JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH. (ENGINEERING DESIGN)

EFFECTIVE FROM ACADEMIC YEAR 2019- 20 ADMITTED BATCH

R19 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 Mechanics of Machinery	3	0	0	3
Professional Elective - I	1. Theory of Elasticity 2. Advanced Machine Design 3. Random Vibrations	3	0	0	3
Professional Elective - II	1. Design for Manufacturing & Assembly 2. Optimization Techniques & Applications 3. Mechanical Behaviour of Engineering Materials	3	0	0	3
	Research Methodology & IPR	2	0	0	2
Lab - I	Advanced Dynamics Lab	0	0	4	2
Lab - II	Advanced Material Testing 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 Modelling	3	0	0	3
Professional Core - IV	Advanced Finite Element and Boundary Element Methods	3	0	0	3
Professional Elective - III	1. Vibration Analysis of Mechanical Systems 2. Industrial Robotics 3. Fuzzy Logic and Neural Networks	3	0	0	3
Professional Elective - IV	1. Experimental Stress Analysis 2. Design and Analysis of Experiments 3. Tribology	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. Concurrent Engineering 2. Product Design and Development 3. Microprocessors in Automation	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review - II	0	0	12	6
	Total	**6**	**0**	**12**	**12**

II YEAR II SEMESTER

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

***For Dissertation Work Review - I, Please refer 7.8 in R19 Academic Regulations.**

Audit Course I & II:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)
ADVANCED MECHANICS OF SOLIDS (Professional Core - I)

Prerequisite: Applied Mechanics, Mechanics of solids

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

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

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

UNIT–I:
Shear center: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections.
Unsymmetrical bending: Bending stresses in Beams subjected to Nonsymmetrical bending, Deflection of straight beams due to nonsymmetrical bending.

UNIT–II:
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–III:
Torsion: Linear elastic solution Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section, Hollow thin wall torsion members, Multiply connected Cross Section.

UNIT–IV:
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.

UNIT–V:
Introduction to Three Dimensional Problems: Uniform stress stretching of a prismatic bar by its own weight twist of circular shafts of constant cross section, pure bending of plates.

TEXT BOOKS:

1. Advanced Mechanics of materials by Boresi & Sidebottom, Wiely International.
2. Theory of elasticity by Timoschenko S.P. and Goodier J.N. McGraw, Hill Publishers 3rd Edition

REFERENCE BOOKS:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates by Timoshenko.
3. Strength of materials & Theory of structures by B.C Punmia (Vol I & II)
4. Strength of materials by Sadhu singh

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)
ADVANCED MECHANICS OF MACHINERY (Professional Core - II)

Prerequisite: Kinematics of machinery

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

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

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

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

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

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

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

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

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

THEORY OF ELASTICITY (Professional Elective - I)

Prerequisite: Mechanics of solids

Course Objectives: The objectives of this course are to introduce graduate and senor undergraduate's students to advanced topics in linear elasticity. Students will build on the knowledge gained through all mechanical related courses of the undergraduate curriculum (statics, mechanics of materials etc)

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

- Deriving the governing equations for 2D and 3D elastic problems.
- Solve these problems with various solution methodologies.

UNIT-I:
Introduction: Elasticity – notation for forces and stress components of stresses - components of strain - Hooks law. Plane Stress and plain strain analysis - plane stress - plane strain- differential equations of equilibrium - boundary conditions – compatibility equations –stress function - boundary condition.

UNIT-II:
Two dimensional problems in rectangular co-ordinates-solution by polynomials - Saint-vanant's principle-determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems-gravity loading.

UNIT-III:
Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates – displacements - displacement for symmetrical stress distribution - simple symmetric and asymmetric problems - general solution of two-dimensional problem in polar coordinates - application of general solution in polar coordinates.

UNIT-IV:
Analysis of stress and strain in three dimensions - principal stress - stress ellipsoid - director surface - determination of principal stresses - max shear stresses - homogeneous deformation - principal axes of strain rotation. General Theorems. Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solutions - the reciprocal theorem.

UNIT- V:
Torsion of Prismatic Bars - torsion of prismatic bars - bars with elliptical cross sections - other elementary solution - membrane analogy - torsion of rectangular bars-solution of torsional problems by energy method - use of soap films in solving torsion problem - hydro dynamical analogies - torsion of shafts, tubes, bars etc.

TEXT BOOKS:

1. Theory of Elasticity by Timoshenko, Mc Graw hill Publications

REFERENCE BOOKS:

1. Theory of Elasticity by Y. C. Fung.
2. Theory of Elasticity by Sadhu Singh. Dhanpat Rai sons Private Limited, New Delhi

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)
ADVANCED MACHINE DESIGN (Professional Elective - I)

Prerequisite: Design of Machine Elements

Course Objectives:

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

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

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

UNIT-I:

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

UNIT-II:

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

UNIT-III:

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

UNIT-IV:

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

UNIT-V:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

RANDOM VIBRATIONS (Professional Elective - I)

Pre-requisites: Probability & Statistics, Kinematic of machinery and Dynamics of machinery.

Course Objectives: The main objective of course is to present fundamentals to a modern treatment of vibrations, placing the emphasis on analytical developments and computational solutions. This course will provide the detail knowledge about nonlinear and random vibration with fault diagnosis of machinery using vibration signature analysis.

Course Outcomes: After completing this course, students should be able to:

- Apply tools from probabilistic modeling to analyze dynamic systems while accounting for variability and uncertainties that are inevitably present in real engineered systems.
- Classify random excitations as stationary or non-stationary
- Discuss important properties of random processes
- Define and compute power spectral density functions
- Compute auto-and cross-correlation functions, and relate them to power spectral
- Density functions Describe the dynamic response of a multi-degree-of-freedom system to a stochastic excitation
- Quantify the distributions of peak loads and peak responses from a system subject to stochastic excitation

UNIT-I
Probability Theory: Random Vibrations - Probability distribution and density functions - Excreted values - Conditional probability - Characteristic and log characteristic functions - Chebyshev inequality - Functions of random variables.

UNIT–II
Random Processes - I: Concept of stationary and ergodicity - Evolutionary nono stationary process - Auto and cross correlation and covariance Functions - Mean square limit, differentiability and inerrability - Spectral decomposition.

UNIT-III
Random Processes - II: Power spectral and cross spectral density Factions - Wiener - Khintchine relations - Properties of Gaussian. Poisson and Markov processes –Fokker - Planck Equation - Broad band and narrow band random processes - white noise.

UNIT-IV
Random Vibrations - I: Response of linear single and multi - degree of freedom systems to stationary excitation - Response of continuous systems - Normal mode method.

UNIT-V
Random Vibrations - II: Level crossing, peak and envelop statistics - First excursion and fatigue.

TEXT BOOKS:

1. Probabilistic Methods in the Theory of Structures by Lishakoff, I John Wiley, New York, 1983.
2. An Introduction to Random Vibrations and Spectral Analysis by Newland and D. E Longman Inc., New York, Second Edition, 1984.

REFERENCE BOOKS:

1. Introduction to Random Vibrations by Nigam, N.C., MIT Press, Cambridge, Massachusetts, 1983.
2. Applications of Random Vibrations by Nigam, N.C. and Narayanan, S., Narosa Publications, 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

DESIGN FOR MANUFACTURING & ASSEMBLY (Professional Elective - II)

Prerequisites: Manufacturing Processes, Engineering Materials

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

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

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

UNIT - I:

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

UNIT - II:

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

UNIT - III:

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

UNIT-IV

Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.
Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-V:

Design of Manual Assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and

fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

TEXT BOOKS:

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

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

OPTIMIZATION TECHNIQUES & APPLICATIONS (Professional Elective - II)

Pre-requisites: Operations Research

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

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

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

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

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

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

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

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

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

UNIT-V:

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

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

TEXT BOOKS:

1. Optimization theory & Applications by S. S. Rao, New Age International.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

REFERENCE BOOKS:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS (Professional Elective - II)

Prerequisite: Physical Metallurgy

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

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

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

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

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

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

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

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

TEXT BOOKS:
1. Mechanical Metallurgy by G. E. Dieter, McGraw Hill, (1988)
2. Thin Film Materials L. B. Freund and S. Suresh, Cambridge University Press (2003).

REFERENCE BOOKS:
1. Fracture Mechanics Fundamentals and Applications by T.L. Anderson, 2nd Ed. CRC press, (1995)
2. Fracture of Brittle Solids by B. Lawn, Cambridge Solid State Science Series 2nd ed 1993.
3. Fundamentals of Fracture Mechanics by J. F. Knott, Butter worths (1973)
4. Worked examples in Fracture Mechanics by J.F. Knott, P Withey, Institute of Materials.
5. Fracture Mechanics by H.L. Ewald and R. J. H. Wanhill, Edward Arnold, (1984).

6. Fatigue of Materials by S. Suresh, Cambridge University Press, (1998)
7. Inelastic Deformation of Metals by D.C. Stouffer and L.T. Dame, Wiley (1996)
8. The Physics of Creep by F. R. N. Nabarro, H.L. de Villiers, Taylor and Francis, (1995)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

RESEARCH METHODOLOGY AND IPR

Prerequisite: None

Course Objectives:

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

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT-I:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II:
Effective literature studies approaches, analysis, Plagiarism, Research ethics

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

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

UNIT-V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:

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

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (ENGG. DESIGN)

ADVANCED DYNAMICS LAB (Lab - I)

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

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ADVANCED MATERIAL TESTING LAB (Lab - II)

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
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COMPUTER AIDED GEOMETRIC MODELLING (Professional Core - III)

Prerequisites: CAD/CAM

Course Objectives:

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

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

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

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

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

UNIT–III:
Cubic Splines: Algebraic and geometric force of cubic spline, parametric space of a curve, blending functions, Problems
Bezier Curves: Berustein's polynomials, equations, control points, convex hull property, truncating and subdividing composite and Rational Bezier curves, Problems
B-Spline Curves: Uniform and non-uniform B-Spline basis functions, quadratic and cubic B-spline basis functions, NURBS, Problems

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

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

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

REFERENCE BOOKS:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

ADVANCED FINITE ELEMENT AND BOUNDARY ELEMENT METHODS
(Professional Core - IV)

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

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

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

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

UNIT–I:
One Dimensional Problems: Formulation of Stiffness Matrix for a Bar Element by the Principle of Minimum Potential Energy, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions.
Analysis of Trusses: Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of reaction forces and displacements.
Analysis of Beams: Derivation of Stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams.

UNIT–II:
Finite element – formulation of 2D Problems: Derivation of Element stiffness matrix for two-dimensional CST Element, Derivation of shape functions for CST Element, Elasticity Equations, constitutive matrix formulation, Formulation of Gradient matrix. Two dimensional Isoparametric Elements and Numerical integration.
Finite element – formulation of 3D problems: Derivation of Element stiffness matrix for Tetrahedron Element, Properties of Shape functions for 3D Tetrahedral Element, Stress-Strain Analysis for 3D Element, Strain Displacement for Relationship Formulation.

UNIT–III:
Steady state heat transfer analysis: One Dimensional Finite Element analysis of fin and composite slabs. **Two-dimensional steady state heat transfer problems:** Derivation of Thermal Stiffness matrix for 2D heat transfer problems-CST, Derivation of thermal force vector for 2D heat transfer problems.
Dynamic Analysis: Formulation of mass matrices for uniform bar and beam Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems.

UNIT–IV:
Plate Bending: Introduction – Plate behavior – C^1 (Kirchoff) 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: Potential Problems: Introduction, boundary Element Approach- Fundamental solution. Numerical Implementation - Determination of Ci, Final Relation, Three-dimensional analysis, tackling kernel singularity.

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

Text Books:

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

Reference Books:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

VIBRATION ANALYSIS OF MECHANICAL SYSTEMS (Professional Elective - III)

Prerequisite: Basic concepts of Physics

Course Objectives:

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

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

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

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

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

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

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

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

Text Books:

1. Mechanical Vibrations by S.S. Rao, 4th Edition, Pearson Publications.

2. Elements of Vibration Analysis by Meirovitch.

Reference Books:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

INDUSTRIAL ROBOTICS (Professional Elective - III)

Prerequisites: Kinematics of machinery

Course Objectives:

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

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

- Understand the evolution, classification, structures and drives for robots.
- Teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors.
- Expose the students to build a robot for any type of application.

UNIT-I:

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

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

UNIT-II:

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

UNIT-III:

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

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

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

UNIT-IV:

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

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

UNIT-V:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Industrial robotics by Mikell P. Groover, McGraw Hill
2. Robotics by K.S. Fu, McGraw Hill.
3. Introduction to Robotics Mechanics & Control by John J. Craig, Pearson
4. Robot Analysis by Lung Wen Tsai, John Wiley & Sons
5. Robot Analysis and Control by Asada H. and J. E. Slotin, Wiley, New York.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

FUZZY LOGIC AND NEURAL NETWORKS (Professional Elective - III)

UNIT- I

Fuzzy Set Theory and Fuzzy Logic Control: Basic concepts of fuzzy sets- Operations on fuzzy sets- Fuzzy relation equations- Fuzzy logic control- Fuzzification –Defuzzificatiuon- Knowledge base- Decision making logic- Membership functions – Rule base.

UNIT- II

Adaptive Fuzzy Systems: Performance index- Modification of rule base0- Modification of membership functions- Simultaneous modification of rule base and membership functions- Genetic Algorithms- Adaptive fuzzy system- Neuro fuzzy systems.

UNIT- III

Artificial Neural Networks: Introduction- History of neural networks- multilayer perceptions- Back propagation algorithm and its Variants- Different types of learning, examples.

UNIT- IV

Mapping and Recurrent Networks: Counter propagation –Self organization Map- Congnitron and Neocognitron- Hopfield Net- Kohonnen Nets- Grossberg Nets- Art-I, Art-II reinforcement learning

UNIT- V

Case Studies: Application of fuzzy logic and neural networks to Measurement- Control- Adaptive Neural Controllers – Signal Processing and Image Processing

TEXT BOOK:

1. Vallum B. R And Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB Publications, New Delhi, 1996

REFERENCE BOOKS:

1. Fuzzy logic & Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
2. Neural Networks for control, Millon W. T, Sutton R.S and Werbos P.J, MIT Press 1992
3. Fuzzy sets Fuzzy logic, Klir, G.J anfd Yuan B.B Prentice Hall of India Pvt. Ltd., New Delhi
4. Neural Networks and Fuzzy systems, Kosko.. Prentice hall of India Pvt. Ltd., New Delhi 1994
5. Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996.
6. Introduction to Artificial Neural systems, Zurada J. M Jaico Publishing House, New Delhi 1994

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

EXPERIMENTAL STRESS ANALYSIS (Professional Elective - IV)

Prerequisite: Strength of Materials, Theory of Elasticity desirable

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

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

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

UNIT- I:
Strain Gauges - Mechanical and optical strain gauges – Description and operation –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 - 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:
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:
Three-dimensional photo elasticity - Introduction – Stress freezing techniques – Stress separation techniques – Scattered light photo elasticity – Reflection polariscope.

UNIT - V:
Miscellaneous Methods - Brittle coating method – Birefringence techniques – Moire fringe method – Non-destructive testing – Ultrasonic pulse velocity technique – Rebound hammer method – X-ray method – Gamma-ray method.

Text Books:

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

Reference Books:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

DESIGN AND ANALYSIS OF EXPERIMENTS (Professional Elective - IV)

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

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

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

UNIT- IV:
Response surface methodology: Concept, linear model, steepest ascent, second order model, regression.

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

TRIBOLOGY (Professional Elective - IV)

Prerequisite: Design of machine members, Fluid Mechanics

Course Objectives:

- To Explain the processes of lubrication in all regimes
- To Explain the friction phenomena
- To Select a suitable lubricant for a specific application
- To Select a suitable material combination for tribological contacts
- To Determine the risk of wear by using simple analyses
- To Suggest an explanation to the cause of a tribological failure

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

- Understand the different types of lubrications and relevant theories used in supporting elements.
- Understand the failure mechanisms in different types of supporting elements.

UNIT–I:

Selection of rolling element bearings: Nominal life, static and dynamic capacity - Equivalent load, probabilities of survival - cubic mean load - bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

UNIT–II:

Hydrodynamic bearings: Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number - performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings - fixed tilting pads, single and multiple pad bearings - optimum condition with largest minimum film thickness.

UNIT–III:

Hydrostatic Bearings: Thrust bearings – pad coefficients - restriction - optimum film thickness - journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure.

UNIT–IV:

Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants - additives - lubrication systems and their selection – selection of pump, filters, piping design - oil changing and oil conservation.

UNIT–V:

Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferro graphy. Factors to be considered for life enhancement

TEXT BOOKS:

1. Hydrostatic and Hybrid bearing design by Rowe W W & O Dionoghue, Butterworths & Co. Publishers Ltd, 1983.
2. Mechanical Fault diagnosis and condition monitoring by Collacott R.A, Chapman and Hall, London

1977.
3. Fundamentals of fluid film lubricant by Bernard J.Hamrock, Mc Graw-Hill Co., 1994.

REFERENCES BOOKS:

1. Tribology hand Book by Neale MJ, (Editor), Neumann Butter worths, 1975.
2. Standard hand book of lubrication engineers by Connor and Boyd JJO (Editors), ASLE, Mc Graw Hill Book & Co.,1968
3. Mechanical Engineering Design by Shigley J, E Charles, McGraw Hill Co., 1989.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

ADVANCED COMPUTER AIDED MODELLING LAB (Lab – III)

Prerequisite: CAD, FEM

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

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

DRAFTING:

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

PART MODELING:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year II Sem. (ENGG. DESIGN)

ADVANCED COMPUTER AIDED ANALYSIS LAB (Lab - IV)

Prerequisite: CAD, FEM

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

- Students should be able to carry out structural, Harmonic and fracture analysis using FEA software for real time applications.

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. (ENGINEERING DESIGN)

CONCURRENT ENGINEERING (Professional Elective - V)

Prerequisites: Computer-Aided Design

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

Course Outcomes:

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

UNIT-I:
Introduction: Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development
Use Of Information Technology: IT support - Solid modeling - Product data management - Collaborative product commerce - Artificial Intelligence - Expert systems - Software hardware co-design.

UNIT-II:
Design Stage: Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design.
Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

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

UNIT-IV:
JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning - Design of Automated manufacturing.
Project Management: Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost.

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

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

REFERENCE BOOKS:
1. Integrated Product Development by Anderson MM and Hein, L. Berlin, Springer Verlog, 1987.

2. Design for Concurrent Engineering by Cleetus, J.Concurrent Engineering Research Centre, Morgantown W V, 1992.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. (ENGINEERING DESIGN)

PRODUCT DESIGN & DEVELOPMENT (Professional Elective - V)

Prerequisites: None

Course Outcomes:

- After doing this course, the student should be able to understand the need of Industrial Product & Development, customer needs & Design aspects of new products.
- Able to involve customer into the development of new products and managing requirements
- Able to understand the design of experiments and technical analysis
- Know product architecture
- Investigate the customer requirement and survey of problems
- Design for manufacture and do prototyping

UNIT – I:

Introduction: Need for IPPD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification.

UNIT – II:

Concept generation and concept selection: Activity of concept generation – Structured approaches – Five step Method: clarify – Search-Externally and internally – explore systematically – reflect on the solutions and processes – **Concept selection** – Integral part of PDD process-methodology – benefits.

UNIT – III:

Product architecture: Implications – Product change – variety – component standardization – Product performance – manufacturability

Industrial design: Assessing the need for industrial design, impact – design process Integrate design process – assessing the quality of industrial design.

ROBUST DESIGN - introduction, various steps in robust design.

UNIT – IV:

Investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT – V:

Design for manufacturing: Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs –cost of supporting production. Minimizing System complexity.

Prototyping: Prototype basics – Principles of prototyping – planning for prototypes – Economic analysis. Understanding and representing tasks – baseline project planning – accelerating the project execution.

REFERENCE BOOKS:

1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger /McGraw Hill International Edns. 1999.
2. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.

3. Concurrent Engg/ integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)377-569, Workshop Book.
4. Tool Design – Integrated Methods for Successful Product Engineering / Staurt Pugh / Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. II Year I Sem. (ENGINEERING DESIGN)

MICROPROCESSORS IN AUTOMATION (Professional Elective - V)

Prerequisites: Introduction to Logic Design, Programming and Introductory Data Structures

Course Objectives: To introduce the basic concepts of Digital circuits, Microprocessor system and digital controller

Course Outcomes: Students who have done this course will have a good idea of the use of microprocessors for automation

UNIT-I:
Introduction to Number Systems, codes, digital electronics: Logic Gates, combinational circuits design, Flip-flops, Sequential logic circuits design: Counters, Shift registers.

UNIT-II:
Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals, Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

UNIT-III:
Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller.

UNIT-IV:
Interfacing peripherals: Programmable peripheral interface (8255), Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features.

UNIT-V:
Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z Transform, Digital Filters, Implementation of Digital Algorithm.

TEXT BOOKS:

1. Digital Computer Electronics: An Introduction to Microcomputers by Albert Pual Malvino, Tata McGraw-Hill Publishing Company Ltd.
2. Digital Electronics: An Introduction to Theory and Practice by William H. Gothmann, PHI Learning Private Limited
3. Microprocessor Architecture, Programming, and Applications with the 8085 by Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems by Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition, 2007).

REFERENCE BOOKS:

1. Digital and Microprocessor Engineering by S. J. Cahill, Wllis Horwood Limited (John Wiley & Sons)
2. Microprocessors and Interfacing: Programming and Hardware by Douglas V. Hall
3. Microcomputer Experimentation with the Intel SDK-85 by Lance A. Leventhal, Prentice Hall

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

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

Prerequisite: None

Course objectives: Students will be able to:

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

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

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

UNIT-III:
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

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

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

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

DISASTER MANAGEMENT (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to

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

UNIT-I:

Introduction:

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

Disaster Prone Areas in India:

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

UNIT-II:

Repercussions of Disasters and Hazards:

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

UNIT-III:

Disaster Preparedness and Management:

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

UNIT-IV:

Risk Assessment Disaster Risk:

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

UNIT-V:

Disaster Mitigation:

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

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

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

Prerequisite: None

Course Objectives:

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

Course Outcomes: Students will be able to

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

UNIT-I:
Alphabets in Sanskrit,

UNIT-II:
Past/Present/Future Tense, Simple Sentences

UNIT-III:
Order, Introduction of roots,

UNIT-IV:
Technical information about Sanskrit Literature

UNIT-V:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

VALUE EDUCATION (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to

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

Course outcomes: Students will be able to

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

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

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

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

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

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

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

CONSTITUTION OF INDIA (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:

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

Course Outcomes: Students will be able to:

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

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

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

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

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

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

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

PEDAGOGY STUDIES (Audit Course - I & II)

Prerequisite: None

Course Objectives: Students will be able to:

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

Course Outcomes: Students will be able to understand:

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

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

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

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

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

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

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

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

Prerequisite: None

Course Objectives:

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

Course Outcomes: Students will be able to:

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

UNIT-I:
Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:
Yam and Niyam.

UNIT-III:
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:
Asan and Pranayam

UNIT-V:
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (ENGG. DESIGN)

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Audit Course - I & II)

Prerequisite: None

Course Objectives:

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

Course Outcomes: Students will be able to

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

UNIT-I:

Neetisatakam-Holistic development of personality

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

UNIT-II:

Neetisatakam-Holistic development of personality

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

UNIT-III:

Approach to day to day work and duties.

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

UNIT-IV:

Statements of basic knowledge.

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

UNIT-V:

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

TEXT BOOKS/ REFERENCES:

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