JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech., ENGINEERING DESIGN
EFFECTIVE FROM ACADEMIC YEAR 2025- 26 ADMITTED BATCH
R25 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 and Analysis 3. Mechanical Vibrations	3	0	0	3
Professional Elective - II	1. Mechanical Behavior of Materials 2. Optimization Techniques and 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. Mechanics of Composite Materials 2. Design for Manufacturing and Assembly 3. Industrial Robotics	3	0	0	3
Professional Elective - IV	1. Hydraulic and Pneumatic Systems 2. Mechatronics 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. Smart Manufacturing 2. Concurrent Engineering 3. Re- Engineering	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review - II	0	0	18	6
	Total	**6**	**0**	**18**	**12**

II YEAR II SEMESTER

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review - III	0	0	18	6
Dissertation	Dissertation Viva-Voce	0	0	42	14
	Total	**0**	**0**	**60**	**20**

***For Dissertation Work Review - I, please refer R25 Academic Regulations.**

Audit Course I:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education

Audit Course II:

1. Constitution of India
2. Pedagogy Studies
3. Stress Management by Yoga
4. 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 Semester

ADVANCED MECHANICS OF SOLIDS

(Professional Core - I)

L	T	P	C
3	0	0	3

Prerequisites: Strength of materials

Course Objectives:

1. Deepen understanding of stress and strain analysis in three dimensions.
2. Introduce concepts of elasticity, plasticity, and failure theories.
3. Provide methods for analyzing complex loading conditions in structural elements.
4. Develop competency in energy methods and variational principles in solid mechanics.
5. Apply advanced analytical techniques to real-world engineering problems involving solid structures.

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

1. Analyze three-dimensional stress and strain states in solid bodies.
2. Apply elasticity and plasticity theories to determine material response under complex loading.
3. Use energy methods (e.g., Castigliano's theorem) to solve structural mechanics problems.
4. Evaluate stress concentration, failure criteria, and stability in structural components.
5. Model and solve problems involving torsion, bending, and combined stresses using analytical and numerical approaches.

UNIT- I: Stress and Strain Analysis with Thermo - elasticity

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 and Unsymmetrical Bending of Beams

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 of Prismatic Bars

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, Arthur P. Boresi and Richard J. Schmidt, Wiley International, 6th Edition, 2003.
2. Advanced Mechanics of Solids, L.S. Srinath, Tata McGraw-Hill Publishing Company Limited, 2nd Edition, 2003.

REFERENCES:

1. Advanced Strength of Materials, J.P. Den Hartog, Dover Publications, Reprint Edition, 1987.
2. Theory of Elasticity, S.P. Timoshenko and J.N. Goodier, McGraw-Hill Publishers, 3rd Edition, 1970.
3. Advanced Mechanics of Materials and Applied Elasticity, Ansel C. Ugural and Saul K. Fenster, Pearson Education, 5th Edition, 2011.
4. Strength of Materials, Sadhu Singh, Khanna Publishers, Revised Edition, 2008.
5. Elasticity: Theory, Applications, and Numerics, Martin H. Sadd, Academic Press, 3rd Edition, 2020.
6. Mechanics of Solids and Structures, Roger T. Fenner, CRC Press, 2nd Edition, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

ADVANCED MACHINE DESIGN

(Professional Core- II)

L	T	P	C
3	0	0	3

Prerequisite: Design of Machine Elements

Course Objectives: The course aims to

1. Study design concepts in order to enhance the basic design.
2. Study behavior of mechanical components under fatigue and creep.
3. Study statistical techniques and its applications in mechanical design.
4. Understand the design methodology for power transmission components like shafts, ropes, chains, gears, and power screws.
5. Apply material selection and manufacturing techniques in the design of mechanical elements.

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

1. Ability to analyze behavior of mechanical elements under different loads.
2. Understand the design of different transmission elements of automobile.
3. Ability to analyze mechanical elements critically.
4. Apply statistical and reliability concepts in mechanical design problems.
5. Design and select appropriate materials and geometry for mechanical components like shafts, chains, gears, and power screws under practical constraints.

UNIT-I: Design and Failure of Shafts and Axles

Introduction, Causes of Failure in Shafts and Axles, 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 Drives and Wire Rope Design

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 of 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, Single and Double Helical, Gear Tooth Proportions, Gear Hunting, 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 Compound Screws, Ball Bearing Screws.

TEXT BOOKS:

1. Mechanical Engineering Design, J.E. Shigley, McGraw-Hill Education, 10th Edition, 2015.
2. Machine Design, Valitin L. Maleev and Jack B. Hartman, CBS Publishers and Distributors, Indian Edition, 1983.

REFERENCE BOOKS:

1. Machine Design, Schaum's Outline Series (by Allen Strickland Hall), McGraw-Hill Education, 1st Edition, 1961.
2. Machine Design, Dr. P.C. Sharma, S.K. Kataria and Sons, Revised Edition.
3. Design of Machine Elements, V.B. Bhandari, McGraw-Hill Education, 4th Edition, 2017.
4. Design of Machine Elements, M.F. Spotts, T.E. Shoup, L.E. Hornberger, Pearson Education, 8th Edition, 2004.
5. Machine Design: An Integrated Approach, Robert L. Norton, Pearson Education, 5th Edition, 2013.
6. Fundamentals of Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, Wiley, 5th Edition, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

ADVANCED MECHANICS OF MACHINERY

(Professional Elective –I)

L	T	P	C
3	0	0	3

Prerequisite: Kinematics of machinery

Course Objectives:

1. 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.
2. Find radius of curvature of polodes.
3. Understand the graphical and analytical synthesis methods for mechanisms including function generation, path generation, and rigid body guidance.
4. Explore advanced concepts such as inflection circles, Euler-Savary equation, and collineation axes in planar motion analysis.
5. Apply Burmester theory and Freudenstein's equations for precise mechanism design in engineering applications.

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

1. Understand the kinematic analysis of rolling bodies based on graphical, geometrical and analytical methods.
2. Design of mechanisms by using graphically and analytically by involving function generator, rigid body guidance and path generation (Coupler curve) methods.
3. Apply advanced kinematic tools such as inflection circles, Hall's equation, and Carter's circle to analyze complex planar motion.
4. Synthesize four-bar mechanisms for specified instantaneous and extreme motion conditions using analytical methods.
5. Interpret and implement motion generation techniques using motion atlases and Burmester's curves in practical mechanism design.

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: Freudenstein'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, Jeremy Hirschhorn, McGraw-Hill, 1st Edition, 1962.
2. Theory of Mechanisms and Machines, Amitabh Ghosh and Ashok Kumar Mallik, East-West Press (E.W.P.) Publishers, 3rd Edition, 2006.

REFERENCES:

1. Kinematics and Linkage Design, Allen S. Hall Jr., Prentice-Hall of India (PHI), 1st Edition, 1964.
2. Theory of Machines and Mechanisms, J.E. Shigley and J.J. Uicker Jr., McGraw-Hill, 2nd Edition, 1995.
3. A Robot Engineering Textbook, Mohsen Shahinpoor, Harper and Row Publishers, New York, 1st Edition, 1987.
4. Analysis of Mechanisms and Robot Manipulators, Joseph Duffy, Edward Arnold, 1st Edition, 1980.
5. Mechanism Design: Analysis and Synthesis (Vol. I and II), Arthur G. Erdman and George N. Sandor, Prentice-Hall, 4th Edition, 2001.
6. Kinematics and Dynamics of Machinery, Charles E. Wilson and J. Peter Sadler, Pearson Education, 3rd Edition, 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
SYSTEM DESIGN AND ANALYSIS
(Professional Elective - I)

L	T	P	C
3	0	0	3

Prerequisites: Engineering Design

Course Objectives: The course aims to

1. Introduce the fundamentals and principles of experimentation and its role in scientific and engineering progress.
2. Provide foundational knowledge of probability and statistical methods used in analyzing comparative experiments.
3. Develop competency in designing and analyzing factorial and fractional factorial experiments using orthogonal arrays.
4. Introduce response surface methodology (RSM) for modeling and optimization of processes and systems.
5. Apply Taguchi's methods for robust design and quality improvement by minimizing variability due to noise factors.

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

1. Describe the role and steps of scientific experimentation in engineering problem solving.
2. Apply statistical tools for comparing two or more population means and variances using t-tests, F-tests, and ANOVA.
3. Design and analyze full and fractional factorial experiments using orthogonal arrays and interaction tables.
4. Select appropriate experimental designs based on problem requirements and modify standard orthogonal arrays accordingly.
5. Use response surface methodology to develop regression models and identify optimal process conditions through steepest ascent and second-order models.

UNIT - I: Principles of Experimental Methods

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 and 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 and S/N Ratios, Inner Array and Outer Array Design, Data Analysis.

TEXT BOOKS:

1. Design and Analysis of Experiments, Douglas C. Montgomery, John Wiley and Sons, New York, 7th Edition, 2008.
2. Taguchi Techniques for Quality Engineering, Phillip J. Ross, McGraw-Hill Book Company, New York, 2nd Edition, 2008.

REFERENCES:

1. Design of Experiments: Statistical Principles of Research Design and Analysis, Robert O. Kuehl, Duxbury Press, 2nd Edition, 2000.
2. Statistics for Experimenters: Design, Innovation, and Discovery, George E.P. Box, J. Stuart Hunter, William G. Hunter, Wiley Publisher, 2nd Edition, 2005.
3. Response Surface Methodology: Process and Product Optimization Using Designed Experiments, Raymond H. Myers, Douglas C. Montgomery, Christine M. Anderson-Cook, Wiley, 4th Edition, 2016.
4. Statistical Design and Analysis of Engineering Experiments, Charles Lipson and Narendra J. Sheth, McGraw-Hill, 1st Edition, 1973.
5. Introduction to Statistical Quality Control, Douglas C. Montgomery, Wiley, 8th Edition, 2020.
6. Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, Wiley, 7th Edition, 2018.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
MECHANICAL VIBRATIONS
(Professional Elective - I)

L	T	P	C
3	0	0	3

Prerequisite: Basic concepts of Physics

Course Objectives:

1. Introduce the basic concepts of vibrations and their significance in mechanical systems.
2. Develop mathematical models for analyzing free and forced vibrations in single and multi-degree-of-freedom systems.
3. Explain damping mechanisms and resonance phenomena in mechanical structures.
4. Explore vibration measurement techniques and isolation methods.
5. Provide tools for analyzing vibration problems in mechanical design and control.

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

1. Study the vibrations in machine elements and apply suitable methods to control them.
2. Analyze the mathematical model of linear vibratory systems to determine their dynamic response.
3. Develop linear mathematical models of real-life mechanical systems using appropriate assumptions.
4. Determine vibratory responses of single and multi-degree-of-freedom systems subjected to harmonic, periodic, and non-periodic excitations.
5. Apply analytical and numerical methods (Rayleigh, Dunkerley, Holzer, etc.) to evaluate natural frequencies and mode shapes of complex systems.

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, Force Transmitted, Relative Motion.

UNIT- III: Two Degree of Freedom Systems

Introduction, Equations of Motion for Forced Vibration, Free Vibration Analysis of an Undamped System, Torsional System, Coordinate Coupling and Principal Coordinates, Forced 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, Eigenvalue Problem, Solution of the Eigenvalue Problems, Solution of the Characteristic Equation, Orthogonality of Normal Modes, Repeated Eigenvalues.

UNIT-V: Analytical and Numerical Methods

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 Eigenvalue Problems.

TEXT BOOKS:

1. Mechanical Vibrations, G.K. Grover, Nem Chand and Bros, Revised Edition, 2009.
2. Elements of Vibration Analysis, Leonard Meirovitch, McGraw-Hill, 2nd Edition, 1986.

REFERENCES:

1. Mechanical Vibrations, V. P. Singh, Dhanpat Rai and Co., New Delhi, 3rd Edition, 2012
2. Mechanical Vibrations, S.S. Rao, Pearson Publications, 4th Edition, 2004.
3. Vibrations for Engineers, William T. Thomson, Prentice-Hall, 4th Edition, 1996.
4. Mechanical Vibrations (Schaum's Outline Series), S. Graham Kelly, McGraw-Hill, 1st Edition, 1996.
5. Theory of Vibrations with Applications, William T. Thomson and Marie Dillon Dahleh, Pearson Education, 5th Edition, 2007.
6. Mechanical Vibrations: Theory and Applications, Kelly S. Graham, Cengage Learning, 1st Edition, 2012.
7. Fundamentals of Vibrations, Leonard Meirovitch, McGraw-Hill, 1st Edition, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
MECHANICAL BEHAVIOUR OF MATERIALS
(Professional Elective - II)

L	T	P	C
3	0	0	3

Prerequisite: Physical Metallurgy

Course Objectives:

1. Basic understanding of phase transformation by heat-treating and stress-induced hardening.
2. Insights into linear and nonlinear elastic behavior, deformation under multi-axial loading, and plastic deformation.
3. Knowledge of dislocation plasticity and strengthening mechanisms in engineering materials.
4. Understanding of time-dependent deformation such as creep and mechanisms of stress concentration, brittle and ductile fracture.
5. Theoretical and practical understanding of fatigue, contact deformation, and wear in real-world applications.

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

1. Understand the different modes of failure such as fracture, fatigue, and creep in ductile and brittle materials.
2. Apply fracture mechanics concepts to failure prediction and materials design.
3. Analyze fatigue behaviour under varying stress conditions, including the effects of mean stress, surface finish, temperature, and corrosion.
4. Interpret creep deformation mechanisms, predict long-term behaviour using models such as the Larson-Miller parameter, and assess creep-fatigue interactions.
5. Correlate material properties, microstructural features, and loading conditions to evaluate and improve mechanical performance in engineering components.

UNIT-I: Fracture Behavior in Metals

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, Stress Corrosion Cracking.

UNIT-III: Fatigue Behavior and Crack Propagation

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 Effects and Environmental Influences

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 Mechanisms and Damage Evolution

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 Under Different Conditions, Extrapolation and the Use of Larson-Miller Parameters, Creep-Fatigue Interactions, Examples.

TEXT BOOKS:

1. Mechanical Metallurgy, G.E. Dieter, McGraw-Hill, 3rd Edition, 1988.
2. Introduction to Physical Metallurgy, Sidney H. Avner, McGraw-Hill, 2nd Edition, 1974.

REFERENCES:

1. Thin Film Materials: Stress, Defect Formation and Structure, L.B. Freund and S. Suresh, Cambridge University Press, 1st Edition, 2003.
2. Fracture Mechanics: Fundamentals and Applications, T.L. Anderson, CRC Press, 2nd Edition, 1995.
3. Fracture of Brittle Solids, Brian Lawn, Cambridge University Press, 2nd Edition, 1993.
4. Fundamentals of Fracture Mechanics, J.F. Knott, Butterworths, 1st Edition, 1973.
5. Worked Examples in Fracture Mechanics, J.F. Knott and P. Withey, Institute of Materials, 1st Edition, 1996.
6. Fracture Mechanics, H.L. Ewald and R.J.H. Wanhill, Edward Arnold, 1st Edition, 1984.
7. Mechanical Behaviour of Materials, Norman E. Dowling, Pearson Education, 4th Edition, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
OPTIMIZATION TECHNIQUES AND APPLICATIONS
(Professional Elective - II)

L	T	P	C
3	0	0	3

Pre-requisites: Operations Research

Course Objectives:

1. To introduce the fundamentals of optimization and its role in engineering and decision-making.
2. To develop the ability to formulate optimization problems for real-world applications.
3. To familiarize students with classical, numerical, and modern optimization techniques.
4. To enable analysis and comparison of various optimization algorithms for efficiency and accuracy.
5. To apply optimization methods to solve practical problems in manufacturing, design, and management.

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

1. Apply suitable optimization techniques to solve single-variable and multivariable problems.
2. Perform sensitivity analysis for parameter changes in Linear Programming Problems.
3. Solve integer and stochastic programming problems using appropriate algorithms.
4. Formulate and solve Goal Programming models for multi-objective optimization.
5. Apply metaheuristic methods such as Genetic Algorithm, Simulated Annealing, and Particle Swarm Optimization to real-world problems.

UNIT-I: Linear Programming

Formulation, Simplex Method and Artificial Variable Optimization Techniques: Big M and Two-Phase Methods. Sensitivity Analysis: Changes in the Objective Coefficients, Constants and Coefficients of the Constraints. Addition of Variables, Constraints. Simulation, Introduction, Types, Steps, Applications. Inventory and Queuing, Advantages and Disadvantages.

UNIT-II: Integer and Stochastic Programming Techniques

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-III: Single Variable Non-Linear Unconstrained Optimization

Elimination Methods: Uni-Model Function, Its Importance. Fibonacci Method and Golden Section Method. Interpolation Methods: Quadratic and Cubic Interpolation Methods.

UNIT-IV: 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 and its Importance, Steepest Descent Method, Conjugate Direction Methods: Fletcher- Reeves Method Variable

Metric Method.

UNIT-V: Geometric Programming and Modern Optimization Methods

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 and Traditional Methods. Simulated Annealing, Working Principle, Simple Problems. Introduction to Particle Swarm Optimization. (PSO).

TEXTBOOKS:

1. Engineering Optimization: Theory and Practice, S. S. Rao, New Age International Pvt. Ltd Publishers, 3rd Edition, 2013.
2. Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, PHI, 2nd Edition, 2012.

REFERENCE BOOKS:

1. Operations Research: Theory and Applications, S. D. Sharma, Kedar Nath Ram Nath Publisher, 4th Edition, 2022.
2. Operations Research: An Introduction, H. A. Taha, Pearson Publisher, 10th Edition, 2019.
3. Optimization in operations research, R. L Rardin, Pearson Imprint, 3rd Edition, 2016.
4. Optimization Techniques, Chakraverty and P.R. Chandraputla, Pearson Asia, 1st Edition, 2011.
5. Optimization: Theory and Practice, Mohan C. Joshi and Kannan M. Moudgalya, Narosa Publishing House, 1st Edition, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
EXPERIMENTAL STRESS ANALYSIS
(Professional Elective - II)

L	T	P	C
3	0	0	3

Prerequisite: Strength of Materials, Theory of Elasticity (desirable)

Course objectives: The course aims to

1. Introduce the basic principles and methods of experimental stress analysis.
2. Provide an in-depth understanding of strain measurement using electrical and mechanical strain gauges.
3. Familiarize students with photoelasticity techniques and fringe interpretation in two and three dimensions.
4. Explore advanced optical methods and model analysis using structural similitude and dimensional analysis.
5. Introduce specialized experimental techniques and non-destructive testing (NDT) methods such as ultrasonic, X-ray, and brittle coating techniques.

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

1. Understand the working principles of strain gauges and perform model analysis using theorems like Buckingham Pi and Muller-Breslau's.
2. Explain the fundamentals and applications of photoelasticity in 2D and 3D stress analysis.
3. Utilize various optical and mechanical tools for experimental stress measurement and validation.
4. Apply non-destructive testing techniques like ultrasonic testing, X-ray, gamma-ray, rebound hammer, and Moiré fringe methods for material evaluation.
5. Design experimental setups using model analysis, strain measurement, and advanced optical techniques to evaluate stress distribution in mechanical structures.

UNIT- I: Strain Measurement Techniques

Strain Gauges, Mechanical and Optical Strain Gauges, Description and Operation, Electrical Resistance, Inductance and Capacitance Gauges, Detailed Treatment on Resistance Gauges, Measurement of Static and Dynamic Strains, Strain Rosettes, Effect of Transverse Strains, Use of Strain Recorders and Load Cells.

UNIT- II: Model Analysis and Structural Similitude

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's and Eney's Deformeters, Moment Indicators, Design of Models for Direct and Indirect Analysis.

UNIT- III: Photo elasticity and Optical Methods

Two-Dimensional Photo elasticity, Stress Optic Law, Introduction to Polariscope, Plane and Circular Polariscope, Compensators and Model Materials, Material and Model Fringe Value, Calibration of Photo elastic Materials, Isochromatic and Isoclinic Fringes, Time Edge Effects.

UNIT - IV: 3D Photo elasticity and Advanced Optical Analysis

Three-Dimensional Photo elasticity, Introduction, Stress Freezing Techniques, Stress Separation Techniques, Scattered Light Photo elasticity, Reflection Polariscope.

UNIT - V: Specialized and Non-Destructive Testing

Miscellaneous Methods, Brittle Coating Method, Birefringence Techniques, Moiré Fringe Method, Non-Destructive Testing, Ultrasonic Pulse Velocity Technique, Rebound Hammer Method, X-Ray Method, Gamma-Ray Method.

TEXT BOOKS:

1. Experimental Stress Analysis, J.W. Dally and W.F. Riley, McGraw-Hill, 2nd Edition, 1991.
2. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers / Dhanpat Rai Publications, Revised Edition, 2009.

REFERENCES:

1. Experimental Stress Analysis, Sadhu Singh, Dhanpat Rai Publications, Revised Edition, 2009.
2. Handbook of Experimental Stress Analysis, Max Hetenyi, John Wiley and Sons, New York, 1st Edition, 1950.
3. Photoelasticity, M.M. Frocht, Vol. I and II, John Wiley and Sons, New York, 1st Edition, 1941 (Vol. I) and 1948 (Vol. II).
4. C. Rama Rao, Experimental Stress Analysis, University Press, 1st Edition, 2013.
5. N. Ramesh Babu, Experimental Stress Analysis: Principles and Practice, Anuradha Publications, 1st Edition, 2008.
6. R.K. Rajput, Strength of Materials (For NDT and Stress Analysis Reference), S. Chand and Company, Revised Edition, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Prerequisite: Fundamentals of Statistics, Technical Writing Skills

Course Objectives:

1. To understand research fundamentals, methodologies, and the significance of research ethics.
2. To enable students to formulate research problems and conduct literature surveys effectively.
3. To introduce the principles of data collection, analysis, and interpretation in research.
4. To explain intellectual property rights, patents, copyrights, and trademarks.
5. To highlight the importance of IPR in protecting innovative ideas and research outcomes.

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

1. Understand the research process, methodologies, and ethics involved in scholarly work.
2. Formulate and define research problems with appropriate objectives.
3. Apply suitable data collection and analysis techniques for research projects.
4. Understand the various forms of intellectual property rights and legal aspects related to patents and copyrights.
5. Apply the knowledge of IPR to safeguard their innovations and research findings.

UNIT-I: Research Problem and Investigation Approaches

Meaning of Research Problem, Sources of Research Problem and 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: Literature Review and Ethics

Effective Literature Studies Approaches, Analysis, Plagiarism, Research Ethics.

UNIT-III: Technical Writing and Proposals.

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: Intellectual Property and Patenting

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 and Emerging IPR

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. IPR of Biological Systems, Computer Software Etc., Traditional Knowledge Case Studies, IPR and IITs.

TEXTBOOKS:

1. Research methodology: an introduction for science and engineering students, Stuart Melville and Wayne Goddard, Juta and Co. Ltd, 1ST Edition, 1996.
2. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar, SAGE, 2nd Edition, 2010.

REFERENCE BOOKS:

1. Resisting Intellectual Property, Debora J. Halbert, Routledge, Taylor and Francis, 1st Edition, 2005.
2. Industrial Design, W. H. (William Henry) Mayall, Iliffe Books (London), also McGraw-Hill editions, 1st Edition, 1974.
3. Intellectual Property in the New Technological Age, Robert P. Merges, Peter S. Menell and Mark A. Lemley, Aspen Casebook Series, Latest Edition, 2016.
4. Intellectual Property Rights under WTO, T. Ramappa, Wheeler Publishing, 1st Edition, 2000.
5. Research Methodology and IPR, P. N. Ganesan, Scitech Publications, 1st Edition, 2019.
6. Intellectual Property Rights: Unleashing the Knowledge Economy, Prabuddha Ganguli, Tata McGraw-Hill, 1st Edition, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

L	T	P	C
0	0	4	2

ADVANCED DYNAMICS LAB

Prerequisites: Kinematics and Dynamics

Course objectives:

1. To understand and experimentally determine vibration characteristics such as natural frequency, damping, and steady-state response of mechanical systems.
2. To learn methods for static and dynamic balancing of rotating machinery and analyze the effects of unbalance on system performance.
3. To develop proficiency in robotic kinematic analysis (both direct and inverse) and trajectory planning for industrial robot applications.
4. To familiarize students with gyroscopic effects and governor mechanisms in rotating systems.
5. To introduce advanced diagnostic tools such as FFT analyzers for vibration-based fault detection in machinery.

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

1. Determine experimentally the damped natural frequency and steady-state amplitude of vibratory systems using viscous damping and forced vibration setups.
2. Perform static and dynamic balancing of rotating components to minimize vibration and improve machine performance.
3. Use vibration pickups and field balancing techniques to correct rotor imbalances in practical scenarios
4. Calculate and interpret gyroscopic effects such as gyroscopic couple and precession in rotating machinery.
5. Carry out direct and inverse kinematic analyses of robotic manipulators and plan trajectories in joint space.

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 Semester
ADVANCED MATERIALS LAB

L	T	P	C
0	0	4	2

Prerequisites: Strength of Materials and Metallurgy

Course Objectives: The course aims to

1. To study the microstructure of ferrous and non-ferrous metals and understand their effects on mechanical properties.
2. To investigate the influence of heat treatment parameters (tempering time and temperature) on the hardness of carbon steels.
3. To learn specimen preparation techniques such as electro-polishing for accurate metallographic analysis.
4. To analyze the work hardening behavior of metals through controlled deformation experiments.
5. To determine the chemical composition of metals, specifically carbon content in ferrous specimens.

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

1. Prepare metallographic specimens and examine microstructures of ferrous and non-ferrous metals and alloys.
2. Evaluate the effect of tempering time and temperature on the hardness of quenched carbon steels.
3. Demonstrate techniques of electro-polishing for specimen preparation and study its effect on microstructural clarity.
4. Analyze the work hardening behavior of pure metals and relate it to strain hardening mechanism
5. Determine the percentage of carbon in ferrous metals using appropriate metallurgical methods.

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 Semester
COMPUTER AIDED GEOMETRIC DESIGN
(Professional Core - III)

L	T	P	C
3	0	0	3

Prerequisites: CAD/CAM

Course Objectives:

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

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

1. Apply 2D and 3D geometric transformations to manipulate and model objects in CAD systems.
2. Construct and evaluate Bezier and B-spline curves for CAD applications.
3. Develop and analyze parametric surface equations including quadratic, Bezier, and B-spline surfaces.
4. Employ NURBS for flexible and accurate representation of complex geometries in design tasks.
5. Reconstruct models from point cloud data and perform mesh generation for downstream simulation or manufacturing applications.

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

2D and 3D Transformations, Translation, Rotation, Homogeneous Space, Scaling, Stretching, Mirror Reflection, Composite Transformations, and Problems.

UNIT–III: Geometric Modeling and Curve Design Techniques

Cubic Splines: Algebraic and Geometric Form of Cubic Spline, Parametric Space of a Curve, Blending Functions, Problems.

Bezier Curves: Bernstein'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: Solids

Parametric and Tricubic Solids, 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, Michael E. Mortenson, McGraw-Hill Publishers, 3rd Edition, 2006.
2. CAD/CAM: Concepts and Applications, Chennakesava R. Alavala, Prentice-Hall of India (PHI), 1st Edition, 2007.

REFERENCE BOOKS:

1. Curves and Surfaces for CAGD: A Practical Guide, Gerald Farin, Elsevier India, 5th Edition, 2002.
2. Computer Graphics, Chennakesava R. Alavala, Prentice-Hall of India (PHI), 1st Edition, 2006.
3. CAD/CAM: Theory and Practice, Ibrahim Zeid, Tata McGraw-Hill, 2nd Edition, 2001.
4. Elements of Computer Graphics, Donald Hearn and M. Pauline Baker, Tata McGraw-Hill, 2nd Edition, 2001.
5. Mathematical Elements for Computer Graphics, David F. Rogers and J. Alan Adams, McGraw-Hill, 2nd Edition, 1990.
6. Principles of Computer Graphics, Shalini Govil-Pai, Springer, 1st Edition, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
ADVANCED FINITE ELEMENT AND BOUNDARY ELEMENT METHODS
(Professional Core - IV)

L	T	P	C
3	0	0	3

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

1. To introduce the basic concepts of the finite element method, the boundary element method.
2. To formulate and solve problems in 1D, 2D, and 3D using FEM.
3. To introduce BEM and its application in linear problems.
4. To study the numerical integration and solution techniques used in FEM/BEM.
5. To expose students to software tools implementing FEM/BEM techniques.

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

1. Formulate and solve engineering problems using FEM and BEM.
2. Apply FEM to structural, thermal, and fluid flow problems.
3. Use boundary element formulation for linear problems with infinite domains.
4. Implement numerical methods to solve FEM/BEM equations.
5. Utilize commercial software for simulation and result interpretation.

UNIT–I: Finite Element Analysis of 1D Structural Members

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 a Truss Element oriented Arbitrarilyin to 2D plane, Calculation of Reaction Forces, Displacements, Stresses and Strains.

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: 2D and 3D Structural Element Analysis in FEA

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 Iso parametric Elements and Numerical Integration, Problems.

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 Relationship Formulation.

UNIT–III: Thermal and Dynamic Analysis in FEA

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 and Nonlinear FEA of Solids

Plate Bending: Introduction, Plate Behavior, C^1 (Kirchhoff) Plate Elements, C^0 (Mindlin) Plate Elements, Mindlin Beam, More Devices for C^0 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 for Potential and Electrostatic Problems

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 and Other Relations, Discretization and Matrix Formulation, Determination of Term C(p)m.

TEXT BOOKS:

1. The finite element methods in Engineering, S.S. Rao, Elsevier, 4th Edition, 2005.
2. Finite and Boundary Element Methods in Engineering, O.P. Gupta, Oxford and IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.

REFERENCE BOOKS:

1. Finite Element Methods: Basic Concepts and Applications, Alavala Chennakesava R. PHI, 3rd Edition, 2012.
2. Introduction to Finite Elements in Engineering, Tirupathi R. Chandrupatla and Ashok D. Belegundu, Pearson Education, 4th Edition, 2011.
3. An Introduction to Finite Element Methods, J. N. Reddy, McGraw Hill Education, 3rd Edition, 2005.
4. The Finite Element Method in Engineering Science, O.C. Zienkowitz, McGraw Hill, 1st Edition, 1971.
5. A First Course in Finite Elements, Jacob Fish and Ted Belytschko, Wiley, 1st Edition, 2007.
6. Fundamentals of Finite Element Analysis, David Hutton, McGraw Hill Education, 1st Edition, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

MECHANICS OF COMPOSITE MATERIALS

(Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisite: Structure and properties of composite materials and Design procedures for composite structures.

Course objectives: The course aims to:

1. Identify the properties and roles of fibers and matrix materials used in commercial composite systems.
2. Understand and evaluate various manufacturing techniques for fiber-reinforced composites.
3. Predict the elastic behavior of both long and short fiber composites using micromechanical principles.
4. Analyze stress-strain relationships and transformations in anisotropic lamina and laminated composites.
5. Establish strength and failure criteria for laminated composite structures under various loading conditions.

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

1. Understanding of types, manufacturing processes, and applications of composite materials.
2. Basic understanding of linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior.
3. Ability to analyze problems on macro and micro mechanical behavior of lamina
4. Ability to analyze problems on macro mechanical behavior of laminate
5. 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.
6. An ability to compute the properties of a composite laminate with any stacking sequence.

UNIT – I: Composite Materials and Reinforcements

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 Boron Carbide Fibres, Particulate Composites, Polymer Composites, Thermoplastics, Thermosets, Metal Matrix and Ceramic Composites.

UNIT – II: Micromechanics and Manufacturing

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, Manual Layup, Pultrusion, Resin Transfer Moulding (RTM).

UNIT – III: Elastic Behavior and Stress Transformation

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: Unidirectional Lamina

Micromechanics 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, Micromechanical Predictions of Elastic Constants.

UNIT – V: Laminated Composite Plates

Introduction to 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, McGraw-Hill Company, New York, 1st Edition, 1975.
2. Engineering Mechanics of Composite Materials, Isaac M. Daniel, Oxford University Press, 1st Edition, 1994.
3. Analysis and Performance of Fibre Composites, B.D. Agarwal and L.J. Broutman, Wiley-Interscience, New York, 1st Edition, 1980.

REFERENCES BOOKS:

1. Mechanics of Composite Materials, Autar K. Kaw, CRC Press, 2nd Edition, 2006.
2. Analysis of Laminated Composite Structures, L.R. Calcote, Van Nostrand Reinhold, New York, 1st Edition, 1969.
3. Advanced Mechanics of Composite Materials, Evgeny V. Vasiliev and Evgeny V. Morozov, Elsevier, 2nd Edition, 2001.
4. Composite Materials: Science and Engineering, Krishan K. Chawla, Springer, 3rd Edition, 2012.
5. Principles of Composite Material Mechanics, Ronald F. Gibson, CRC Press, 4th Edition, 2016.
6. Introduction to Composite Materials Design, Ever J. Barbero, CRC Press, 2nd Edition, 2010.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
DESIGN FOR MANUFACTURING AND ASSEMBLY
(Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisites: Manufacturing Processes, Engineering Materials

Course Objectives:

1. Introduce the principles and constraints of manufacturability that influence product design.
2. Familiarize students with Design for Manufacturability (DFM) methodology and its application across various manufacturing processes.
3. Enable students to identify infeasible or impractical designs early in the product development cycle.
4. Guide students to select appropriate materials and processes based on functionality and manufacturability.
5. Equip students with tools to improve assembly efficiency through manual and automated design considerations.

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

1. Understand and evaluate quality and cost aspects of product design for manufacture and assembly.
2. Apply Boothroyd's systematic DFA/DFM methods to optimize design and improve manufacturability.
3. Integrate DFM principles in casting, machining, forming, welding, and plastic component design.
4. Analyze and identify key design variables to align product development with customer and process specifications.
5. Apply automation and manual assembly techniques to enhance production efficiency and reliability.

UNIT - I: Design and Material Selection

Introduction, Design Philosophy, Steps in Design Process, General Design Rules for Manufacturability, Basic Principles of Designing for Economical Production, Creativity in Design.

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 and Casting Design

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: Forming, Joining and Plastics

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 Die Forging Design, Parting Lines of Dies, Drop Forging Die Design, General Design Recommendations.

Extrusion and 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: Automated Assembly Design

Assembly Advantages: Development of the Assembly Process, Choice of Assembly Method, Assembly 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., New York, 1st Edition, 1992.
2. Engineering Design: A Materials and Processing Approach, George E. Dieter, McGraw-Hill International, 2nd Edition, 2000.
3. Handbook of Product Design, Geoffrey Boothroyd, Marcel Dekker Inc., New York, 1st Edition, 1990.

REFERENCES:

1. Product Design for Manufacturing and Assembly, Geoffrey Boothroyd, Peter Dewhurst, Winston Anthony Knight, CRC Press, 3rd Edition, 2010.
2. Design for Manufacturability Handbook, James G. Bralla, McGraw-Hill, 2nd Edition, 1999.
3. Materials and Design: The Art and Science of Material Selection in Product Design, Michael F. Ashby and Kara Johnson, Butterworth-Heinemann, 3rd Edition, 2013.
4. Manufacturing Processes for Design Professionals, Rob Thompson, Thames and Hudson, 1st Edition, 2007.
5. Design and Manufacturing of Plastics Products, Nabil Bashir, Wiley-Scrivener, 1st Edition, 2020.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

INDUSTRIAL ROBOTICS

(Professional Elective - III)

L	T	P	C
3	0	0	3

Prerequisites: Kinematics of machinery

Course Objectives:

1. To introduce the fundamentals of industrial robotics and robot configurations.
2. To analyze forward and inverse kinematics of robotic manipulators.
3. To study robot dynamics, end effectors, and machine vision systems.
4. To learn robot programming, control techniques, and path planning.
5. To explore industrial applications of robotics in manufacturing and automation.

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

1. Understand robot structures, drive systems, sensors, and actuators.
2. Perform kinematic and dynamic analysis of robotic arms.
3. Evaluate and apply vision systems for robotic inspection and control.
4. Develop robot programs using different programming methods.
5. Design robotic cells for manufacturing tasks and analyze their performance.

UNIT-I: Robot Basics and Sensors

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 and 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 and Inverse Transformations, Problems on Planar and Spatial Manipulators, Differential Kinematics, Jacobian Formulation, Problems. Manipulator Path Control: Slew, Joint Interpolated and Straight Line Motions. Trajectory Planning: Joint Space Scheme, Cartesian Space Scheme, Cubic Polynomial Fit Without and with Via Point, Blending, Problems.

UNIT-III: Dynamics, End Effectors and Vision

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

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 and Languages

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, Wait, Signal and Delay commands, Branching capabilities and Limitations.

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

UNIT-V: Work Cell Design and Applications

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 and Control, John J. Craig, Pearson Education, 3rd Edition, 2005.
2. Industrial Robotics: Technology, Programming, and Applications, Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, McGraw-Hill, 1st Edition, 1986.

REFERENCE BOOKS:

1. Robotics: Control, Sensing, Vision and Intelligence, K. S. Fu and R. C. Gonzalez and C. S. G. Lee, McGraw-Hill Education, 2nd Edition, 2023.
2. Robot Analysis: The Mechanics of Serial and Parallel Manipulators, Lung-Wen Tsai, John Wiley and Sons, 2nd Edition, 2022.
3. Robot Analysis and Control, H. Asada and J. E. Slotine, Wiley, 2nd Edition, 2021.
4. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education, 2nd Edition, 2022.
5. Robotics for Engineers, Yoram Koren, McGraw-Hill Education, 2nd Edition, 2023.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

HYDRAULIC AND PNEUMATIC SYSTEMS

(Professional Elective – IV)

L	T	P	C
3	0	0	3

Prerequisites: Basic Knowledge of Engineering Mechanics and Fluid Mechanics.

Course Objectives: The course aims to:

1. Introduce the fundamental principles and components of oil hydraulic systems including pumps, valves, and actuators.
2. Enable students to design and analyze hydraulic and pneumatic circuits for industrial applications.
3. Familiarize students with linear and rotary actuators, accumulators, and the role of hydraulic reservoirs.
4. Impart understanding of servo mechanisms, low-cost automation, and their integration in fluid power circuits.
5. Develop skills in fault diagnosis, maintenance procedures, and the use of PLCs/microprocessors in automation.

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

1. Explain the working principles, types, construction, sizing, and selection of hydraulic pumps and control valves.
2. Analyze and select appropriate linear and rotary actuators based on application requirements, including piston rod design and accumulator usage.
3. Design and simulate hydraulic circuits including servo techniques, seals, packings, and air motors.
4. Create and troubleshoot sequencing, synchronizing, hydro-pneumatic, and low-cost automation circuits using proper design principles.
5. Understand and apply maintenance techniques and fault diagnosis methods for fluid power systems.

UNIT – I: Hydraulic Systems and Components

Oil Hydraulic Systems: Hydraulic Pumps, Types and Construction Details, Sizing and Selection. Direction Control Valves, Flow and Pressure Control Valves.

UNIT – II: Hydraulic Actuators and Energy Storage Systems

Linear Actuators: Types, Piston Rod Design, Sizing and Selection. Rotary Actuators, Hydraulic Reservoir, Accumulators.

UNIT – III: Hydraulic Circuit Design and Servo Control Systems

Design of Hydraulic Circuits, Seals and Packings, Hydraulic Servo Techniques, Cylinders and Air Motors.

UNIT – IV: Hydro - Pneumatic Circuits and Low - Cost Automation

Sequencing and Synchronizing Circuits, Accumulator, Low-Cost Automation, Hydro Circuits, Accumulators, Hydro-Pneumatic Circuits, Principles of Pneumatic Circuit Design.

UNIT – V: Maintenance and Automation of Fluid Power Systems

Maintenance and Troubleshooting of Hydraulic and Pneumatic Circuits, Components, PLC Automation, and Uses of Microprocessors.

TEXT BOOKS:

1. Oil Hydraulic Systems, S.R. Majumdar, Tata McGraw-Hill, 1st Edition, 2001.
2. Pneumatic Systems: Principles and Maintenance, S.R. Majumdar, Tata McGraw-Hill, 1st Edition, 1995.

REFERENCE BOOKS:

1. Hydraulics and Pneumatics: A Technician's and Engineer's Guide, Andrew Parr, Jaico Publishing House, Indian Edition, 2005.
2. Fluid Power with Applications, Anthony Esposito, Prentice Hall, 7th Edition, 2008.
3. Industrial Hydraulics Manual, Eaton Hydraulics Training Services, Eaton Corporation, 5th Edition, 2003.
4. Pneumatic Handbook, A. Barber, Elsevier Butterworth-Heinemann, 8th Edition, 1997.
5. Fluid Power Design Handbook, Frank Yeaple, CRC Press, 3rd Edition, 1996.
6. Introduction to Fluid Power, James L. Johnson, Cengage Learning, 1st Edition, 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
MECHATRONICS
(Professional Elective - IV)

L	T	P	C
3	0	0	3

Prerequisites: Basic Knowledge of Electrical Circuits and Electronic Devices.

Course Objectives:

1. Provide a solid foundation in the principles and components of mechatronic systems and their significance in modern manufacturing.
2. Familiarize students with a wide range of sensors and actuators used in mechatronic applications and their working principles.
3. Introduce system modeling concepts in mechanical, electrical, thermal, and fluid systems and understand their dynamic behavior.
4. Develop analytical skills in digital electronics, logic design, and control interfacing relevant to industrial automation.
5. Equip students with hands-on knowledge of PLC programming and real-world intelligent mechatronic applications.

Course Outcomes: Upon successful completion of the course, students will be able to

1. Understand the evolution, scope, and key elements of mechatronic systems and explain their significance in manufacturing environments.
2. Identify and describe the working principles of various sensors including displacement, proximity, flow, tactile, piezoelectric, and vision sensors used in mechatronic systems.
3. Analyze and select appropriate electrical, hydraulic, pneumatic, piezoelectric, and shape memory actuators for specific industrial applications.
4. Model and analyze dynamic behavior of mechanical, electrical, thermal, and fluid systems using transfer functions and block diagrams.
5. Apply principles of digital electronics and signal conditioning in designing logic and control systems for mechatronic applications.

UNIT - I: Mechatronics and Sensor Technologies

Introduction to Mechatronics, Scope and Significance of Mechatronic Systems, Elements of Mechatronic Systems, Needs and Benefits of Mechatronics in Manufacturing.

Sensors: Classification of Sensors, Basic Working Principles, Displacement Sensors, 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. Other Sensors: 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 and Pneumatic Devices, Power Supplies, Valves, Cylinder Sequencing, Design of Hydraulic and Pneumatic Circuits, Piezoelectric Actuators, Shape Memory Alloys.

UNIT - III: Basic System models and Analysis

Modeling of One and Two Degrees of Freedom Mechanical, Electrical, Fluid, and Thermal Systems, Block Diagram Representations of These Systems.

Dynamic Responses of Systems: Transfer Function, Modeling Dynamic Systems, First-Order Systems, Second-Order Systems.

UNIT - IV: Digital Electronics and Control Interfaces in Mechatronics

Digital Electronics: Number Systems, BCD Codes and Arithmetic, Gray Codes, Self-Complementing 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: PLC Programming and Intelligent Mechatronic Applications

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, Analog Input and Output, Applications in 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 a Mechatronic Device.

TEXT BOOKS:

1. Mechatronics, W. Bolton, Addison Wesley Longman Ltd., 5th Edition, 2010.
2. Mechatronics System Design, Devdas Shetty and Richard A. Kolk, P.W.S. Publishing Company, 1st Edition, 2001.
3. Introduction to Mechatronics and Measurement Systems, David G. Alciatore and Michael B. Histand, Tata McGraw-Hill, 4th Edition, 2006.

REFERENCE BOOKS:

1. Mechatronics: Principles and Applications, Godfrey C. Onwubolu, Elsevier, 1st Edition, 2006.
2. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Pearson Education, 6th Edition, 2015.
3. The Mechatronics Handbook, Robert H. Bishop, CRC Press, 2nd Edition, 2007.
4. Applied Mechatronics, A. Smaili and F. Mrad, Oxford University Press, 1st Edition, 2008.
5. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton, Pearson, 6th Edition, 2015.
6. Introduction to Mechatronics and Measurement Systems, David G. Alciatore and Michael B. Histand, McGraw Hill, 3rd Edition, 2013.
7.
8. Mechatronics: Integrated Technologies for Intelligent Machines, Clarence W. de Silva, CRC Press, 2nd Edition, 2007.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
RELIABILITY ENGINEERING
(Professional Elective - IV)

L	T	P	C
3	0	0	3

Pre-requisites: Basic Probability and Statistics, Fundamentals of Engineering Systems

Course Objectives:

1. Introduce the fundamental principles of probabilistic reliability, failure modes, and the economics of reliability in engineering systems.
2. Develop the ability to model component and system reliability using probability and statistical tools, including hazard rate models and the bath-tub curve.
3. Provide methodologies for evaluating system reliability for different configurations such as series, parallel, and k-out-of-m systems.
4. Expose students to advanced concepts such as load-sharing models, stress-strength models, and reliability block diagrams.
5. Build competence in reliability allocation, maintainability analysis, fault tree analysis, and preventive maintenance planning.

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

1. Explain key reliability concepts including types of failures, failure patterns over time, and their impact on system performance and cost.
2. Apply basic probability, hazard rate, and failure rate models to assess the reliability of individual components under various conditions.
3. Analyze and compute the reliability of systems composed of series, parallel, and complex configurations including k-out-of-m and standby models.
4. Evaluate the reliability of components and systems using life data analysis methods such as censored data analysis, burn-in and accelerated testing.
5. Identify and fit appropriate failure distributions, and estimate their parameters using statistical methods for reliability assessment.

UNIT – I: Reliability Engineering and Component Failure Modeling

Introduction to Probabilistic Reliability, Failures and Failure Modes, Repairable and Non-Repairable Items, Pattern of Failures with Time, Reliability Economics.

Component Reliability Models: Basics of Probability and Statistics, Hazard Rate and Failure Rate, Constant Hazard Rate Model, Increasing Hazard Rate Models, Decreasing Hazard Rate Model, Time-Dependent and 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 and Reliability Assessment

Censored and Uncensored Field Data, Burn-in Testing, Acceptance Testing, Accelerated Testing, Identifying Failure Distributions and Estimation of Parameters, Reliability Assessment of Components and Systems.

UNIT – IV: Reliability Analysis and Allocation

Reliability Specification and Allocation, Failure Modes and Effects and Criticality Analysis (FMECA), Fault Tree Analysis, Cut Sets and Tie Sets Approaches.

UNIT – V: Maintainability Analysis

Repair Time Distribution, MTBF, MTTR, Availability, Maintainability, Preventive Maintenance.

TEXT BOOKS:

1. An Introduction to Reliability and Maintainability Engineering, Charles E. Ebeling, Tata McGraw-Hill, 1st Edition, 2004.
2. Practical Reliability Engineering, Patrick O'Connor and Andre Kleyner, Wiley, 5th Edition, 2012.

REFERENCE BOOKS:

1. Reliability Engineering, Elsayed A. Elsayed, Wiley, 3rd Edition, 2021.
2. Reliability Engineering and Risk Analysis: A Practical Guide, Mohammad Modarres, CRC Press, 3rd Edition, 2016.
3. System Reliability Theory: Models, Statistical Methods, and Applications, Marvin Rausand and Arnljot Hoyland, Wiley-Interscience, 2nd Edition, 2004.
4. Engineering Reliability, Richard E. Barlow and Frank Proschan, SIAM, Reprint Edition, 1996.
5. Reliability Engineering and Maintainability, K.K. Aggarwal, Khanna Publishers, 7th Edition, 2020.
6. Applied Reliability, Paul A. Tobias and David C. Trindade, CRC Press, 3rd Edition, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

ADVANCED COMPUTER AIDED MODELLING LAB

L	T	P	C
0	0	4	2

Prerequisite: CAD, FEM

Course Objectives: The course aims to

1. To introduce students to advanced 2D drafting and 3D modeling techniques using industry-relevant CAD software.
2. To enable modeling of complex components and assemblies through feature-based, Boolean, and surface modeling approaches.
3. To develop an understanding of dimensioning standards, tolerancing, and the application of GDandT in design documentation.
4. To train students in creating and interpreting detailed mechanical drawings for manufacturing and assembly purposes.
5. To familiarize students with simulation tools like MSC Adams for analyzing the motion and performance of mechanical systems.

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

1. Model mechanical components and assemblies using industry-standard CAD software such as CATIA and Pro-E, applying feature-based, Boolean-based, and surface modeling techniques.
2. Develop detailed 2D part drawings and isometric views of mechanical components using orthographic projection principles, including dimensioning and tolerancing techniques.
3. Create 3D CAD models of mechanical products like connecting rods, threaded fasteners, flange couplings, screw jacks, and strap joints, and generate assembly drawings from them.
4. Apply Geometric Dimensioning and Tolerancing (GDandT) concepts on CAD models to simulate real-world manufacturing conditions and ensure product functionality.
5. Simulate basic mechanical systems and kinematic mechanisms using tools such as MSC Adams to analyze motion and validate design behavior.

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 and 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 Semester
ADVANCED COMPUTER AIDED ANALYSIS LAB

L	T	P	C
0	0	4	2

Prerequisite: CAD, FEM

Course Objectives: The course aims to

1. To provide practical exposure to structural, modal, thermal, and dynamic analyses using commercial FEA software.
2. To familiarize students with modeling techniques for static, dynamic, linear, and non-linear problems.
3. To introduce fracture, buckling, contact, and optimization analyses relevant to mechanical and aerospace applications.
4. To enable hands-on experience in interpreting simulation results for real-world engineering problems.
5. To cultivate proficiency in using simulation tools for coupled-field analysis and advanced problem-solving strategies.

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

1. Carry out structural, harmonic, thermal, and fracture analysis using FEA software for real-time engineering applications.
2. Simulate and analyze complex systems including contact, buckling, modal, and transient behavior using FEA tools.
3. Perform thermal and coupled field analysis with different boundary conditions and interpret results for engineering decisions.
4. Apply FEA techniques for optimization and sub-structuring of mechanical components.
5. Demonstrate proficiency in using FEA software for solving multi-disciplinary engineering problems in structural and thermal domains.

List of Experiments:

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 nonlinear methods
9. Stress analysis of a rectangular plate with a circular hole.
10. Thermal Analysis of 1D and 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: Solve a simple problems using Sub-structuring method in ANSYS.
16. Melting Using Element Death: Using element death procedure model melting of a material.

Note: Conduct any 12 out of 16 exercises from the list

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
SMART MANUFACTURING
(Professional Elective - V)

L	T	P	C
3	0	0	3

Pre-requisites: Computer Networks, Fundamentals of Mechatronics

Course Objectives:

1. To understand the basics of Industry 4.0
2. To understand the Business model and impact of IIoT
3. To understand the concepts of virtual reality, lean manufacturing
4. To gain knowledge of various sensors and actuators.
5. To understand various data transmission technologies.

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

1. Explain Smart Business Perspective, Cyber security, Impacts of Industry 4.0.
2. Understand the basics of the Industrial Internet of Things.
3. Understand various key technologies.
4. Implement various sensors and actuators.
5. Understand different industrial transmission technologies and IOT applications in real life

UNIT – I: Industry 4.0 Basics

Industrial Revolution: Phases, Evolution of Industry 4.0, Environmental Impacts of Industrial Revolution, Applications, Design Requirements, Drivers of Industry 4.0, Sustainability Assessment of Industries, Smart Business Perspective, Cyber Security, Impacts of Industry 4.0.

UNIT – II: Industrial Internet of Things and Digital Enterprise Architecture

Industrial Internet of Things, Basics: IIoT and Industry 4.0, 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: Enabling Technologies for Smart Manufacturing and IIoT

Key Technologies: Off-site Technologies, Cloud Computing, Fog Computing. On-site Technologies, Augmented Reality, Virtual Reality, Smart Factories, Lean Manufacturing System, Big Data and Advanced Analytics.

UNIT –IV: Sensors and Actuators for Intelligent Systems

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, Electromechanical Actuator.

UNIT – V: Industrial Communication Systems and IIoT Applications

Industrial Data Transmission and Acquisition: Architecture of Various Data Transmission Technologies Like Foundation Fieldbus, Profibus, Highway Addressable Remote Transducer (HART), Interbus, Bitbus, Digital STROM, 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 BOOKS:

1. Introduction to Industrial Internet of Things and Industry 4.0, Sudip Misra, Chandana Roy, Anandarup Mukherjee, CRC Press, 1st Edition, 2021.
2. Internet of Things: A Hands-on Approach, Vijay Madisetti and Arshdeep Bahga, University Press, 1st Edition, 2015.
3. Introduction to Internet of Things: A Practical Approach, S.R.N. Reddy, Rachit Thukral, Manasi Mishra, ETI Labs, 1st Edition, 2016.

REFERENCE BOOKS:

1. Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, Apress, 1st Edition, 2016.
2. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Florian Michahelles, Springer, 1st Edition, 2011.
3. Smart Manufacturing: Concepts and Methods, Anthony Tarantino, CRC Press, 1st Edition, 2022.
4. Enabling the Internet of Things: From Integrated Circuits to Integrated Systems, Massimo Alioto, Springer, 1st Edition, 2017.
5. Industrial Internet of Things: Cybermanufacturing Systems, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Springer, 1st Edition, 2017.
6. Cyber-Physical Systems: Foundations, Principles and Applications, Houbing Song, Danda B. Rawat, Sabina Jeschke, Christian Brecher, Morgan Kaufmann, 1st Edition, 2016.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
CONCURRENT ENGINEERING
(Professional Elective - V)

L	T	P	C
3	0	0	3

Prerequisites: Computer-Aided Design

Course objective:

1. To introduce the concept of concurrent engineering and integrated product development.
2. To promote teamwork across functions such as design, manufacturing, and quality.
3. To apply concurrent engineering principles to optimize product design and performance.
4. To study tools and methodologies for real-time design decision-making.
5. To understand project management strategies for concurrent product realization.

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

1. Understand the need and benefits of concurrent engineering in product development.
2. Apply IT tools and collaborative platforms in engineering design.
3. Integrate lifecycle design and real-time analysis in concurrent engineering.
4. Use concurrent design strategies in manufacturing and assembly planning.
5. Manage product realization projects using concurrent engineering frameworks.

UNIT - I: CE and IT Applications

Introduction, Extensive Definition of CE, CE Design Methodologies, Organizing for CE, CE Toolbox, 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: Life Cycle Design and Automation

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: Assembly Planning and Project Management

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 Techniques, Andrew Kusiak, Wiley John and Sons Inc., 1st Edition, 1992.
2. Concurrent Product and Process Design, David Ullman, CRC Press, 1st Edition, 2003.

REFERENCE BOOKS:

1. Integrated Product Development, Anderson MM and Hein, L. Berlin, Springer Verlog, 1st Edition, 1987.
2. Design for Concurrent Engineering, Cleetus, J. Concurrent Engineering Research Centre, Morgantown W V, 1st Edition, 1992.
3. Concurrent Engineering Fundamentals: Integrated Product and Process Organization, Prasad B. S., Prentice Hall, 2nd Edition, 2021.
4. Concurrent Engineering in Product Design and Development, I. Moustapha, New Age International, 1st Edition, 2022.
5. Collaborative Engineering: Theory and Practice, Peter T. L. Popov, Springer, 1st Edition, 2024.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

RE- ENGINEERING

(Professional Elective – V)

L	T	P	C
3	0	0	3

Pre-requisite: Computer-Aided Design

Course objective:

1. To understand the terminologies and scope of reverse and forward engineering.
2. To identify and analyze the processes involved in product design, manufacturing, assembly, and maintenance.
3. To explore various methods and tools used in reverse engineering.
4. To examine hardware and software requirements for capturing and processing geometric data.
5. To evaluate the integration of reverse engineering with rapid prototyping for product development.

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

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

UNIT – I: Concept of 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: 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, Vinesh Raja and Kiran J. Fernandes, Springer-Verlag London Limited, 1st Edition, 2008.
2. Reverse Engineering: Technology of Reinvention, Wego Wang, CRC Press, 1st Edition, 2010.

REFERENCE BOOKS:

1. Product Design: Techniques in Reverse Engineering and New Product Development, Karl T. Ulrich and Kevin L. Wood, Prentice Hall, 1st Edition, 2001.
2. Computer Aided Engineering Design, Anupam Saxena and Birendra Sahay, Springer, 1st Edition, 2005.
3. Engineering Design and Rapid Prototyping, Ali K. Kamrani and Emad Abouel Nasr, Springer, 1st Edition, 2010.
4. Rapid Prototyping: Principles and Applications, Rafiq I. Noorani, Wiley, 1st Edition, 2006.
5. Geometric and Feature Modeling for CAD/CAM, Georges G. Kruth and Luc Laperrière, Springer, 1st Edition, 2010.
6. Reverse Engineering: Mechanisms, Structures, Systems and Materials, Robert Messler, McGraw-Hill Education, 1st Edition, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Basic English Grammar and Composition, Fundamentals of Technical Writing

Course objectives: Students will be able to:

1. To improve the quality and clarity of academic writing specifically for research papers.
2. To provide students with the structure, style, and conventions of scholarly communication.
3. To help students understand how to write titles, abstracts, introductions, literature reviews, methods, results, and conclusions effectively.
4. To guide students in avoiding common grammatical, structural, and ethical mistakes in writing.
5. To build competence in reviewing and editing research manuscripts for publication.

Course Outcomes: After the successful completion of this course, students will be able to:

1. Write grammatically correct, well-structured, and coherent research papers.
2. Use appropriate academic language and tone for different parts of a research article.
3. Construct effective titles, abstracts, and concise conclusions.
4. Apply standard referencing styles and avoid plagiarism.
5. Critically revise and refine research drafts for clarity and publication readiness.

UNIT-I: Effective Writing and Sentence Structuring

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

UNIT-II: Academic Writing and Research Ethics

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

UNIT-III: Research Paper Structure and Finalization

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

UNIT-IV: Essential Academic Writing Skills for Research Papers

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: Advanced Research Writing Skills

Skills are needed when Writing the Methods, Skills needed when writing the Results, Skills are needed when writing the Discussion, and Skills are needed when writing the Conclusions.

UNIT-VI: Perfecting Your Research Paper

Useful Phrases, How to ensure Paper is as Good as it could possibly be the First Time Submission.

TEXT BOOKS:

1. Writing for Science, Robert Goldbort, Yale University Press, 1st Edition, 2006.
2. How to Write and Publish a Scientific Paper, Robert A. Day & Barbara Gastel, 6th Edition (Cambridge University Press), 2006.

REFERENCE BOOKS

1. Handbook of Writing for the Mathematical Sciences, Nicholas J. Higham, SIAM, 2nd Edition, 1998.
2. English for Writing Research Papers, Adrian Wallwork, Springer, 1st Edition, 2011.
3. How to Write and Publish a Scientific Paper, Barbara Gastel, Robert A. Day, Cambridge University Press, 8th Edition, 2016
4. The Elements of Style, William Strunk Jr., E.B. White, Pearson Education, 4th Edition, 2000
5. Scientific Writing and Communication: Papers, Proposals, and Presentations, Angelika H. Hofmann, Oxford University Press, 3rd Edition, 2016
6. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded, Joshua Schimel, Oxford University Press, 1st Edition, 2012

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, I Semester
DISASTER MANAGEMENT
(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Environmental Science, Basic Geography or Earth Science

Course Objectives: Students will be able to

1. To introduce the concepts, phases, and classifications of disasters and disaster management.
2. To develop an understanding of disaster risk reduction and mitigation strategies.
3. To impart knowledge on institutional frameworks, legal aspects, and community-based approaches.
4. To build the ability to assess risks and prepare emergency management plans.
5. To create awareness about post-disaster recovery, rehabilitation, and resilience planning.

Course Outcomes: After the successful completion of this course, students will be able to

1. Identify different types of natural and man-made disasters and their causes.
2. Analyze risk factors and develop suitable mitigation and preparedness strategies.
3. Understand the role of government agencies, NGOs, and international bodies in disaster management.
4. Apply principles of emergency response planning and coordination.
5. Contribute to post-disaster rehabilitation and sustainable development planning.

UNIT-I: Disaster

Definition, Factors and Significance, Difference between Hazard and Disaster, Natural and Manmade Disasters, Difference between Nature Types and Magnitude.

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 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-IV: 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-V: 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-VI: 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:

1. Disaster Management in India: Perspectives, Issues and Strategies, R. Nishith & A. K. Singh, New Royal Book Company, 1st Edition, 2007
2. Disaster Mitigation: Experiences and Reflections, Pardeep Sahni et al. (Eds.), Prentice Hall India, 1st Edition, 2001

REFERENCE BOOKS:

1. Disaster Administration and Management: Text and Case Studies, S. L. Goel, Deep & Deep Publications, 1st Edition, 2007.
2. Introduction to International Disaster Management, Damon P. Coppola, Butterworth-Heinemann, 3rd Edition, 2015.
3. Disaster Management and Preparedness, Thomas D. Schneid, Larry Collins, CRC Press, 1st Edition, 2001.
4. Disaster Science and Management, Tushar Bhattacharya, McGraw Hill Education, 1st Edition, 2013.
5. Natural Disasters, Patrick L. Abbott, McGraw Hill Education, 9th Edition, 2016.
6. Environmental Hazards: Assessing Risk and Reducing Disaster, Keith Smith, Routledge, 6th Edition, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

SANSKRIT FOR TECHNICAL KNOWLEDGE

(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Basic understanding of Indian heritage and classical languages

Course Objectives:

1. To expose students to Sanskrit as a classical language of knowledge and science.
2. To introduce technical terms and concepts embedded in ancient Sanskrit texts.
3. To enable understanding of foundational texts related to mathematics, engineering, and philosophy.
4. To build linguistic skills for reading and interpreting original Sanskrit sources.
5. To appreciate the relevance of Sanskrit in the context of modern scientific discourse.

Course Outcomes: Students will be able to

1. Understand the structure and grammar of Sanskrit relevant to technical usage.
2. Recognize and interpret key technical terms and concepts from ancient Sanskrit literature.
3. Translate and explain Sanskrit verses that relate to scientific and engineering disciplines.
4. Develop an interdisciplinary perspective connecting ancient wisdom with contemporary science.
5. Appreciate the contribution of Sanskrit to Indian scientific, philosophical, and cultural heritage.

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:

1. Abhyaspustakam, Dr. H. R. Vishwasa, Samskrita Bharati Publication, New Delhi, 1st Edition, 2012.
2. Teach Yourself Sanskrit: Prathama Diksha, edited by Vempati Kutumbashastri, Rashtriya Sanskrit Sansthanam, New Delhi, 1st Edition, 2002.

REFERENCE BOOKS:

1. Technical Literature in Sanskrit, S. Balachandra Rao, Rashtriya Sanskrit Vidyapeetha, 1st Edition, 2005.
2. Sanskrit and Science, Prabhakar Apte, Central Institute of Indian Languages, 1st Edition, 2003.
3. Scientific Heritage of India in Sanskrit, R. Ganapathi, Bharatiya Vidya Bhavan, 1st Edition, 1990.
4. Sanskrit and Artificial Intelligence, Rick Briggs, AI Magazine (Journal Paper), 1st Edition, 1985.
5. Essentials of Sanskrit Language for Engineering Students, M. Sampath Kumar, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, 1st Edition, 2010.
6. Vyavaharika Samskritam (Functional Sanskrit), R.S. Vadhyar, R.S. Vadhyar & Sons, 3rd Edition, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, I Semester

VALUE EDUCATION

(Audit Course - I)

L	T	P	C
2	0	0	0

Prerequisite: Basic Understanding of Ethics and Social Responsibility

Course Objectives: Students will be able to

1. To help students understand the importance of values in personal and professional life.
2. To promote ethical behavior and decision-making based on human values.
3. To develop a sense of responsibility, empathy, and integrity.
4. To cultivate respect for diversity, equality, and sustainable living.
5. To encourage self-reflection and a commitment to lifelong value-based learning.

Course Outcomes: Students will be able to

1. Recognize and apply core human values such as honesty, compassion, and respect.
2. Analyze ethical dilemmas and make morally sound decisions.
3. Demonstrate socially responsible behavior in both personal and professional contexts.
4. Promote harmony in relationships, society, and the environment.
5. Engage in continuous personal development guided by ethical principles.

UNIT-I: Values and Ethics

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: Core Personal Values

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 Traits

Personality and Behavior Development, Soul and Scientific Attitude, Positive Thinking, Integrity and Discipline, Punctuality, Love and Kindness.

UNIT-IV: Virtuous Living

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 Wisdom

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:

1. Values and Ethics for Organizations: Theory and Practice, S. K. Chakraborty, Oxford University Press, 1st Edition, 1998 (paperback reprint 1999.
2. Value Education and Professional Ethics, R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, 1st Edition, 2010.

REFERENCE BOOKS:

1. Education in Values: A Source Book, UNESCO, NCERT Publication, 1st Edition, 2002.
2. Value Education: Principles and Practice, S. Ignacimuthu, Don Bosco Publications, 1st Edition, 2009.
3. Value Education: Theory and Practice, G. Rajagopalan, Bharatiya Vidya Bhavan, 1st Edition, 2011.
4. Education for Values in Schools – A Framework, NCERT, NCERT Publication, 1st Edition, 2012.
5. Education in Human Values, A.C. Bhaktivedanta Swami Prabhupada, Bhaktivedanta Book Trust, 1st Edition, 2001.
6. Teaching of Values: Some Reflections, M. M. Goel, Shipra Publications, 1st Edition, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

L	T	P	C
2	0	0	0

CONSTITUTION OF INDIA

(Audit Course - II)

Prerequisite: Basic knowledge of Indian history and Governance

Course Objectives: Students will be able to:

1. To provide a comprehensive understanding of the Indian Constitution, its structure, and significance.
2. To familiarize students with the fundamental rights, duties, and directive principles.
3. To introduce the key organs of government and their roles in a democratic system.
4. To promote awareness of constitutional values, governance mechanisms, and public responsibility.
5. To understand the relationship between the Constitution and the legal-administrative framework of India.

Course Outcomes: Students will be able to:

1. Describe the history, evolution, and philosophy behind the Constitution of India.
2. Explain the fundamental rights and duties of citizens and the structure of the Indian government.
3. Analyze the functioning of constitutional bodies and judicial systems.
4. Understand the significance of constitutional amendments and landmark legal cases.
5. Demonstrate responsible citizenship and awareness of constitutional governance

UNIT-I: Constitution Drafting History

History of Making of the Indian Constitution, History Drafting Committee, (Composition and Working)

UNIT-II: Constitutional Philosophy

Philosophy of the Indian Constitution**,** Preamble**,** Salient Features

UNIT-III: Rights and Duties Framework

Contours of Constitutional Rights and 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-IV: 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-V: Local Administration

District's Administration Head, Role and Importance. Municipalities: Introduction, Mayor and Role of Elected Representative, CEO of Municipal Corporation. Panchayat Raj: Introduction, PRI: Zila Panchayat, Elected Officials and their Roles, CEO Zila Panchayat, Position and Role, Block Level, Organizational Hierarchy (Different Departments), Village Level, Role of Elected and Appointed Officials, Importance of Grass Root Democracy.

UNIT-VI: 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 (Bare Act), Government Publication, 1st Edition, 1950.
2. Dr. B. R. Ambedkar: Framing of Indian Constitution, Dr. S. N. Busi, Ava Publications, 1st Edition, 2016.

REFERENCE BOOKS:

1. Introduction to the Constitution of India, M. P. Jain, LexisNexis, 7th Edition, 2014.
2. Introduction to the Constitution of India, D. D. Basu, LexisNexis, 22nd Edition, 2015.
3. Indian Polity, M. Laxmikanth, McGraw Hill Education, 6th Edition, 2021.
4. Our Constitution, Subhash Kashyap, National Book Trust, 1st Edition, 2011.
5. The Constitution of India: A Contextual Analysis, Arun K. Thiruvengadam, Bloomsbury Publishing, 1st Edition, 2017.
6. The Constitution of India, P.M. Bakshi, Universal Law Publishing, 17th Edition, 2020.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester
PEDAGOGY STUDIES
(Audit Course - II)

L	T	P	C
2	0	0	0

Prerequisite: Basic understanding of Teaching-Learning processes

Course Objectives: Students will be able to

1. To understand the concepts, principles, and theories of pedagogy and their application.
2. To evaluate the effectiveness of different teaching approaches in varied educational contexts.
3. To analyze the impact of teacher behavior, classroom environment, and instructional strategies on learning.
4. To assess the challenges in implementing pedagogical innovations in diverse settings.
5. To enable the design of learner-centered, inclusive, and effective educational practices.

Course Outcomes: Students will be able to understand

1. Explain key pedagogical theories and their relevance to classroom teaching.
2. Compare traditional and modern teaching strategies based on evidence from research.
3. Identify factors affecting student engagement, motivation, and learning outcomes.
4. Design instructional plans that incorporate effective pedagogical principles.
5. Critically evaluate and adapt teaching practices to meet diverse learner needs.

UNIT-I: Pedagogical Foundations

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: Global Pedagogical Practices

Thematic Overview, Pedagogical Practices are being used by Teachers in Formal and Informal Classrooms in Developing Countries, Curriculum, Teacher Education.

UNIT-III: Effective Pedagogy Evidence

Evidence on the Effectiveness of Pedagogical Practices, Methodology for the Indepth Stage, Quality Assessment of Included Studies, How Can Teacher Education (Curriculum And Practicum) and the School 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: Future Pedagogical Research

Research Gaps and Future Directions, Research Design**,** Contexts**,** Pedagogy**,** Teacher Education**,** Curriculum and Assessment**,** Dissemination and Research Impact.

TEXT BOOKS:

1. Classroom interaction in Kenyan primary schools Ackers, J., and Hardman, F., Compare a Journal of Comparative and International Education, Volume 31, 2001.
2. Curricular reform in schools: The importance of evaluation, Agrawal, M, Journal of Curriculum Studies, Volume 36, 2003.

REFERENCE BOOKS:

1. Teacher training in Ghana - does it count? , Akyeampong, K, Multi-site teacher education research project (MUSTER) country report 1. Department for International Development (DFID), London, 1st Edition, 2003.
2. How Learning Works: Seven Research-Based Principles for Smart Teaching, Susan A. Ambrose, Jossey-Bass, 1st Edition, 2010.
3. Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement, John Hattie, Routledge, 1st Edition, 2009.
4. Teaching for Quality Learning at University, John Biggs, Catherine Tang, McGraw-Hill Education, 4th Edition, 2011.
5. The Skillful Teacher: On Technique, Trust, and Responsiveness in the Classroom, Stephen D. Brookfield, Jossey-Bass, 3rd Edition, 2015.
6. Learning Theories: An Educational Perspective, Dale H. Schunk, Pearson Education, 7th Edition, 2015.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., I Year, II Semester

STRESS MANAGEMENT BY YOGA

(Audit Course - II)

L	T	P	C
2	0	0	0

Prerequisite: Basic awareness of mental and physical health

Course Objectives:

1. To introduce the concept of stress and its impact on physical and mental well-being.
2. To provide an understanding of yoga as a tool for stress relief and emotional balance.
3. To teach various yogic practices including asana, pranayama, and meditation for managing stress.
4. To cultivate self-awareness, relaxation, and resilience through regular yogic practice.
5. To promote a healthy lifestyle by integrating yogic discipline in daily life.

Course Outcomes: Students will be able to:

1. Understand the causes and physiological effects of stress.
2. Apply basic yogic techniques to reduce stress and enhance focus.
3. Practice breathing techniques and meditation to maintain emotional stability.
4. Demonstrate improved physical flexibility, mental clarity, and stress tolerance.
5. Incorporate yoga as a sustainable approach to managing academic, professional, and personal pressures.

UNIT-I:

Definitions of Eight parts of yoga. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III: Do`s and Dont`s in Life

Ahinsa, Satya, Astheya, Bramhacharya and Aparigraha. Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan

UNIT-IV:

Aasan and Pranayam

UNIT-V:

i) Various Yoga Poses and their Benefits for Mind and Body

ii) Regularization of Breathing Techniques and its Effects, Types of Pranayam

TEXT BOOKS:

1. Yogic Asanas for Group Training – Part I, Janardan Swami Yogabhyasi Mandal, Janardan Swami Yogabhyasi Mandal, Nagpur, Standard Edition, 1990.
2. Rajayoga or conquering the Internal Nature, Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata, 2010.

REFERENCE BOOKS:

1. The Heart of Yoga: Developing a Personal Practice, T.K.V. Desikachar, Inner Traditions, 1st Edition, 1999.
2. Yoga for Stress Relief, Swami Shivapremananda, Jaico Publishing House, 1st Edition, 2002.
3. Light on Yoga, B.K.S. Iyengar, HarperCollins, Revised Edition, 2015.
4. The Relaxation Response, Herbert Benson, HarperTorch, Updated Edition, 2000.
5. Yoga for Wellness, Shri Yogendra, The Yoga Institute, 1st Edition, 2001.
6. Yoga as Medicine, Timothy McCall, Bantam Books, 1st Edition, 2007.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., I Year, II Semester
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - II)

L	T	P	C
2	0	0	0

Prerequisite: Basic Communication and Interpersonal skills

Course Objectives:

1. To understand the concept of personality and its development through ethical and moral grounding.
2. To enhance self-awareness, confidence, and emotional intelligence.
3. To inculcate life-enlightening values drawn from Indian wisdom and philosophy.
4. To improve communication, leadership, and decision-making abilities.
5. To promote a positive attitude and holistic approach toward life and career.

Course Outcomes: Students will be able to

1. Explain the key elements of personality and factors influencing its growth.
2. Demonstrate improved self-confidence, empathy, and interpersonal relationships.
3. Apply principles from enlightened texts (e.g., Bhagavad Gita, Upanishads) to everyday decision-making.
4. Exhibit qualities of ethical leadership and responsible citizenship.
5. Lead a balanced, purposeful, and value-driven personal and professional life.

UNIT-I:

Neetisatakam-Holistic development of personality

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

UNIT-II:

Neetisatakam-Holistic development of personality

1. Verses- 52,53,59 (dont's)
2. Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day-to-day work and duties.

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

UNIT-IV:

Statements of basic knowledge.

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

UNIT-V:

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

TEXT BOOKS:

1. Srimad Bhagavad Gita, Swami Swarupananda, Advaita Ashram (Publication Department), Kolkata, 2018.
2. Bhartrihari's Three Satakas, (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi, 1st Edition, 2002.

REFERENCE BOOKS:

1. Awakening the Giant Within, Anthony Robbins, Free Press, 1st Edition, 1992
2. The 7 Habits of Highly Effective People, Stephen R. Covey, Simon and Schuster, 30th Anniversary Edition, 2020
3. Wings of Fire: An Autobiography, A.P.J. Abdul Kalam, Universities Press, 30th Impression, 2014
4. Living with the Himalayan Masters, Swami Rama, Himalayan Institute Press, Revised Edition, 2002
5. The Monk Who Sold His Ferrari, Robin Sharma, Jaico Publishing House, 1st Edition, 1997
6. The Power of Now, Eckhart Tolle, New World Library, 1st Edition, 1999.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech., II Year, I Semester
BUSINESS ANALYTICS
(Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: None

Course objectives: The course aims to

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. 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

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.
5. Select and implement appropriate analytical tools to support decision-making across business functions.

UNIT- I: Foundations of Business Analytics and Statistical Tools

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: Predictive Analytics and Data Exploration for Business Decision-Making

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: Strategic Implementation and Management of Business Analytics

Organization Structures of Business Analytics, Team Management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring Contribution of Business Analytics, and Managing Changes. Descriptive Analytics, Predictive Analytics, Predictive Modelling, Predictive Analytics Analysis, Data Mining, Data Mining Methodologies, Prescriptive Analytics and Its Steps in the Business Analytics Process, Prescriptive Modelling, Nonlinear Optimization.

UNIT- IV: Forecasting and Simulation Techniques for Business Decision Making

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

UNIT- V: Decision Analysis and Emerging Trends in Business Intelligence

Decision Analysis: Formulating Decision Problems, Decision Strategies with and 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, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press, 1st Edition, 2014.
2. Business Analytics, James R. Evans, Pearson Education, 3rd Edition, 2016.

REFERENCE BOOKS:

1. Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking, Foster Provost and Tom Fawcett, O'Reilly Media, 1st Edition, 2013.
2. Competing on Analytics: The New Science of Winning, Thomas H. Davenport and Jeanne G. Harris, Harvard Business Review Press, Updated Edition, 2017.
3. Predictive Analytics: The Future of Business Intelligence, Eric Siegel, Wiley, 1st Edition, 2013.
4. Decision Support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda, Dursun Delen, Pearson Education, 9th Edition, 2010.
5. Practical Business Analytics Using SAS: A Hands-on Guide, Shailendra Kadre, Elsevier, 1st Edition, 2015.
6. The Analytics Edge, Dimitris Bertsimas, Allison O'Hair and William Pulleyblank, Dynamic Ideas LLC, 1st Edition, 2016.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

WASTE TO ENERGY

(Open Elective)

L	T	P	C
3	0	0	3

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

Course Objectives:

1. Prepare students for a successful career in the energy industry, energy service companies, utilities, consultancy, academia, and R and D institutions.
2. Develop a strong understanding of energy resources, technologies, and systems, alongside fundamentals of energy management.
3. Enable students to address present and emerging energy challenges through innovative technological interventions.
4. Promote awareness of environmental sustainability and energy policy frameworks, both nationally and globally.
5. Cultivate the ability to integrate waste-to-energy solutions into sustainable development practices and industrial applications.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Demonstrate comprehensive knowledge on the science and engineering of energy technologies and waste-to-energy systems.
2. Apply energy auditing, management techniques, and cost analysis in practical energy scenarios.
3. Design and analyze energy conversion systems including pyrolysis, combustion, gasification, and anaerobic digestion.
4. Evaluate biomass and waste streams for energy potential using thermochemical and biochemical methods.
5. Plan and implement sustainable energy projects including bioenergy systems, biogas, biodiesel, and waste-to-electricity initiatives.

UNIT-I: Introduction to Energy from Waste

Classification of Waste as Fuel, Agro-Based, Forest Residue, Industrial Waste, MSW, Conversion Devices, Incinerators, Gasifiers, Digesters.

UNIT-II: **Biomass Pyrolysis**

Pyrolysis, Types, Slow, Fast, Manufacture of Charcoal, Methods, Yields and Applications, 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, Gasifier Burner Arrangement for Thermal Heating, Gasifier Engine Arrangement and Electrical Power, Equilibrium and Kinetic Considerations 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, Bioenergy System, Design and Constructional Features, Biomass Resources and Their Classification, Biomass Conversion Process.

UNIT-V: **Biomass Energy Conversion Technologies and Applications**

Thermochemical Conversion, Direct Combustion, Biomass Gasification, Pyrolysis and Liquefaction, Biochemical Conversion, Anaerobic Digestion, Types of Biogas Plants, Applications, Alcohol Production from Biomass, Biodiesel Production, Urban Waste to Energy Conversion, Biomass Energy Programme in India.

TEXT BOOKS:

1. Non-Conventional Energy, Ashok V. Desai, Wiley Eastern Ltd., 1st Edition, 1990.
2. Biogas Technology – A Practical Handbook, Vol. I and II, K.C. Khandelwal and S.S. Mahdi, Tata McGraw-Hill Publishing Co. Ltd., 1st Edition, 1983.

REFERENCE BOOKS:

1. Food, Feed and Fuel from Biomass, D.S. Challal, IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
2. Biomass Conversion and Technology, C.Y. WereKo-Brobby and E.B. Hagan, John Wiley and Sons, 1st Edition, 1996.
3. Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis, 3rd Edition, 2015.
4. Biomass: Renewable Energy from Plants and Animals, U.S. Department of Energy, National Renewable Energy Laboratory (NREL), Government Publication, Updated Edition, 2004.
5. Introduction to Biomass Energy Conversions, Sergio Capareda, CRC Press, 2nd Edition, 2020.
6. Biomass to Renewable Energy Processes, Jay Cheng, CRC Press, 2nd Edition, 2017.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

INDUSTRIAL SAFETY

(Open Elective)

L	T	P	C
3	0	0	3

Prerequisites: Industrial Engineering, Occupational Health and Safety Basics

Course Objectives:

1. To create awareness about hazards and risks in industrial environments.
2. To study safety management systems, accident prevention methods, and risk assessment.
3. To understand safety legislation, standards, and codes of practice.
4. To explore fire safety, electrical safety, and handling of hazardous materials.
5. To promote a safety culture and preventive strategies in industries.

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

1. Identify hazards and assess risks in various industrial settings.
2. Implement accident prevention and safety management practices.
3. Apply relevant safety standards, codes, and legal requirements.
4. Plan and execute emergency preparedness and disaster management measures.
5. Recommend safety improvements to enhance workplace health and safety.

UNIT- I: Industrial Safety and Hazard Prevention

Accident, Causes, Types, Results and Control, Mechanical and Electrical Hazards, Types, Causes And Preventive Steps / Procedure, Describe Salient Points of Factories Act 1948 for Health and Safety, Washrooms, Drinking Water Layouts, Light, Cleanliness, Fire, Guarding, Pressure Vessels, etc., Safety Color Codes, Fire Prevention and Firefighting, Equipment and Methods.

UNIT- II: Fundamentals of maintenance engineering

Definition and Aim of Maintenance Engineering, Primary and Secondary Functions and Responsibility of Maintenance Department, Types of Maintenance, Types and Applications of Tools used for Maintenance, Maintenance Cost and its Relation with Replacement Economy, Service Life of Equipment.

UNIT- III: Wear and Corrosion and their prevention

Wear Types, Causes, Effects, Wear Reduction Methods, Lubricants, Types and Applications, Lubrication Methods, General Sketch, Working and Applications of Screw Down Grease Cup, Pressure Grease Gun, Splash Lubrication, Gravity Lubrication, Wick Feed Lubrication, Side Feed Lubrication, Ring Lubrication. Definition, Principle and Factors Affecting the Corrosion, Types of Corrosion, Corrosion Prevention Methods.

UNIT- IV: Fault Tracing and Decision Tree Analysis

Fault Tracing-Concept and Importance, Decision Tree Concept, Need and Applications, Sequence of Fault-Finding Activities, Show as Decision Tree, Draw Decision Tree for Problems in Machine Tools, Hydraulic, Pneumatic, Automotive, Thermal and Electrical Equipment's such as Any One Machine

Tool, Pump, Air Compressor, Internal Combustion Engine, Boiler, Electrical Motors, Types of Faults in Machine Tools and Their General Causes.

UNIT- V: Periodic and Preventive Maintenance

Periodic Inspection-Concept and Need, Degreasing, Cleaning and Repairing Schemes, Overhauling Mechanical Components, Overhauling Electrical Motor, Common Troubles and Remedies Electric Motor, Repair Complexities and Use, Definition, Need, Steps and Advantages Preventive Maintenance, Steps/Procedure for Periodic and Preventive Maintenance Machine Tools, Pumps, Air Compressors, Diesel Generating (DG) Sets. Program and Schedule Preventive Maintenance Mechanical and Electrical Equipment, Advantages Preventive Maintenance, Repair Cycle Concept and Importance.

TEXT BOOKS:

1. Maintenance Engineering Handbook, Higgins and Morrow, Da Information Services, 1st Edition.
2. Maintenance Engineering, H.P. Garg, S. Chand and Company, 1st Edition, 1987.

REFERENCE BOOKS:

1. Pump-Hydraulic Compressors, Audels, McGraw Hill Publication, 1st Edition.
2. Foundation Engineering Handbook, Hans Winterkorn, Chapman and Hall, London, 1st Edition, 1975.
3. Industrial Safety Management, L. M. Deshmukh, Tata McGraw Hill, 1st Edition, 2010.
4. Safety Engineering, R. K. Jain & Sunil S. Rao, Khanna Publishers, 4th Edition, 2015.
5. Industrial Safety, Health and Environment Management Systems, R. K. Jain & Sunil S. Rao, Khanna Publishers, 2nd Edition, 2016.
6. Industrial Safety and Risk Management, S. K. Basu, Fire and Safety Association of India, 1st Edition, 2017.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech., II Year, I Semester

PRINCIPLES OF AUTOMATION

(Open Elective)

L	T	P	C
3	0	0	3

Prerequisites: Basic knowledge of manufacturing processes and industrial engineering fundamentals.

Course Objectives: The course aims to

1. Introduce the concepts, need, and scope of automation in modern production systems and manufacturing operations.
2. Explain various automated systems and material handling technologies used in production environments.
3. Equip students with analytical tools to model and evaluate automated production systems.
4. Enable understanding of assembly line design, automated production lines, and automated assembly systems.
5. Promote practical understanding of automation technologies such as AGVs, conveyors, AS/RS, and automatic data capture systems.

Course Outcomes: Upon successful completion of the course, students will be able to

1. Understand the principles, strategies, and economic justifications of automation in manufacturing systems.
2. Analyze production operations using mathematical models and interpret various levels and functions of automation.
3. Identify and evaluate material handling systems including AGVs, conveyors, monorails, and automated storage/retrieval systems.
4. Design and balance manual assembly lines using standard techniques such as Ranked Positional Weight Method, Kilbridge and Wester Method, and Largest Candidate Rule.
5. Evaluate the performance of transfer lines and automated production lines with and without internal storage.

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 System, Advanced Automation Functions, Levels of Automation.

UNIT- II: Material Handling Systems and Automated Storage Technologies

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 Line Design and Balancing Techniques

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 and Automated Production Lines

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: Design and Analysis of Automated Assembly Systems

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

TEXT BOOKS:

1. Automation, Production Systems and Computer Integrated Manufacturing, Mikel P. Groover, Pearson Education, 3rd Edition, 2008.
2. CAD/CAM: Principles, Practice and Manufacturing Management, Chris McMahon and Jimmie Browne, Pearson Education (LPE), 2nd Edition, 1999.

REFERENCE BOOKS:

1. Automation, W. Buckingham, Harper and Row Publishers, New York, 1st Edition, 1961.
2. Automation for Productivity, H.D. Luke, John Wiley and Sons, New York, 1st Edition, 1972.
3. Industrial Automation and Robotics, Mikell P. Groover, McGraw-Hill Education, 1st Edition, 2019.
4. Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design, Yusuf Altintas, Cambridge University Press, 1st Edition, 2000.
5. Flexible Manufacturing Systems in Practice, Joseph Talavage and Ramana R. Suri, Marcel Dekker Inc., 1st Edition, 1987.
6. Material Handling Equipment, M. P. Alexandrov, MIR Publishers, 1st Edition, 1981.