-IV:**

**Multi-degree of Freedom Systems:** Introduction Modeling of Continuous systems as Multi-degree of Freedom systems, Using Newton’s second law to derive equations of motion, Influence Coefficients. Potential and kinetic energy expressions in matrix form, Generalized coordinates and generalized forces, Using Lagrange’s equations to derive equations of motion, Equations of motion of undamped systems in matrix form, Eigen value problem, solution of the Eigen value problems – solution of the characteristic equation, orthogonality of normal modes, repeated Eigen values.

**UNIT-V:**

**Determination of Natural Frequencies and Mode Shapes**: Introduction, Dunkerley’s formula, Rayleigh’s Method- Properties of Rayleigh’s Quotient, Computation of the Fundamental Natural Frequency, Fundamental Frequency of Beams and Shafts. Holzer’s Method-Torsional systems, Spring Mass Systems. Jacobi method, Standard Eigen value Problems.

**TEXT BOOKS:**

1. Mechanical Vibrations by S.S. Rao, 4th Edition, Pearson Publications.
2. Elements of Vibration Analysis by Meirovitch.

**REFERENCE BOOKS:**

1. Mechanical Vibrations by G.K. Groover.
2. Vibrations by W.T. Thomson
3. Mechanical Vibrations by Schaum series.

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**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**MECHANICAL BEHAVIOUR OF MATERIALS (Professional Elective - II)**

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| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Prerequisite**: Physical Metallurgy

**Course Objectives:** The main objectives are to provide students with basic understanding of phase transformation by heat treating and stress-induced hardening, linear and nonlinear elastic behavior, deformation under multi-axial loading, plastic deformation and yield criteria, dislocation plasticity and strengthening mechanisms, creep, stress concentration effects, brittle versus ductile fracture, fracture mechanisms at different scales, fatigue, contact deformation, and wear.

**Course outcomes:** After completing this course, the student should be able to:

* Understand the different modes of failures like fracture, fatigue and creep of ductile and brittle materials

**UNIT-I:**

**Fracture:** Introduction, Types of Fracture in Metals, Griffith Theory of Brittle Fracture, Fracture of Single Crystals, Ductile Fracture, Concept of the Fracture Curve.

**UNIT-II:**

**Fracture Mechanics:** Strain Energy Release rate, Fracture Toughness and Design, Crack Opening Displacement, J-Integral, R Curve,

**UNIT-III:**

**Fatigue-I:** Introduction, Stress Cycles, S-N Curve, Effect of Mean Stress on Fatigue, Cyclic Stress strain curve, Low Cycle Fatigue, Strain Life Equation, Structural Features of Fatigue, Fatigue Crack Propagation, Effect of Metallurgical Variables on Fatigue.

**UNIT-IV:**

**Fatigue-II:** Effect of stress concentration on Fatigue, Size Effect, Surface effects on Fatigue, Fatigue under Combined stresses, Design for Fatigue, Machine Design approach-Infinite life design, Local strain approach, Corrosion Fatigue, Effect of Temperature on fatigue.

**UNIT-V:**

**Creep deformation:** The evolution of creep damage, primary, secondary and tertiary creep, Micro mechanisms of creep in materials and the role of diffusion, Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters, Creep-fatigue interactions, Examples.

**TEXT BOOKS:**

1.Mechanical Metallurgy by G. E. Dieter, McGraw Hill, (1988)

2.Thin Film Materials L.B. Freund and S. Suresh, Cambridge University Press (2003).

**REFERENCE BOOKS:**

1.Fracture Mechanics Fundamentals and Applications by T.L. Anderson, 2nd Ed. CRC press, (1995) 2.Fracture of Brittle Solids by B. Lawn, Cambridge Solid State Science Series 2nd ed1993.

3.Fundamentals of Fracture Mechanics by J.F. Knott, Butter worths (1973)

4.Worked examples in Fracture Mechanics by J.F. Knott, P Withey, Institute of Materials.

5. Fracture Mechanics by H.L. Ewald and R. J. H. Wanhill, Edward Arnold, (1984).**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**OPTIMIZATION TECHNIQUES & APPLICATIONS (Professional Elective - II)**

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| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Pre-requisites**: Operations Research

**Course Objectives:** The main objectives of the course are: Learn

* Numerical optimization techniques for single variable and multi variable non- linear optimization problems.
* Sensitivity analysis on LPP queuing
* Simulation of annexing problem & inventory problem.
* Geometry cutting plane method & branch bound method for linear IPP.
* Meaning of stochastic programming problem simple problems for finding mean variance of random variables chance constrained algorithm.
* Formulation of GP model and solving it using arithmetic geometric inequality theorem.
* State of art nontraditional optimization technique, namely genetic algorithm simulated annealing & particle swarm optimization.

**Course Outcomes:** At the end of the course, the student is able to apply appropriate optimization techniques and solve.

* Based on the type of optimization problem like single variable or multivariable,
* Make sensitivity analysis to study effect of changes in parameters of LPP on the optimal solution without reworking.
* Simulate the system to estimate specified performance measures.
* Solve integer programming problem by either geometry cutting plane algorithm or branch band method.
* Apply chance constrained algorithm and solve stochastic linear programme.
* Formulate GP model and solve it.
* Solve given optimization problem by genetic algorithm or simulated annealing or PSO.

**UNIT-I:**

**Single Variable Non-Linear Unconstrained Optimization:** Elimination methods: Uni-Model function-its importance, Fibonacci method & Golden section method. Interpolation methods: Quadratic & Cubic interpolation methods.

**UNIT-II:**

**Multi variable non-linear unconstrained optimization:** Direct search methods – Univariant method, Pattern search methods – Powell’s, Hook -Jeeves, Rosenbrock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

**UNIT-III:**

**Linear Programming:** Formulation, Simplex method & Artificial variable optimization techniques: Big M & Two-phase methods. Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition of variables, constraints. Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

**UNIT-IV:**

**Integer Programming:** Introduction – formulation – Geometry cutting plane algorithm – Zero or one algorithm, branch and bound method

**Stochastic Programming**: Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

**UNIT-V:**

**Geometric Programming:** Posynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (≤ type only)

**Non-Traditional Optimization Algorithms:** Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing-Working Principle-Simple Problems. Introduction to Particle Swarm Optimization (PSO) (very brief)

**TEXT BOOKS:**

1. Optimization theory & Applications by S. S. Rao, New Age International.
2. Optimization Methods for Engineers, NVS Raju, PHI Publications.

**REFERENCE BOOKS:**

1. Operations Research by S. D. Sharma
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI
3. Operation Research by H. A. Taha, TMH
4. Optimization in operations research by R. L Rardin
5. Optimization Techniques by Benugundu & Chandraputla, Pearson Asia.
6. Optimization Techniques theory and practice by M. C. Joshi, K. M. Moudgalya, Narosa Publications.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**EXPERIMENTAL STRESS ANALYSIS(Professional Elective- II)**

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| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **0** | **0** | **3** |

**Prerequisite:**Strength of Materials, Theory of Elasticity desirable

**Course objectives:**To introduce the basic principles and methods of experimental stress analysis thatincludes enhancive treatment of the most versatile teaching like photo elasticity and straingauges. It also provides the sin different experimental teaching such as more brittle coatings,thermo elastic stress analysis and NW time.

**Course Outcomes:**At the end of the course the students will be able to

* Know the working principle of strain gauges and do the model analysis using differenttheorems.
* Know the concepts of photo elasticity and its applications.
* Use the various Non-destructive testing methods.

**UNIT- I:**

Strain Gauges - Mechanical and optical strain gauges – Description and operation –Electricalresistance- Inductance and capacitance gauges – Detailed treatment on Resistance gauges –Measurement of static and dynamic strains – Strain rosettes – Effect of transverse strains – Use ofstrain recorders and load cells.

**UNIT- II:**

Model Analysis - Structural similitude – Use of models – Structural and dimensional analysis –Buckingham Pi Theorem – Muller Breslau’s principle for indirect model analysis – Use of Begg’sand Eney’s deformeters – Moment indicators – Design of models for direct and indirect analysis.

**UNIT- III:**

Two-dimensional photo elasticity - Stress optic law – Introduction to polariscope – Plane andcircular polariscope – Compensators and model materials – Material and model fringe value –Calibration of photo elastic materials – Isochromatic and isoclinic fringes – Time edge effects.

**UNIT - IV:**

Three-dimensional photo elasticity - Introduction – Stress freezing techniques – Stress separationtechniques – Scattered light photo elasticity – Reflection polariscope.

**UNIT - V:**

Miscellaneous Methods - Brittle coating method – Birefringence techniques – Moire fringemethod – Non-destructive testing – Ultrasonic pulse velocity technique – Rebound hammermethod – X-ray method – Gamma-ray method.

**Text Books:**

1. Experimental stress analysis by Dally and Riley, Mc Graw-Hill

**Reference Books:**

* + - 1. Experimental stress analysis by Sadhu singh, Danapathi rai publications
			2. Handbook of Experimental Stress Analysis by Heteny M, John Wiley and Sons, New York.
			3. Photo elasticity by Frocht M.M., Vol. I & II, John Wiley and Sons, New York.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**RESEARCH METHODOLOGY AND IPR**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **2** | **0** | **0** | **2** |

**Prerequisite:** None

**Course Objectives:**

* To understand the research problem
* To know the literature studies, plagiarism and ethics
* To get the knowledge about technical writing
* To analyze the nature of intellectual property rights and new developments
* To know the patent rights

**Course Outcomes:** At the end of this course, students will be able to

* Understand research problem formulation.
* Analyze research related information
* Follow research ethics
* Understand that today’s world is controlled by Computer, Information Technology, but

 tomorrow world will be ruled by ideas, concept, and creativity.

* Understanding that when IPR would take such important place in growth of individuals &

 nation, it is needless to emphasis the need of information about Intellectual Property Right

 to be promoted among students in general & engineering in particular.

* Understand that IPR protection provides an incentive to inventors for further research work

 and investment in R & D, which leads to creation of new and better products, and in turn

 brings about, economic growth and social benefits.

**UNIT-I:**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**UNIT-II:**

Effective literature studies approaches, analysis, Plagiarism, Research ethics

**UNIT-III:**

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**UNIT-IV:**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**UNIT-V:**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information

and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**TEXT BOOKS:**

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

**REFERENCES:**

1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.
5. Asimov, “Introduction to Design”, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
7. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**ADVANCED DYNAMICS LAB (Lab - I)**

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**List of Experiments:**

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
2. Determination of steady state amplitude of a forced vibratory system.
3. Static balancing using steel balls.
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
5. Field balancing of the thin rotors using vibration pickups.
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession and representation of vectors.
7. Direct Kinematic analysis of a robot.
8. Inverse Kinematic analysis of a robot.
9. Trajectory planning of a robot in joint space scheme.
10. Palletizing operation using Robot programming.
11. To determine the characteristic curves of the Watt and Porter Governors.
12. To determine the characteristic curves of the Proell and Spring-loaded Governors
13. To determine the characteristics of Journal Bearings
14. Determination of natural frequency of given structure using FFT analyzer.
15. Diagnosis of a machine using FFT analyzer.

**Note**: Any 10 experiments may be performed from the above listed experiments.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year I Sem. (ENGG. DESIGN)**

**ADVANCED MATERIALS LAB (Lab - II)**

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**List of Experiments:**

1. Preparation and study of the Micro Structure of ferrous metals and alloys.
2. Preparation and study of the Microstructure of nonferrous metals and alloys.
3. Effect of tempering time on the hardness of quenched carbon steels.
4. Effect of tempering temperature on the hardness of a hardened carbon steels.
5. Preparation of metallic specimens by electro polishing.
6. Study of work hardening characteristics of a pure metal.
7. Determination of carbon percentage in the given ferrous specimen.
8. To determine the deflection of a Structural Member using Pin-jointed setup
9. Calculation of Shear Centre of a different cross-sections using Shear Centre setup
10. To determine the deflection of a Frame using Portal Frame Setup
11. Analyse the Stress Distribution of a Structural Member using Curved Beam apparatus.
12. Determination of natural frequency of given structure using FFT analyzer.
13. Diagnosis of a machine using FFT analyzer.

**Note**: Any 10 experiments may be performed from the above listed experiments.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**COMPUTER AIDED GEOMETRIC DESIGN (Professional Core- III)**

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**Prerequisites: CAD/CAM**

**Course Objectives:**

* Learn modeling curves (B-splines and Bezier)
* Learn modeling Bezier and B-spline surfaces
* Familiarity with NURBS
* Familiarity with advanced techniques such as subdivision and reconstruction
* Mastery of object construction and manipulation methods including lofting, surface of revolution, and tubularization.
* Mastery of Reconstruction from PCD and Mesh generation

**Course Outcomes:** After doing this course, the student should be able to do

* 2D & 3D transformations
* Develop cubic splines, Bezer curves and B-spline curves
* Write equations of surfaces, quadratic surfaces and analyze mathematically

**UNIT–I:**

**Geometrical Modeling:** Introduction, History, Geometrical representation, Linear Algebra Boolean Algebra, Vectors, Matrices, Equations for curves- Intrinsic and Explicit ,parametric equations of curves, conic curves and points on curves, Problems

**UNIT–II:**

**Transformations:** 2-D and 3D Transformations, translation, Rotation, Homogeneous space, Scaling, stretching, Mirror reflection, Composite Transformations and problems

**UNIT–III:**

**Cubic Splines:** Algebraic and geometric force of cubic spline, parametric space of a curve, blending functions, Problems

**Bezier Curves:** Berustein’s polynomials, equations, control points, convex hull property, truncating and subdividing composite and Rational Bezier curves, Problems

**B-Spline Curves:** Uniform and non-uniform B-Spline basis functions, quadratic and cubic B-spline basis functions, NURBS, Problems

**UNIT–IV:**

**Surfaces:** Explicit and Implicit equations of surfaces, quadratic surfaces, parametric equation of surfaces, Curve Nets and Embedded Curves, Generation, Mathematical Analysis, Applications of Bezier and B-Spline Surfaces, Surface patches. Problems

**UNIT–V:**

1. **Solids:** Parametric and Tricubicsolids, sweep solids, Topology of models, graph and boolean based models. Constructive solid Geometry (CSG), B-rep models. Problems; Feature modeling, rendering, lighting, animation.

**TEXT BOOKS:**

1. Geometric Modeling by Micheal E. Mortenson, Third Edition, McGraw Hill Publishers
2. CAD/CAM concepts and Applications by Alavala, PHI.

**REFERENCE BOOKS:**

1. Curves and surfaces for CAGD, Fifth Edition by Gerald Farin, Elsevier, India
2. Computer Graphics by Alavala, PHI, New Delhi
3. CAD/CAM by Ibrahim Zeid, Tata McGraw Hill.
4. Elements of Computer Graphics by Roger & Adams, Tata McGraw Hill.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**ADVANCED FINITE ELEMENT AND BOUNDARY ELEMENT METHODS**

**(Professional Core - IV)**

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**Prerequisite:** Strength of Materials, Mathematics, Heat Transfer and Vibrations.

**Course Objectives**:

* To Introduce the basic concepts of the finite element method, the boundary element method
* To discuss the advantages and limitations of each method
* To Demonstrate the capabilities of each method on a variety of problems

**Course outcomes**: After completing this course, the student should be able to

* Understand the background of mathematical equations used for development of modeling software modules to develop the various structural related applications
* Identify mathematical model for solution of common engineering problems.
* Solve structural, thermal, fluid flow problems.
* Use professional-level finite element software to solve engineering problems in Solid mechanics, fluid mechanics and heat transfer.

**UNIT–I:**

**One Dimensional Problems**: Formulation of Stiffness Matrix for a Bar Element by the Principle of Minimum Potential Energy, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions.

**Analysis of Trusses:** Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of reaction forces and displacements.

**Analysis of Beams:** Derivation of Stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams.

**UNIT–II:**

**Finite element – formulation of 2D Problems:** Derivation of Element stiffness matrix for two-dimensional CST Element, Derivation of shape functions for CST Element, Elasticity Equations, constitutive matrix formulation, Formulation of Gradient matrix. Two dimensional Isoparametric Elements and Numerical integration.

**Finite element – formulation of 3D problems:** Derivation of Element stiffness matrix for

Tetrahedron Element, Properties of Shape functions for 3D Tetrahedral Element, Stress-Strain Analysis for 3D Element, Strain Displacement for Relationship Formulation.

**UNIT–III:**

**Steady state heat transfer analysis**: One Dimensional Finite Element analysis of fin and composite slabs. **Two-dimensional steady state heat transfer problems:** Derivation of Thermal Stiffness matrix for 2D heat transfer problems-CST, Derivation of thermal force vector for 2D heat transfer problems.

**Dynamic Analysis**: Formulation of mass matrices for uniform bar and beam Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems.

**UNIT–IV:**

**Plate Bending**: Introduction – Plate behavior – C1 (Kirchoff) Plate elements – C0 (Mindlin) Plate elements – Mindlin beam – More devices for C0 Plate elements – Boundary conditions - Analytical problems.

**Nonlinear finite element of solids**: Material Nonlinearities, objective rates, nonlinear elasticity, Plasticity, viscoplasticity, viscoelasticity

**UNIT–V:**

**Boundary Element Method: Potential Problems:** Introduction, boundary Element Approach-Fundamental solution. Numerical Implementation - Determination of Ci, Final Relation, Three-dimensional analysis, tackling kernel singularity.

**Boundary Element Formulation for Electrostatic Problems:** Introduction, Basic Relation- Boundary condition, other relations. Discretization and Matrix Formulation – Determination of term C(p)m.

**Text Books**:

1. Finite and Boundary Element Methods in Engineering by O.P. Gupta, Oxford & IBH Publishing Co. Pvt. Ltd
2. The finite element methods in Engineering by S.S. Rao, Elsevier, 4th edition

**Reference Books:**

1. Finite Element Methods by Alavala, PHI.
2. Introduction to Finite Elements in Engineering by Tirupathi K. Chandrupatla and Ashok D. Belagundu.
3. An Introduction to Finite Element Methods by J. N. Reddy, Mc Graw hill
4. The Finite element method in engineering science by O.C. Zienkowitz, Mc Graw hill.
5. Concepts and Applications of Finite Element Analysis by Robert Cook, Wiley

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**MECHANICS OF COMPOSITE MATERIALS (Professional Elective - III)**

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**Prerequisite:** Structure and properties of composite materials and design procedures for composite structures

**Course objectives:** To identify the properties of fiber and matrix materials used in commercial composites as well as some common manufacturing teaching and to predict the elastic properties of both long and short fiber and understand the stress-strain relations and establish the failure criteria for laminated structures.

**Course Outcomes:** At the end of the course the students will be able to

* Understanding of types, manufacturing processes, and applications of composite materials.
* Basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior.
* Ability to analyze problems on macro and micro mechanical behavior of lamina
* Ability to analyze problems on macro mechanical behavior of laminate
* An ability to predict the loads and moments that cause an individual composite layer and a composite laminate to fail and to compute hygro thermal loads in composites.
* An ability to compute the properties of a composite laminate with any stacking sequence.

**UNIT – I:**

**Basic Concepts and Characteristics:** Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

**Reinforcements:** Fibres – Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

**UNIT – II:**

**Micromechanics:** Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

**Manufacturing methods:** Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

**UNIT – III:**

**Coordinate Transformation:** Hooke’s law for different types of materials, Hooke’s law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off – axis, stiffness modulus, off – axis compliance.

**Elastic behavior of unidirectional composites:** Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

**UNIT – IV:**

**Strength of Unidirectional Lamina:** Micro mechanics of failure, Failure mechanisms, strength of an orthotropic lamina, strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micros mechanical predictions of elastic constants.

**UNIT – V:**

**Analysis of Laminated Composite Plates:** Introduction thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

**TEXT BOOKS:**

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
3. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley- Interscience, New York, 1980.

**REFERENCES BOOKS:**

1. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K. Kaw,**Publisher:** CRC
2. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Rainfold, New York, 1969.
3. Advanced Mechanics of Composite Materials/ Vasiliev & Morozov /Elsevier/Second Edition

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**DESIGN FOR MANUFACTURING & ASSEMBLY (Professional Elective - III)**

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**Prerequisites:** Manufacturing Processes, Engineering Materials

**Course Objectives**: The objective of course is identify the manufacturing constraints that influence the design of parts and part systems. Students will be introduced to the Design for Manufacturability (DFM) methodology, and will be motivated to understand infeasible or impractical designs.

**Course Outcomes:** At the end of the course, the student will be able to:

* Understand the quality aspects of design for manufacture and assembly
* Apply Boothroyd method of DFM for product design and assembly
* Apply the concept of DFM for casting, welding, forming and assembly
* Identify the design factors and processes as per customer specifications
* Apply the DFM method for a given product

**UNIT - I:**

**Introduction:** Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of design Ling for economical production - creativity in design. Materials: Selection of Materials for design Developments in Material technology - criteria for material selection - Material selection interrelationship with process selection process selection charts.

**UNIT - II:**

**Machining Process**: Overview of various machining processes - general design rules for machining - Dimensional tolerance and surface roughness - Design for machining - Ease - Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts. **Metal Casting**: Appraisal of various casting processes, selection of casting process, - general design considerations for casting - casting tolerances - use of solidification simulation in casting design - product design rules for sand casting.

**UNIT - III:**

**Metal Joining**: Appraisal of various welding processes, Factors in design of weldments
- general design guidelines - pre and post treatment of welds - effects of thermal stresses in weld joints - design of brazed joints. Forging - Design factors for Forging - Closed dies forging design - parting lines of dies drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

**PLASTICS**: Viscoelastic and Creep behavior in plastics – Design guidelines for Plastic components – Design considerations for Injection Moulding.

**UNIT-IV**

**Assemble Advantages:** Development of the assemble process, choice of assemble method assemble advantages social effects of automation.

**Automatic Assembly Transfer Systems**: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

**UNIT-V:**

**Design of Manual Assembly**: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

**TEXT BOOKS:**

1. Assembly Automation and Product Design/ Geoffrey Boothroyd/ Marcel Dekker Inc., NY, 1992.
2. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed. 2000.
3. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.

**REFERENCES:**

1. Computer Aided Assembly London/ A Delbainbre/
2. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**INDUSTRIAL ROBOTICS (Professional Elective - III)**

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**Prerequisites:** Kinematics of machinery

**Course Objectives:**

* To Demonstrate knowledge of different types of actuators used in robotic systems.
* To Analyze the position and velocity kinematics of a robot arm, implement in 2D.
* To Analyze the dynamics of a robot arm, implement in 2D.
* To Analyze sensor signals to implement real-time control algorithms.
* To Demonstrate knowledge of error propagation in electrical, mechanical and computational systems.
* To Construct, program, and test the operation of a robotic system to perform a specified task.

**Course Outcomes:** After doing this course, the student should be able to,

* Understand the evolution, classification, structures and drives for robots.
* Teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors.
* Apply spatial transformation to obtain forward kinematics equation of robot manipulators
* Solve inverse kinematics of simple robot manipulators
* Expose the students to build a robot for any type of application.

**UNIT-I:**

**Introduction:** Automation and Robotics, Robot anatomy configuration, motions joint motion and notatioin, work volume, robot drive system, control system and dynamic performance, precision of movement.

**Control System and Components:** basic concept and modals controllers control system analysis, robot actuators and feedback components (sensors): Internal & External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics, Power Transmission Systems.

**UNIT-II:**

**Motion Analysis and Control:** Manipulator kinematics, position representation Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward & Inverse transformations, problems on planar & spatial manipulators, Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated & Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending.

**UNIT-III:**

**Robot Dynamics:** Lagrange – Euler & Newton - Euler formulations, problems on two link planar manipulators, configuration of robot controller.

**End Effectors**: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.

**Machine Vision:** Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

**UNIT-IV:**

**Robot Programming:** Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations.

**Robot Languages:** Textual robot languages, Generation, Robot language structures, Elements and functions.

**UNIT-V:**

**Robot Cell Design and Control:** Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.

**Robot Applications:** Material transfer, Machine loading/unloading. Processing operations, Assembly and Inspection, Future Applications.

**TEXT BOOKS:**

1. Introduction to Robotics Mechanics & Control by John J. Craig, Pearson
2. Industrial robotics by Mikell P. Groover, McGraw Hill.

**REFERENCE BOOKS:**

1. Robot Analysis and Control /Asada H. and J. E. Slotin, Wiley, New York

2. Theory of Applied Robotics: Kinematics, Dynamics and Control/ Reza N. Jazar, Springer, India.

 3. Robot Analysis/Lung Wen Tsai/John Wiley & Sons

4. Robotics by K.S. Fu, McGraw Hill.

 5. Robotics & Control /RK Mittal & IJ Nagrath/ Tata Mc-GrawHill

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**HYDRAULIC AND PNEUMATIC SYSTEMS (Professional Elective - IV)**

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**UNIT – I:**

Oil hydraulic systems Hydraulic pumps, types and construction details, sizing and selection.

Direction control valves, flow and pressure control valves.

**UNIT – II:**

Linear actuators types Piston rod design sizing and selection, Rotary actuators, hydraulic reservoir accumulators.

**UNIT – III:**

Design of hydraulic circuits, seals and packings, hydraulic servo techniques, cylinders and air motors.

**UNIT – IV:**

Sequencing and synchronizing circuits, accumulator, low cost automation Hydro circuits, accumulators, Hydro pneumatic circuits principles of pneumatic circuit design.

**UNIT – V:**

Maintenance and trouble shooting of hydraulic and pneumatic circuits, components,

PLC Automation and uses of Microprocessors.

**REFERENCES:**

1. Oil Hydraulic Systems/ S.R. Majumdar/ Tata McGraw Hill
2. Pneumatic systems, principles and maintenance/ S.R. Majumdar/Tata McGraw Hill
3. Hydraulic and pneumatics/ Andrew Darr/ Jaico Publishing Hoise.
4. Fluid power with applications/ Antony Esponssito/ Prentice Hall

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**MECHATRONICS (Professional Elective - IV)**

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**Unit I:**

**Introduction:** Overview, History of mechatronics, Scope and significance of Mechatronics systems, elements of Mechatronic systems, Needs and benefits of Mechatronics in manufacturing.

**Sensors:** Classification of sensors basic working principles, displacement sensor – linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders, Proximity and range sensors – Eddy current sensor, ultrasonic sensor, laser interferometer transducer, hall Effect sensor, inductive Proximity switch, Light sensors – Photodiodes, Phototransistors, Flow Sensors – ultrasonic Sensor, Laser Doppler Anemometer, Tactile Sensors – PVDF tactile sensor, micro-switch and reed switch, Piezoelectric sensors, Vision Sensor.

**Unit II:**

**Actuators: Electrical Actuators**: Solenoids, relays, diodes, thyristors, triacs, BJT, FET, DC motor, Servo Motor, BLDC Motor, AC Motor, Stepper Motor, Hydraulic & pneumatic devices – Power supplies, valves, Cylinder sequencing, Design of hydraulic & pneumatic circuits. PiezoElectric Actuators, Shape memory alloys.

**Unit III:**

**Basic System models & Analysis:** Modeling of one & two degrees of freedom Mechanical, Electrical, fluid and thermal systems, block diagram representations of these systems. Dynamic Responses of System: Transfer function, modeling dynamic systems, first order systems, second order systems.

**Unit IV:**

**Digital Electronics:** Number systems, BCD codes and arithmetic, Gray codes, self complimenting codes, Error detection and correction principles. Boolean functions using Karnaugh Map, Design of combinational circuits, design of arithmetic circuits, Design of code converters, encoders and decoders.

**Signal Conditioning:** Operational amplifiers, inverting amplifier, differential amplifier, Protection, comparator, filters, multiplexer, Pulse width modulation counters, decoders. Data acquisition – Quantizing theory, Analog to digital conversion, digital to analog conversion.

**Controllers:** Classification of Control systems, Feedback, Closed loop and open loop systems **PLC**

**Unit V:**

**Programming:** PLC Principles of operation, PLC sizes, PLC hardware components, I/O section Analog I/O section, Analog I/O modules, digital I/O modules, CPU processor memory, module programming, Ladder Programming, ladder diagrams, Timers, Internal relays and counters, data handling, analogue input and output. Application on real time industrial automation systems.

**Advanced Applications in Mechatronics:** Sensors for condition monitoring, mechatronic control in automated manufacturing, Artificial intelligence in Mechatronics, micro sensors in mechatronics, Application of Washing machine as mechatronic device.

1. W. Boton, “Mechatronics”, 5th edition, Adison WesleyLongman ltd, 2010.

2. Mehatronics system design by Devdas Shetty and Richard A. Kolk, P.W.S. Publishing

company, 2001.

3. Alciatore David G & Histand Michael B, “Introduction to Mechatronics and

Measurement systems”, 4th edition, Tata McGraw Hill, 2006

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**RELIABILITY ENGINEERING (Professional Elective - IV)**

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**Unit – I:**

**Introduction**: Probabilistic reliability, failures and failure modes, repairable and non-repairable items, pattern of failures with time, reliability economics;

**Component Reliability Models**: Basics of probability & statistics, hazard rate & failure rate, constant hazard rate model, increasing hazard rate models, decreasing hazard rate model, time-dependent & stress-dependent hazard models, bath-tub curve;

**Unit – II:**

**System Reliability Models**: Systems with components in series, systems with parallel components, combined series-parallel systems, k-out-of-m systems, standby models, load-sharing models, stress-strength models, reliability block diagram;

**Unit – III:**

**Life Testing & Reliability Assessment**: Censored and uncensored field data, burn-in testing, acceptance testing, accelerated testing, identifying failure distributions & estimation of parameters, reliability assessment of components and systems;

**Unit – IV:**

**Reliability Analysis & Allocation**: Reliability specification and allocation, failure modes and effects and criticality analysis (FMECA), fault tree analysis, cut sets & tie sets approaches;

**Unit – V:**

**Maintainability Analysis**: Repair time distribution, MTBF, MTTR, availability, maintainability, preventive maintenance

**Text Books:**

1. Ebeling CE, An Introduction to Reliability and Maintainability Engineering, TMH, New Delhi, 2004.

2. O’Connor P and Kleymer A, Practical Reliability Engineering, Wiley, 2012

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**ADVANCED COMPUTER AIDED MODELLING LAB (Lab – III)**

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**Prerequisite:** CAD, FEM

**Course Outcomes:** At the end of the course the students will be able to

* use CATIA and Pro-E and software for modeling, tolerance & GD&T analysis of a product.
* use CATIA software to model a consumer product and industrial robot.

**DRAFTING:**

1. Development of part drawings for various components in the form of orthographic and isometric.

**PART MODELING:**

1. Generation of various 3D Models through pad, shaft, shell sweep.
2. Feature based and Boolean based modeling surface and Assembly Modeling. Design simple components.
3. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
4. To make an isometric dimensional drawing of a connecting rod.
5. Draw Different type’s bolts and nuts with internal and external threading in Acme and Square threading standards. Save the bolts and nut as blocks suitable for insertion.
6. To model and assemble the flange coupling as per the dimensions given and also convert the 3D model into different views
7. To model and assemble the Screw jack as per the dimensions given and also convert the 3D model into different views.
8. To model and assemble the strap joint of Gib & cotter as per the dimensions given and also convert the 3D model in to different view.
9. Various Dimensioning and tolerancing techniques on typical products using CAD software.
10. Simulation of Kinematic Mechanism using MS Adams Package

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. TECH. I Year II Sem. (ENGG. DESIGN)**

**ADVANCED COMPUTER AIDED ANALYSIS LAB (Lab - IV)**

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| **L** | **T** | **P** | **C** |
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**Prerequisite:** CAD, FEM

**Course Outcomes:** At the end of the course the students will be able to

* carry out structural, Harmonic and fracture analysis using FEA software for real time applications.

**Note:** Conduct any **Ten** exercises from the list given below:

1. Analysis of Framed structures using FEA software.
2. Perform Fracture analysis for simple problem using FEA software.
3. Analysis of laminated composite structures using FEA software.
4. Perform a simple modal analysis for a cantilever beam using FEA software.
5. Perform Harmonic analysis for a given cantilever beam using FEA.
6. Perform a simple transient analysis for different beams.
7. **Non Linear Analysis:** Find the geometric non linearity behavior for a cantilever beam subjected to a large moment.
8. **Buckling analysis:** Solve simple buckling problems using Eigen value and non linear methods
9. Stress analysis of a rectangular plate with a circular hole.
10. Thermal Analysis of 1D & 2D problem with conduction and convection boundary conditions. (Minimum 4 exercises)
11. Design optimization of unknown parameters for a given beam.
12. Use of contact elements to simulate two given beams when they are in contact with each other.
13. **Flow Over a Flat Plate:** Solve a classical flat plate 2-D air flow problem
14. **Using Coupled Structural/Thermal Analysis:** solve a simple structural/thermal problems
15. [**Sub-structuring**](https://sites.ualberta.ca/~wmoussa/AnsysTutorial/AT/Substructuring/Substructuring.html): Solve a simple problems using Sub-structuring method in ANSYS.
16. **Melting Using Element Death**: Using element death procedure model melting of a material.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**INDUSTRY 4.0 & IoT**

**(Professional Elective - V)**

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**Course Objectives:** The objectives of this course are

• To understand the basics of Industry 4.0

•To understand the Business model and impact of IIoT

•To understand the concepts of virtual reality, lean manufacturing

•To gain knowledge of various sensors and actuators.

• To understand various data transmission technologies.

**Course Outcomes:** After completion of the course the student will be able to

* Explain Smart Business Perspective, Cyber security, Impacts of Industry 4.0.
* Understand the basics of the Industrial Internet of Things.
* : Understand various key technologies.
* Implement various sensors and actuators.
* Understand different industrial transmission technologies and IIOT applications in real life

**Unit – I:**

**Industry 4.0 Basics**: Industrial revolution: Phases, Evolution of Industry4.0, Environmental impacts of industrial revolution, Applications, Design requirements, Drivers of Industry4.0, Sustainability Assessment of industries, Smart Business Perspective, Cyber security, Impacts of Industry 4.0.

**Unit – II:**

**Industrial Internet of Things- Basics:** IIoT and Industry4.0, IIC, Industrial Internet Systems, Design of industrial internet systems, Impact of industrial internet, Benefits of industrial internet, Industrial sensing, Industrial Processes, Features of IIoT for industrial processes, Industrial plant–The future architecture, Digital Enterprise

**Business Models and Reference Architecture of IIoT**: Definition of a business model, Business models of IIoT, Industrial Internet Reference Architecture

**Unit –III:**

**Key Technologies:** Off-site Technologies, Cloud Computing, Fog Computing

**Key Technologies:** On-site Technologies, Augmented Reality, Virtual Reality, Smart factories, Lean manufacturing system, Big Data and Advanced Analytics

**Unit –IV:**

**Sensors:** Various sensor types and their underlying working principles, Characteristics of Sensors – Resolution, calibration, accuracy and others, Sensor Categories – Thermal, Mechanical, Electrical, Optical and Acoustic sensors.

**Actuators:** Thermal, Hydraulic, Pneumatic, Electro mechanical Actuator

**Unit – V:**

**Industrial Data Transmission and Acquisition:** Architectureofvarious data transmission technologies like Foundation Fieldbus, Profibus, Highway Addressable Remote Transducer (HART), Interbus, Bitbus, DigitalSTROM, Controller Area Network, and other recent and upcoming Technologies. Distributed Control System, SCADA and PLC System.

**IIOT Applications**: IoT Applications on Industrial automation, Factories and Assembly line, Plant Security and Safety, Transportation, Agriculture, Healthcare, Home Automation,Oil, Chemical and Pharmaceutical Industry and others.

**Text Book:**

1. Introduction to Industrial Internet of Things and Industry 4.0 by Sudip Misra, Chandana Roy, Anandarup Mukherjee, CRC Press
2. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, “A Hands on Approach”, University Press.
3. Dr. SRN Reddy, RachitThukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs
4. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press
5. Adrian McEwen, “Designing the Internet of Things”, Wiley.
6. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill.
7. Cuno Pfister, “Getting Started with the Internet of Things”, O Reilly Media

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**CONCURRENT ENGINEERING (Professional Elective - V)**

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**Prerequisites:** Computer-Aided Design

**Course objective:** To provide a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support.

**Course Outcomes:**

* Understand the need of concurrent engineering and strategic approaches for product design.
* Apply concurrent design principles to product design.
* Design assembly workstation using concepts of simultaneous engineering.
* Design automated fabricated systems – Case studies.

**UNIT-I:**

**Introduction:** Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development

**Use Of Information Technology:** IT support - Solid modeling - Product data management - Collaborative product commerce - Artificial Intelligence - Expert systems - Software hardware co-design.

**UNIT-II:**

**Design Stage:** Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design.

Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

**UNIT-III:**

**Manufacturing Concepts and Analysis:** Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative, physical approach - An intelligent design for manufacturing system.

**UNIT-IV:**

JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning - Design of Automated manufacturing.

**Project Management:** Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost.

**UNIT-V:**

Concurrent mechanical design - decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development.

**TEXT BOOK:**

1. Concurrent Engineering: Automation Tools and Technology by Andrew Kusaik, Wiley John and Sons Inc., 1992.

**REFERENCE BOOKS:**

1. Integrated Product Development by Anderson MM and Hein, L. Berlin, Springer Verlog, 1987.
2. Design for Concurrent Engineering by Cleetus, J.Concurrent Engineering Research Centre, Morgantown W V, 1992.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**RE- ENGINEERING (Professional Elective – V)**

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**Course objective:** The objective is to understand the terminologies related to forward engineering and reverse engineering and to identify the process of designing, manufacturing, assembling, and maintaining products and systems.

**Course Outcomes**: At the end of the course, the student will be able to:

* Familiarize with the process of reverse engineering and its applications.
* Understand the methodologies and techniques for Reverse Engineering.
* Learn various data collection techniques and the data processing chain.
* Select a proper system to generate geometric representations of physical objects.
* Integrate Reverse Engineering and Rapid Prototyping.

**Unit - I**

**Introduction to Reverse Engineering:** Reverse Engineering –The Generic Process

Reverse Engineering in Automotive, Aerospace, Medical sectors: Legal Aspects of Reverse Engineering: Copyright Law, Reverse Engineering, Recent Case Law, Barriers to Adopting Reverse Engineering. A discussion on a few benchmark case studies

**Unit –II**

**Methodologies and Techniques for Reverse Engineering**: The Potential for Automation with 3-D Laser Scanners, What Is Not Reverse Engineering, What is Computer-aided (Forward) Engineering, What Is Computer-aided Reverse Engineering, Computer Vision and Reverse Engineering, Structured-light Range Imaging, Scanner Pipeline

**Unit – III**

**Reverse Engineering–Hardware and Software**: Contact Methods Noncontact Methods, Destructive Method. Reverse Engineering Software Classification, Fundamental Reverse Engineering Operations, Reverse Engineering Phases

**Unit - IV**

**Selecting a Reverse Engineering System**: The Selection Process, Some Additional Complexities, Point Capture Devices, Triangulation Approaches, “Time-of-flight” or Ranging Systems, Structured-light and Stereoscopic Imaging Systems, issues with Light-based Approaches, Tracking Systems, Internal Measurement Systems, X-ray Tomography, Destructive Systems, Some Comments on Accuracy, Positioning the Probe, Post processing the Captured Data, Handling Data Points, Curve and Surface Creation, Inspection Applications, Manufacturing Approaches.

**Unit – V:**

**Integration between Reverse Engineering and Rapid Prototyping**: Modeling Cloud Data in Reverse Engineering, Data Processing for Rapid Prototyping, Integration of RE and RP for Layer-based Model Generation, Adaptive Slicing Approach for Cloud Data Modeling, Planar Polygon Curve Construction for a Layer, Determination of Adaptive Layer Thickness.

**TEXT BOOK:**

1. Reverse Engineering: An Industrial Perspective by Vinesh Raja and Kiran J. Fernandes, Springer-Verlag London Limited 2008

**REFERENCE BOOKS:**

1. K. Otto and K. Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Prentice Hall, 2001.
2. Anupam Saxena, Birendra Sahay, Computer Aided Engineering Design, Springer, 2005.
3. Ali K. Kamrani and Emad Abouel Nasr, Engineering Design and Rapid Prototyping, Springer, 2010.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**Open Elective**

**Business Analytics**

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**Prerequisite:** None

**Course objectives:**

* Understand the role of business analytics within an organization.
* Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
* To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
* To become familiar with processes needed to develop, report, and analyze business data.
* Use decision-making tools/Operations research techniques.
* Mange business process using analytical and management tools.
* Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

**Course Outcomes:** At the end of the course, students will be able to

* demonstrate knowledge of data analytics.
* demonstrate the ability of thinking critically in making decisions based on data and deep analytics.
* demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
* demonstrate the ability to translate data into clear, actionable insights.

**UNIT- I:**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

**UNIT- II:**

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

**UNIT- III:**

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

**UNIT- IV:**

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting.

Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

**UNIT- V:**

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

**TEXT BOOKS:**

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**Waste to Energy**

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**Prerequisites:** An introductory knowledge of solid and hazardous waste along with some basic understanding of solid waste management at industries

**Course Objectives**: To prepare the students for successful career in the energy industry, energy service companies, energy utility and consultancy agencies and in the academic and R&D institutions.

To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy issues.

To produce energy professionals, who are sensitive to, and well aware of, the energy issues and concerns, and who can apply their specialized knowledge for the sustainable development.

**Course Outcomes**: At the end of the course, students will be able to

CO1: Grasp the fundamentals in the science and engineering of energy technologies and systems.

CO 2: Acquired the expertise and skills required for energy auditing and management, economical calculation of energy cost, development, implementation, maintenance of energy systems.

CO 3:Become capable of analysis and design of energy conversion systems. Acquired skills in the scientific and technological communications and project preparation, planning and implementation of energy project

**UNIT-I:**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW – Conversion devices – Incinerators, gasifiers, digestors

**UNIT-II**:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal- Methods – Yields and application- Manufacture of pyrolytic oils and gases, yields and applications. Biomass Gasification: Gasifiers- Fixed bed system- Downdraft and updraft gasifiers- Fluidized bed gasifiers- Design, construction and operation- Gasifiers burner arrangement for thermal heating Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

**UNIT-III**:

Biomass Combustion: Biomass stoves- Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, Inclined grate combustors, Fluidized bed combustors, Design, construction and operation- Operation of all the above biomass combustors.

**UNIT-IV:**

Biogas: Properties of biogas (Calorific value and composition)- Biogas plant technology and status- Bio energy system – Design and constructional features- Biomass resources and their classification- Biomass Conversion Process

**UNIT-V**:

Thermo chemical conversion – Direct combustion – biomass gasification- pyroloysis and liquefaction- biochemical conversion- anerobic digestion- Types of biogas Plants- Applications Alcohol production from biomass- Bio diesel production- Urban waste to energy conversion Biomass energy programme in India

**Text Books**:

1. Non Conversional Energy by Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology – A Practical Hand Book by Khandelwal, K.C and Mahdi, S.S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd, 1983.

**Reference Books**:

1. Food, Feed and Fuel from Biomass by Challal, D.S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology by C.Y. WereKo- Brobby and E.B. Hagan, John Wiley & Sons, 1996.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**INDUSTRIAL SAFETY (Open Elective)**

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**UNIT – I:**

Safety Philosophy and principles of Accident prevention Introduction, accident, injury, unsafe act, unsafe condition, reportable accidents, need for safety, breakdown of accidents, hazardous industries. Theories & Principle of accidents Casualty, cost of accident, computation of cost, utility of cost data. Accident reporting & Investigation Identification of the key facts, corrective actions, classification of facts. Regulation American (OSHA) and Indian Regulation.

**UNIT – II:**

Safety Management Division of responsibility, Location of Safety function, size of safety department, qualification for safety specialist, safety committee – structure and functions.

**UNIT – III:**

Safe Working Condition and Their Development SOP for various Mechanical equipment, Incidental safety devices and methods, statutory of provisions related to safeguarding of Machinery and working condition.

**UNIT – IV:**

Safety in Operation and Maintenance Operational activities and hazards, starting and shut down procedures, safe operation of pumps, compressor, heaters, reactors, work permit system, entry into continued spaces.

**UNIT – V:**

Safety in Storage and Emergency Planning Safety in storage, handling of chemicals and gases, storage layout, ventilation, safety in chemical laboratories, emergency preparedness on site plan, off site plan, toxic hazard control.

**TEXT BOOKS:**

1. Safety and Accident Prevention in Chemical Operation – H.H. Faweett and Wood
2. Personal Protective Equipment – NSC Bombay

**REFERENCE BOOKS:**

1. Ergonomics - P. Krishna Murthy
2. Fire Prevention Hand Book – Derek James

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**M. TECH. II Year I Sem. (ENGINEERING DESIGN)**

**PRINCIPLES OF AUTOMATION (Open Elective)**

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**UNIT- I:**

**Introduction to Automation:** Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

**UNIT- II:**

Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

**UNIT – III:**

Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

**UNIT- IV:**

Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

**UNIT- V:**

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

**REFERENCE BOOKS:**

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Education.
2. CAD CAM: Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE)
3. Automation, Buckinghsm W, / Haper & Row Publishers, New York, 1961
4. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**ENGLISH FOR RESEARCH PAPER WRITING (Audit Course - I & II)**

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**Prerequisite:** None

**Course objectives:** Students will be able to:

* + Understand that how to improve your writing skills and level of readability
	+ Learn about what to write in each section
	+ Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

**UNIT-I:**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

**UNIT-II:**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**UNIT-III:**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

**UNIT-IV:**

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

**UNIT-V:**

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**TEXT BOOKS/ REFERENCES:**

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman’s book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**DISASTER MANAGEMENT (Audit Course - I & II)**

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| **L** | **T** | **P** | **C** |
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**Prerequisite:** None

**Course Objectives:** Students will be able to

* + learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
	+ critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
	+ develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
	+ critically understand the strengths and weaknesses of disaster management approaches,
	+ planning and programming in different countries, particularly their home country or the countries they work in

**UNIT-I:**

**Introduction:**

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**Disaster Prone Areas in India:**

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

**UNIT-II:**

**Repercussions of Disasters and Hazards**:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

**UNIT-III:**

**Disaster Preparedness and Management:**

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

**UNIT-IV:**

**Risk Assessment Disaster Risk:**

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival.

**UNIT-V:**

**Disaster Mitigation:**

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

**TEXT BOOKS/ REFERENCES:**

* 1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal book Company.
	2. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.
	3. Goel S. L., Disaster Administration and Management Text and Case Studies”, Deep &Deep Publication Pvt. Ltd., New Delhi.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course - I & II)**

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| **L** | **T** | **P** | **C** |
| **2** | **0** | **0** | **0** |

**Prerequisite:** None

**Course Objectives:**

* + To get a working knowledge in illustrious Sanskrit, the scientific language in the world
	+ Learning of Sanskrit to improve brain functioning
	+ Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
	+ The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

**Course Outcomes:** Students will be able to

* + Understanding basic Sanskrit language
	+ Ancient Sanskrit literature about science & technology can be understood
	+ Being a logical language will help to develop logic in students

**UNIT-I:**

Alphabets in Sanskrit,

**UNIT-II:**

Past/Present/Future Tense, Simple Sentences

**UNIT-III:**

Order, Introduction of roots,

**UNIT-IV:**

Technical information about Sanskrit Literature

**UNIT-V:**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

**TEXT BOOKS/ REFERENCES:**

* 1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
	2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
	3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**VALUE EDUCATION (Audit Course - I & II)**

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| **L** | **T** | **P** | **C** |
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**Prerequisite:** None

**Course Objectives:** Students will be able to

* Understand value of education and self- development
* Imbibe good values in students
* Let the should know about the importance of character

**Course outcomes:** Students will be able to

* Knowledge of self-development
* Learn the importance of Human values
* Developing the overall personality

**UNIT-I:**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

**UNIT-II:**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

**UNIT-III:**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

**UNIT-IV:**

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

**UNIT-V:**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

**TEXT BOOKS/ REFERENCES:**

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**CONSTITUTION OF INDIA (Audit Course - I & II)**

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| **L** | **T** | **P** | **C** |
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**Prerequisite:** None

**Course Objectives:** Students will be able to:

* + Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
	+ To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
	+ To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**Course Outcomes:** Students will be able to:

* Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
* Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
* Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
* Discuss the passage of the Hindu Code Bill of 1956.

**UNIT-I:**

**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble**,** Salient Features.

**UNIT-II:**

**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights**,** Right to Constitutional Remedies, Directive Principles of State Policy**,** Fundamental Duties.

**UNIT-III:**

**Organs of Governance:** Parliament**,** Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

**UNIT-IV:**

**Local Administration:** District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**UNIT-V:**

**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**TEXT BOOKS/ REFERENCES:**

* 1. The Constitution of India, 1950 (Bare Act), Government Publication.
	2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
	3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
	4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**PEDAGOGY STUDIES (Audit Course - I & II)**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **2** | **0** | **0** | **0** |

**Prerequisite:** None

**Course Objectives:** Students will be able to:

* + Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
	+ Identify critical evidence gaps to guide the development.

**Course Outcomes:** Students will be able to understand:

* + - What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
		- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
		- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

**UNIT-I:**

**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

**UNIT-II:**

**Thematic overview:** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

**UNIT-III:**

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers’ attitudes and beliefs and Pedagogic strategies.

**UNIT-IV:**

**Professional development:** alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

**UNIT-V:**

**Research gaps and future directions:** Research design**,** Contexts**,** Pedagogy**,** Teacher education**,** Curriculum and assessment**,** Dissemination and research impact.

**TEXT BOOKS/ REFERENCES:**

* + 1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
		2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
		3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
		4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
		5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
		6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
		7. www.pratham.org/images/resource%20working%20paper%202.pdf.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**STRESS MANAGEMENT BY YOGA (Audit Course - I & II)**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **2** | **0** | **0** | **0** |

**Prerequisite:** None

**Course Objectives:**

* + - To achieve overall health of body and mind
		- To overcome stress

**Course Outcomes:** Students will be able to:

* + - Develop healthy mind in a healthy body thus improving social health also
		- Improve efficiency

**UNIT-I:**

Definitions of Eight parts of yog. (Ashtanga)

**UNIT-II:**

Yam and Niyam.

**UNIT-III:**

Do`s and Don’t’s in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**UNIT-IV:**

Asan and Pranayam

**UNIT-V:**

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

**TEXT BOOKS/ REFERENCES:**

* + 1. ‘Yogic Asanas for Group Tarining-Part-I”: Janardan Swami Yogabhyasi Mandal, Nagpur
		2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech. (ENGG. DESIGN)**

**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**

**(Audit Course - I & II)**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **2** | **0** | **0** | **0** |

**Prerequisite:** None

**Course Objectives:**

* To learn to achieve the highest goal happily
* To become a person with stable mind, pleasing personality and determination
* To awaken wisdom in students

**Course Outcomes:** Students will be able to

* Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
* The person who has studied Geeta will lead the nation and mankind to peace and prosperity
* Study of Neetishatakam will help in developing versatile personality of students

**UNIT-I:**

Neetisatakam-Holistic development of personality

* Verses- 19,20,21,22 (wisdom)
* Verses- 29,31,32 (pride & heroism)
* Verses- 26,28,63,65 (virtue)

**UNIT-II:**

Neetisatakam-Holistic development of personality

* Verses- 52,53,59 (dont’s)
* Verses- 71,73,75,78 (do’s)

**UNIT-III:**

Approach to day to day work and duties.

* Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
* Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
* Chapter 18-Verses 45, 46, 48.

**UNIT-IV:**

Statements of basic knowledge.

* Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
* Chapter 12 -Verses 13, 14, 15, 16,17, 18
* Personality of Role model. Shrimad Bhagwad Geeta:

**UNIT-V:**

* Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
* Chapter 4-Verses 18, 38,39
* Chapter18 – Verses 37,38,63

**TEXT BOOKS/ REFERENCES:**

1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.