JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech in CAD/CAM
Effective from Academic Year 2017- 18 admitted batch

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Advanced CAD	25	75	4	0	0	4
PC-2	Computer Aided Manufacturing	25	75	4	0	0	4
PC-3	Advanced FEM	25	75	4	0	0	4
PE-1	1. Mechanical Behavior of Materials 2. Stress Analysis and Vibration 3. Additive Manufacturing Technologies	25	75	3	0	0	3
PE-2	1. Automation in Manufacturing 2. Computer Aided Process Planning 3. Performance Modeling and Analysis of Manufacturing Systems	25	75	3	0	0	3
OE-1	***Open Elective - I**	25	75	3	0	0	3
Laboratory I	Advanced CAD/CAM Laboratory	25	75	0	0	3	2
Seminar I	Seminar-I	100	0	0	0	3	2
	Total	**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Design for Manufacturing And Assembly	25	75	4	0	0	4
PC-5	Flexible Manufacturing Systems	25	75	4	0	0	4
PC-6	Industrial Robotics	25	75	4	0	0	4
PE-3	1. Intelligent Manufacturing Systems 2. Special Manufacturing Process 3. Optimization Techniques and Applications	25	75	3	0	0	3
PE4	1. Advanced Mechatronics 2. MEMS and Micro Systems **:** Design and Manufacture 3. Fuzzy Logic and Neural Networks	25	75	3	0	0	3
OE-2	***Open Elective - II**	25	75	3	0	0	3
Laboratory II	Manufacturing simulation & Precision Engineering lab	25	75	0	0	3	2
Seminar II	Seminar-II	100	0	0	0	3	2
	Total	**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
Total	**200**	**100**	**0**	**3**	**22**	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
Total	**100**	**100**	**0**	**0**	**24**	**24**

*Open Elective subjects must be chosen from the list of open electives offered by OTHER departments.

 # For Project review I, please refer 7.10 in R17 Academic Regulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

ADVANCED CAD
(PC-1)

UNIT- I:
CAD Tools: Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software.
Basics of Geometric Modelling: Requirement of geometric 3odeling, Geometric models, Geometric construction methods, Modelling facilities desired.

UNIT- II:
Eometric modelling: Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spleen curvewire, NURBS, Curve manipulations.

UNIT- III:
Surface Modeling : Classification of surface entities, Surface representation methods, Parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder, Parametric representation of synthetic curves: Hermite cubic surface, Bezier surface, B-Spleen surface, Blending surface, Surface manipulations.

UNIT- IV:
Solid Modelling: Geometry and topology, Boundary representation, The Euler-Poincare formula, Euler operators, Constructive solid geometry: CSG primitives, Boolean operators, CSG expressions, Interior, Exterior, closure, Sweeping: linear and non-linear, Solid manipulations.

UNIT- V:
Transformations: @-D and 3-D transformations: translation, scaling, rotation, reflection, concatenation, homogeneous coordinates, Perspective projection, orthotropic projection, isometric projection, Hidden surface removal, shading, rendering.
Evaluation Criteria: Evaluation criteria of CAD software, Data exchange formats: GKS, IGES, PHIGS, CGM, STEP
Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), Least material condition (LMC), Regardless of feature size (RFS).

REFERENCES:
1. CAD/CAM Concepts and Applications/ Alavala/ PHI.
2. Mastering CAD/CAM / Ibrhim Zeid / McGraw Hill International.
3. CAD/CAM Principles and Applications/ P.N. Rao/TMH/3rd Edition
4. CAD/CAM /Groover M.P./ Pearson education
5. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age
6. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson
7. Computer Numerical Control Concepts and programming/ Warren S Seames/ Thomson.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

COMPUTER AIDED MANUFACTURING
(PC-2)

UNIT - I
Computer-Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT - II
Tooling for CNC Machines: Interchangeable tooling system, preset and qualified toois, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

UNIT - III
Post Processors for CNC:
Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP — based- Post Processor: Communication channels and major variables in the DAPP — based Post Processor, th creation of a DAPP — Based Post Processor.

UNIT - IV
Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory:, counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications, and Programming of Micro Controllers. Programming Logic Controllers (PLC' s): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

UNIT - V
Computer Aided Process Planning: Hybrid CAAP System, Computer Aided Inspection and quality control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods, Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

REFERENCES:
1. P.N. Rao, N. K. Tewari, T K Kundra " Computer Aided Manufacturing" McGraw Hill
2. CAD/CAM Principles and Applications, P.N. Rao, TMH
3. Computer Control of Manufacturing Systems / Yoram Koren / McGraw Hill. 1983.
4. CAD / CAM / CIM, Radha krishnan and Subramanian, New Age
5. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

ADVANCED FINITE ELEMENT METHODS
(PC-3)

UNIT-I:
Introduction to FEM, basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

UNIT-II:
1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.
Analysis of Trusses: Plane Trusses and Space Truss elements and problems
Analysis of BECAD/CAM: Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III:
2-D problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.
3-D Problems: Tetrahedran element – Jacobian matrix – Stiffness matrix.

UNIT-VI:
Scalar Field Problems: 1-D Heat conduction-Slabs – fins - 2-D heat conduction problems – Introduction to Torsional problems.

UNIT-V:
Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

REFERENCES:
1. Finite Element Methods: Basic Concepts and applications, Alavala, PHI.
2. Finite Element Method – Zincowitz / McGraw Hill
3. The Finite Element Methods in Engineering / SS Rao / Pergamon.
4. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice – Hall
5. Introduction to Finite element analysis- S.Md. Jalaludeen, Anuradha Publications, print-2012
6. A First Course in the Finite Element Method/Daryl L Logan/ Cengage Learning/5th Edition
7. Finite Element Method – Krishna Murthy / TMH
8. Finite Element Analysis – Bathe / PHI

MECHANICAL BEHAVIOUR OF MATERIALS (PE – I)

UNIT-I:
Introduction to Deformation Behaviour: Concept of stresses and strains, engineering stresses and strains, Different types of loading and temperature encountered in applications, Tensile Test - stress-strain response for metal, ceramic and polymer, elastic region, yield point, plastic deformation, necking and fracture, Bonding and Material Behaviour, theoretical estimates of yield strength in metals and ceramics.

UNIT-II:
Elasticity Theory: The State of Stress and strain, stress and strain tensor, tensor transformation, principal stress and strain, elastic stress-strain relation, anisotropy, elastic behaviour of metals, ceramics and polymers.

Yielding and Plastic Deformation: Hydrostatic and Deviatoric stress, Octahedral stress, yield criteria and yield surface, texture and distortion of yield surface, Limitation of engineering strain at large deformation, true stress and true strain, effective stress, effective strain, flow rules, strain hardening, Ramberg Osgood equation, stress -strain relation in plasticity, plastic deformation of metals and polymers

UNIT-III:
Microscopic view of plastic deformation: crystals and defects, classification of defects, thermodynamics of defects, geometry of dislocations, slip and glide, dislocation generation - Frank Read and grain boundary sources, stress and strain field around dislocations, force on dislocation - self-stress, dislocation interactions, partial dislocations, twinning, dislocation movement and strain rate, deformation behavior of single crystal, critical resolved shear stress (CRSS), deformation of poly-crystals - Hall-Petch and other hardening mechanisms, grain size effect - source limited plasticity, Hall-Petch breakdown, dislocations in ceramics and glasses.

UNIT-IV:
Fracture: fracture in ceramics, polymers and metals, different types of fractures in metals, fracture mechanics - Linear fracture mechanics -KIC, elasto-plastic fracture mechanics - JIC, Measurement and ASTM standards, Design based on fracture mechanics, effect of environment, effect of microstructure on KIC and JIC, application of fracture mechanics in the design of metals, ceramics and polymers

UNIT-V:
Deformation under cyclic load - Fatigue: S-N curves, Low and high cycle fatigue, Life cycle prediction, Fatigue in metals, ceramics and polymers

Deformation at High temperature: Time dependent deformation - creep, different stages of creep, creep and stress rupture, creep mechanisms and creep mechanism maps, creep under multi-axial loading, microstructural aspects of creep and design of creep resistant alloys, high temperature deformation of ceramics and polymers.

REFERENCES:
1. G.E. Dieter, "Mechanical Metallurgy", McGraw-Hill, 1986.
2. R.W. Hertzberg, "Deformation and Fracture Mechanics of Engineering Materials", John Wiley and Sons, 1976.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

STRESS ANALYSIS AND VIBRATION
(P E – I)

UNIT-I:
Two dimensional elasticity theory in Cartesian coordinates, plane stress problem in polar coordinates Thick cylinders, Rotating discs - stress concentration.

UNIT- II:
Torsion of non circular prismatic sections, rectangular and axisymmetric, Circular plates, introduction to shell theory — contact stresses.

UNIT- III:
Single degree freedom, two degree freedom system without and with damping - Free and forced vibrations.Transient vibrations.

UNIT- IV:
Transient vibrations of single and two degree freedom systems, multi-degree of freedom systems - applications of matrix methods , continuous systems.

UNIT -V:
Free and forced vibrations of strings bars and be CAD/CAM. Principle of orthogonality - classical and energy methods.

REFERENCES:
1. Theory of Elasticity/Timoshenko S.P. and Goodier J. N./ Koakusha Publishers
2. Advanced strength of materials / Den Hortog J.P./Torrent
3. Mechanical Vibrations/ Den Ilartog J.P./ Dover Publications
4. Theory of Vibrations with Applications/ Thomson W.T./ CBS Publishing
5. Mechanical Vibrations/ Rao S.S./ Addison Wesley Longman

ADDITIVE MANUFACTURING TECHNOLOGIES (PE – I)

UNIT-I

Introduction: Introduction to Prototyping, Traditional Prototyping Vs Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC and other related technologies, Classification of RP, Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3D View, etc., Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT,STEP.

UNIT-II

RP Processes:
 a) **Photopolymerization RP Processes**:-Stereolithography (SL), SL resin curing process, SL scan patterns, Microstereolithography, Applications of Photopolymerzation processes.
 b) **Power Bed Fusion RP Processes**:-Stereolithography (SL), SL resin curing process, SL scan patterns, Microstereolithography. Applications of Photopolymerization Processes.
 c) **Extrusion Based RP Processes**: Fused Deposition Modelling (FDM), Principles, Plotting and path control, Applications of Extrusion-Based Processes
 d) **Printing RP Processes**: 3D printing (3DP), Research achievements in printing deposition, Technical challenges in printing, Printing process modeling, Application of Printing Process
 e) **Sheet Lamination RP Processes**: Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications
 f) **Beam Deposition RP Processes**: Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Processing-structure-properties, relationships, Benefits and drawbacks.

UNIT-III

Rapid tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods

UNIT-IV

Reverse engineering: Reverse Engineering (RE) Methodologies and Techniques, Selection of RE systems, RE software, RE hardware, RE in product development

UNIT-V

Errors in RP processes and applications: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc., Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP

REFERENCE BOOKS:
1 Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010.
2 Ian Gibson., David W Rosen., Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
3 Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
4 D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer, 2011
5 Amit Bandyopadhyay, Additive Manufacturing, CRC Press 2015.
6 T.S. Srivatsan, T.S. Sudharshan, CRC Press 2015

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

AUTOMATION IN MANUFACTURING
(P E – II)

UNIT – I
Over View of Manufacturing and Automation: Production systems, Automation in production systems, Automation principles and   strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT – II:
Material Handling and Identification Technologies: Material handling, equipment, Analysis. Storage systems, performance and location strategies, Automated storage systems, AS/RS, types. Automatic identification methods, Barcode technology, RFID.

UNIT – III:
Manufacturing Systems and Automated Production Lines: Manufacturing systems: components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.

UNIT – IV:
Automated Assembly Systems: Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT – V:
Quality Control and Support Systems: Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact Vsnon contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

REFERENCES:
1. Automation, production systems and computer integrated manufacturing/ Mikell. P Groover/PHI/3rd edition/2012.
2. Automation, Production Systems and CIM/ Mike J P. Grower/PHI
3. CAD/CAM/CIM/ P. **R**adha Krishnan **& S**. Subrahamanyarn and Raju /New Age International Publishers/2003.
4. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
5. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009.
6. Manufacturing and Automation Technology / R Thomas Wright and Michael Berkeihiser / Good Heart/Willcox Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

COMPUTER AIDED PROCESS PLANNING
(P E – II)

UNIT-I:
Introduction: The Place of Process Planning in the Manufacturing cycle-Process planning and production Planning-Process planning and Concurrent Engineering, CAPP, Group Technology.

UNIT-II:

Part Design Representation: Design Drafting-Dimensioning-Conventional Tolerance- Geometric Tolerance-CAD-input/output devices-Topology - Geometric transformation-Perspective transformation-Data Structure-Geometric modeling for process planning--GT Coding-The OPITZ system-The MICLASS System.

UNIT-III;

Process Engineering and Process Planning: Experience based planning-Decision table and Decision trees-Process capability analysis-Process planning-Variant process planning-Generative approach-Forward and backward planning, Input format, AI.

UNIT-IV

Computer Aided Process Planning Systems: Logical Design of process planning- Implementation considerations-Manufacturing system components, Production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT-V
An Integrated Process Planning Systems: Totally integrated process planning systems-An Overview-Modulus structure-Data Structure-Operation-Report Generation, Expert process planning

REFERENCE BOOKS:
1. Gideon Halevi and Roland D. Weill, "Principle of process planning- A Logical Approach", Chapman & Hall, 1995
2. Chang T. C. & Richard A.Wysk, "An Introduction to automated process planning systems", Prentice Hall 1985
3. Chang, T.C., "An Expert Process Planning System", Prentice Hall, 1985
4. Nanua Singh, "Systems Approach to Computer Integrated Design and Manufacturing", John Wiley & Sons, 1996
5. Rao P.N., "Computer Aided Manufacturing", Tata McGraw Hill Publishing Co., 2000.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS
(PE – II)

UNIT I:
Manufacturing Systems & Control: Automated Manufacturing Systems – Modeling – Role of performance modeling – simulation models-Analytical models. Product cycle – Manufacturing automation – Economics of scale and scope – input/output model – plant configurations. Performance measures – Manufacturing lead time – Work in process – Machine utilization – Throughput – Capacity – Flexibility – Performability – Quality Control Systems – Control system architecture – Factory communications – Local area network interconnections – Manufacturing automation protocol – Database management system.

UNIT II:
Manufacturing Processes: Examples of stochastics processes – Poisson process - Discrete time Markov chain models – Definition and notation – Sojourn times in states – Examples of DTMCs in manufacturing – Chapman – Kolmogorov equation – Steady-state analysis. Continuous Time Markov Chain Models – Definitions and notation – Sojourn times in states – examples of CTMCs in manufacturing – Equations for CTMC evolution – Markov model of a transfer line.Birth and Death Processes in Manufacturing – Steady state analysis of BD Processes – Typical BD processes in manufacturing.

UNIT III:
Queuing Model: Notation for queues – Examples of queues in manufacturing systems – Performance measures – Little's result – Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns – Analysis of a flexible machine center.

UNIT IV:
Queuing Networks: Examples of QN models in manufacturing – Little's law in queuing networks – Tandem queue – An open queuing network with feedback – An open central server model for FMS – Closed transfer line – Closed server model – Garden Newell networks.

UNIT V:
Petrinets: Classical Petri Nets – Definitions – Transition firing and reachability – Representational power – properties – Manufacturing models.
Stochastic Petri Nets – Exponential timed Petri Nets – Generalized Stochastic Petri Nets – modeling of KANBAN systems – Manufacturing models.

REFERENCES:
1. Performance Modelling of Automated Manufacturing Systems/ Viswanadham, N and Narahari, Y/ Prentice Hall of India, New Delhi, 1994
2. Probability and Statistics with Reliability, Queuing and Computer Science Applications/ Trivedi, K.S./ Prentice Hall, New Jersey, 1982.
3. Fundamentals of Mathematical Statistics/ Gupta S.C. & Kapoor V.K./ 3rd Edition, Delhi, 1988

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I year I Sem. (CAD/CAM)

ADVANCED CAD/CAM LAB

Features and selection of CNC turning and milling centers. Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles. Practice in part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine, practice in APT based NC programming. Practice in Robot programming and its languages. Robotic simulation using software. Robo path control, preparation of various reports and route sheets, Simulation of manufacturing system using CAM software, controller operating system commands.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. I YEAR I SEMESTER

List of Open Electives Offered by Various Departments, Effective from AY 2017- 18

S. No	Name of the Department	Open Elective (S) Offered for Other Departments
1	Civil Engineering (Open Elective – I)	Computer Oriented Numerical Methods
2	Electronics and Communication Engineering (Open Elective – I)	Principles of Electronic Communications
3	Electrical and Electronics Engineering (Open Elective – I)	Renewable Energy Systems, Electrical Installation & Safety
4	Mechanical Engineering (Open Elective – I)	Optimization Techniques and Applications
5	Computer Science and Engineering (Open Elective – I)	Fundamentals of Cyber Security

CIVIL ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

COMPUTER ORIENTED NUMERICAL METHODS
(Open Elective – 1)

Course Objectives: To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

Course Outcomes: The learner will be able to apply various mathematical techniques to Structural engineering problems.

Unit - I:
Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method.
Eigen values and Eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

UNIT - II:
Interpolation: Linear Interpolation – Higher order Interpolation – Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation –piece-wise and spline Interpolation.

Unit - III
Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences- Derivation of Differentiation formulae using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations – Applications to Simply Supported Beams, Columns and Rectangular Plates.

UNIT - IV
Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.
Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method – New Marks Method and Application to Beams – Calculation of Slopes and Deflections.

UNIT - V
Ordinary Differential Equation: Euler's method – Backward Euler method – Midpoint method – single step method, Taylor's series method- Boundary value problems.

TEXT BOOKS:
1. Numerical methods for scientific and engineering computations. M.K. Jain-S.R.K. Iyengar – R.K. Jain Willey Eastern Limited
2. Numerical Methods for Engineering Problems, N. Krishna Raju, KU Muthu, Mac-Millan publishers

REFERENCES:
1. Introductory Numerical Methods by S.S. Shastry, PHI Learning Pvt. Ltd.
2. Applied numerical analysis by – Curtis I. Gerala- Addission Wasley – published campus.
3. Numerical methods for Engineers Stevan C. Chopra, Raymond P. Canal Mc. Graw Hill Book Company.
4. C Language and Numerical methods by C. Xavier – New age international publisher.
5. Computer based numerical analysis by Dr. M. Shanta Kumar, Khanna Book publishers, New Delhi.

ELECTRONICS AND COMMUNICATION ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

PRINCIPLES OF ELECTRONIC COMMUNICATIONS
(Open Elective -1)

UNIT - I
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

UNIT - II
Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT - III
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

UNIT - IV
Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT - V
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, WCDMA.
Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

TEXT BOOKS
1. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3rd Ed., McGraw Hill publications, 2008.
2. Kennady, Davis, "Electronic Communications systems", 4Ed., TMH, 1999

REFERENCE BOOKS
1. Tarmo Anttalainen, "Introduction to Telecommunications Network Engineering", Artech House Telecommunications Library.
2. Theodore Rappaport, "Wireless Communications-Principles and practice", Prentice Hall, 2002.
3. Roger L. Freeman, "Fundamentals of Telecommunications", 2 Ed. Wiley publications.
4. Wayne Tomasi, "Introduction to data communications and networking", Pearson Education, 2005.

ELECTRICAL AND ELECTRONICS ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

RENEWABLE ENERGY SYSTEMS
(Open Elective - I)

Course Objectives:
- To recognize the awareness of energy conservation in students
- To identify the use of renewable energy sources for electrical power generation
- To collect different energy storage methods
- To detect about environmental effects of energy conversion

Course Outcomes: Upon the completion of this course, the student will be able to
- find different renewable energy sources to produce electrical power
- estimate the use of conventional energy sources to produce electrical energy
- role-play the fact that the conventional energy resources are depleted
- arrange Store energy and to avoid the environmental pollution

Unit-I:
Photo voltaic power generation ,spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

Unit-II:
Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology.
Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

Unit-III:
Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.
Wave energy conversion: properties of waves and power content, vertex motion of Waves,   device applications. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

Unit-IV:
Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, description of fuel cells, Co-generation and energy storage, combined cycle co-generation, energy storage.
Global energy position and environmental effects: energy units, global energy position.

Unit-V:
Types of fuel cells, H_2-O_2 Fuel cells, Application of fuel cells – Batteries, Description of batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures steam stations and pollution, pollution free energy systems.

TEXT BOOKS:
1. "Energy conversion systems" by Rakosh das Begamudre, New age International publishers, New Delhi - 2000.

2. "Renewable Energy Resources" by John Twidell and Tony Weir, 2nd Edition, Fspon & Co.

REFERENCES:
1. "Understanding Renewable Energy Systems" by Volker Quaschning, 2005, UK.
2. "Renewable Energy Systems-Advanced Conversion, Technologies & Applications" by Faner Lin Luo Honer Ye, CRC press, Taylor & Francis group.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ELECTRICAL INSTALLATION & SAFETY
(Open Elective - I)

Course Objectives: The course should enable the students to:
- Understand Electrical Wiring with IE rules. Residential Building Electrification, Electrification of commercial Installation, Electrification of factory unit Installation
- Protection against electric shocks, Safety Measures & Prevention of Accidents

Course Outcomes: The students will be able to:
- Acquire the knowledge of different types wires and wiring systems, I.E. rules and Electric supply act.
- Explain the importance of earthling, rating of wires & cables, procedures for residential, commercial electrification.
- Able to estimate the length of wire, cable, conduit, earth wire, and earthing and also cost of residential, commercial electrification.

Unit-I: Electrical Wiring with IE rules.
Introduction, Define types of wires; Different types of wiring system; Comparison of different types of wiring; Different types and specifications of wiring materials; Accessories and wiring tools; Prepare I.E. rules for wiring, including Electricity supply act 2003& 2005;

Unit-II : Residential Building Electrification
General rules guidelines for wiring of Residential Installation and positioning of equipment's; Principles of circuit design in lighting and power circuits.; Procedures for designing the circuits and deciding the number of circuits.; Method of drawing single line diagram.; Selection of type of wiring and rating of wires &cables.; Load calculations and selection of size of conductor.; Selection of rating of main switch, distributions board, protective switchgear ELCB and MCB and wiring accessories.; Earthing of Residential Installation.

Unit-III: Electrification of commercial Installation
Concept of commercial Installation.; Differentiate between electrification of Residential and commercial Installation.; Fundamental considerations for planning of an electrical Installation system for commercial building.; Design considerations of electrical Installation system for commercial building.; Load calculations & selection of size of service connection and nature of supply.; Deciding the size of cables, bus bar and bus bar chambers.; Mounting arrangements and positioning of switch boards, distribution boards main switch etc.; Earthing of the electrical Installation; Selection of type wire, wiring system & layout.

Unit-IV: Electrification of factory unit Installation
Concept of Industrial load; Concept of Motor wiring circuit and single line diagram. Important guidelines about power wiring and Motor wiring.; Design consideration of Electrical Installation in small Industry/Factory/workshop.; Motor current calculations.; Selection and rating of wire, cable size & conduct.; Deciding fuse rating, starter, distribution boards main switch etc.; Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing.

Unit-V: Protection against electric shocks
Electric shock- General , Protection against direct contact, Protection against indirect contact, Protection of goods in case of insulation fault, Implementation of the TT system, Implementation of the TN system, Implementation of the IT system. Protection provided for enclosed equipment: codes IP

and IK, IP code definition, Elements of the IP Code and their meanings, IK Code definition, IP and IK code specifications for distribution switchboards

Safety Measures & Prevention of Accidents- Concept of electrical safety, electrical accidents, its causes & preventions.; Safety signs and symbols used in industry.; Electrical shocks and factors affecting the severity of it, method of rescuing electrocuted person & different methods of artificial respiration.; Electrical safety as per I.E. Rules 1956.; Do's & don'ts regarding safety while working on electrical installations.; Concept of Permit system, its preparation & regulation for attending to electrical work.; Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers, types of fire extinguishers.

TEXT BOOKS:
1. Dr. S.L. Uppal of Electrical Wiring, Estimating and Costing, New Age International (p) Limited, New Delhi.
2. Electrical Design Estimating and Costing, K.B. Raina & S.K. Battacharya, new age international (p) limited. Publishers
3. Electrical estimating & costing 2nd addition By Surjit singh
4. Electrical Installation Estimating & Costing, Gupta, J.B., S. K. Kataria & Sons, New Delhi

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech. I Year - I Sem.

OPTIMIZATION TECHNIQUES AND APPLICATIONS
(Open Elective – 1)

UNIT- I
Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods:- Uni-modal function, elimination methods, ,, Fibonacci method, golden section method, interpolation methods – quadratic & cubic interpolation methods.

UNIT-II
Multi variable non-linear unconstrained optimization: Direct search method – Univariant method - pattern search methods – Powell's- Hook -Jeeves, Rosenbrock search methods- gradient methods, gradient of function, steepest decent method, Fletcher Reeves method, variable metric method.

UNIT- III
Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.
Simulation – Introduction – Types- steps – application – inventory – queuing systems

UNIT -IV
Integer Programming: Introduction – formulation – Gomory 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, dynamic programming.

UNIT- V
Geometric Programming: Polynomials – arithmetic - geometric inequality – unconstrained G.P- constrained G.P (<= TYPE ONLY)
 Non-traditional optimization Techniques: Genetic Algorithms-Steps-Solving simple problems- Comparitions of similarities and dissimilarities between traditional and non-traditional techniques- Particle Swarm Optimization (PSO)- Steps(Just understanding)-Simulated Annealing-Steps-Simple problems.

REFERENCES:
1. Optimization theory & Applications / S.S. Rao / New Age International.
2. Engineering Optimization-Kalyan Deb/ PHI
3. Introductory to operation Research / Kasan & Kumar / Springar
4. Optimization Techniques theory and practice / M.C.Joshi, K.M. Moudgalya/ Narosa
5. Publications
6. Operation Research / H.A. Taha /TMH
7. Optimization in operations research / R.L Rardin
8. Optimization Techniques /Benugundu & Chandraputla / Pearson Asia

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

FUNDAMENTALS OF CYBER SECURITY
(Open Elective - I)

Course Objective:
This course is aimed to generate interest and awareness in cyber security field, which is important in the world of information security due to the wide variety of computer crimes that take place in cyber space. The course deals with various types of attacks framed by an attacker, and the security which need to be implemented at various levels along with latest trends in cyber security.

UNIT-I:
Cyber Security Basics – Sphere, Terminology, Vulnerability in the Cyber Structure and Infrastructure, Cyber threats and Weaponry, Cyber Defense, Cyber Attack Detection and Prevention, Information Security Testing, Cyber Security Investigation/assessment, Cyber-Deterrence.

UNIT-II:
Cyber Crimes and Cyber Laws – Introduction, IT laws & Cyber Crimes – Internet, Hacking, Password Cracking, Viruses, Virus Attacks, Pornography, Software Privacy, Intellectual Property, Legal System of Information Technology, Social Engineering, Phishing, Denial of Service attack, Malicious Code, Mail Bombs, Worms, Logic Bombs, Botnet, Trojan, Bug Exploits.

UNIT-III:
End point Security: Desktop and Laptop Security, Cell Phone and PDA Security, Bluetooth Security, Patch and Vulnerability Management, Password Management, Security for Full Virtualization Technologies, Media Sanitization, Security Radio Frequency Identification (RFID) Systems. **Network Security:** Intrusion Detection & Prevention Systems, Firewalls and Firewall Policy, Computer Security Log Management, Enterprise Tele work and Remote Access Security, Securing WiMAX Wireless Communication. **Web Security:** Server Security, Web authentication, SSL and SET, Securing Public Web Servers, Secure Deployment of IPv6, Secure Domain name System (DNS) Deployment, SSL VPNs, Unified Threat Management (UTM).**;**

UNIT-IV:
Application Security: Active Content and Mobile Code, E-commerce Security, Email Security (PGP, S/MIME), Web Security, Web Application Security, OWASP; **Data Security:** Data Management, Database Security, Data Encryption, Data Leakage Prevention (DLP), Data Destruction; **Software Security:** Software Flaws, Malware, Software based Attacks; Insecurity in Software: SRE, Software Tamper Resistance, DRM, Software Development.
Operating System Security: Security Functions, Software Updates and Patches, OS Integrity Checks, Account management, Antivirus Software, Security in Ordinary Operating Systems, Design of Secure OS, OS hardening, Configuring the OS for security, Security kernels, Secure Virtual machine Systems, Trusted Operating System, NGSCB.

UNIT-V:
Recent Trends in Cyber Security – Zero – day Malware, Trojan Wars, New Ways to Monetize Non-Financial Data, Fraud-as-a-service, Out-of-band Methods forcing Cybercriminals to Innovate, The Rise of Hactivism, Attacks in mobile devices, social media and cloud computing; Insider threats, Increased regulatory security, Cyber-Terrorism, Cyber –War and Cyber-Peace. Topological Vulnerability Analysis, Cyber Situational Awareness, Secure Composition of Systems, Autonomic Recovery, Secure Data Centers, Cloud Computing Security, Privacy in location-Based Applications.

TEXT BOOKS:
1. Cyber Security, Edward Amoroso, kindle Edition, 2007
2. Cyber Security ,Understanding Cyber crimes, Computer Forensics and Legal Perspectives, Sunita Belapure and Nina Godbole, Wiley India Pvt Ltd. 2011

REFERENCES:
1. Computer Security, Dirter Gollmann, John Wiley & Sons Publication, 2011
2. Cyber Security Essentials, James Graham, Richard Howrad, Ryan Olson, CRC Press, 2011

DESIGN FOR MANUFACTURING AND ASSEMBLY (PC – 4)

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 die5 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.

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.

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I year II Sem. (CAD/CAM)

FLEXIBLE MANUFACTURING SYSTEMS (PC - 5)

UNIT- I:
Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS. Knowledge based scheduling. The Development of Manufacturing systems. Pallets, Fixtures and Machines, work handling system layouts.

UNIT - II:
Hierarchy of computer control. Supervisory computer. System Management, Tool Management, Simulation and Analysis in the Design of FMS.

UNIT - III:
 Software for simulation and database of FMS. Specification and selection, trends, application of simulation software. Simulation Modeling for FMS.

UNIT - IV:
 Manufacturing data systems data flow, CAD/CAM considerations. Planning FMS database, just in time characteristics, Pull method, quality small lot sizes, work station loads, close supplier ties, flexible workforce — line flow strategy. Simulation for FMS Design.

UNIT - V:
Preventive maintenance. Karban system, implementation issues. Economic justification of FMS; Artificial Intelligence in the Design of FMS.

REFERENCES:
1. Joseph Talavage, Roger G. Hannam " Flexible Manufacturing systems in Practice (Applications, Design and simulation)" CRC Press
2. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.
3. Production System l3eyond Large Scale Production/ Talichi Ohno/ Toyota Productivity Press India Pvt. Lid.
4. Flexible Manufacturing Systems/ H K Shivanand/New Age International/2006
5. S.R.Deb "Robotics Technology and Flexible Automation"McGraw-Hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech – I year II Sem. (CAD/CAM)

INDUSTRIAL ROBOTICS (PC – 6)

UNIT - I
Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.
Control System and Components: basic concept and modais controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT - II
Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT - III
End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.
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, SINONAL AND DELAY commands, Branching capabilities and Limitations.
ROBOT LANGUAGES: Textual robot Languages, Generation, Robot language structures, Elements in function.

UNIT - V
Robot Cell DESGIN AND CONTROL: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detect ion, Work wheel controller.
Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application.

REFERENCES:
1. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pte Ltd.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH
3. Robotics / Fu K S/ McGraw Hill.
4. Industrial Robotics / Groover M P /Pearson Edu.
5. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.
6. Robotic Engineering / Richard D. Klafter, Prentice Hall
7. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.

INTELLIGENT MANUFACTURING SYSTEMS (Professional Elective – 3)

UNIT - I:
Computer Integrated Manufacturing Systems Structure and functional areas of CIM system, - CAD, CAPP, **CAM,** CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems - MAP/TOP, OSI Model, Data Redundancy, Top- down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

UNIT - II:
Components of Knowledge Based Systems - Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT - III:
Machine Learning - Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.

UNIT - IV:
Automated Process Planning - Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning. Knowledge Based System for Equipment Selection (KBSES) - Manufacturing system design. Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KRSES.

UNIT - V:
Group Technology: Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation - Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology - Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBSCIT) — Data Base, Knowledge Base, Clustering Algorithm.

REFERENCES:
1. Intelligent Manufacturing Systems/ Andrew Kusiak/Prentice Hall.
2. Artificial Neural Networks/ Yagna Narayana/PHI/2006
3. Automation, Production Systems and CIM / Groover M.P./PHI/2007
4. Neural networks: A comprehensive foundation/ Simon Haykin/ PHI.
5. Artificial neural networks/ B. Vegnanarayana/PHI
6. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
7. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
8. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

SPECIAL MANUFACTURING PROCESS (Professional Elective – 3)

UNIT- I
Surface Treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT- II
Processing of Ceramics: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT- III
Fabrication of Microelectronic Devices:
Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in micro electronics, surface mount technology, Integrated circuit economics.

UNIT - IV
E-Manufacturing: Nano manufacturing techniques and micromachining, High Speed Machining and hot machining

UNIT -V
Rapid Prototyping: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method, Applications and Limitations, Rapid tooling, Techniques of rapid manufacturing

REFERENCES:
1. Manufacturing Engineering and Technology *I* Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.
3. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand   Renihold,
4. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
5. Advanced Machining Processes / V.K.Jain / Allied Publications.
6. Introduction to Manufacturing Processes / John A Schey *I* Mc Graw Hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech – I year II Sem. (CAD/CAM)

OPTIMIZATION TECHNIQUES AND APPLICATIONS (Professional Elective – 3)

UNIT - I
Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods:- Uni-modal function, elimination methods, ,, Fibonacci method, golden section method, interpolation methods – quadratic & cubic interpolation methods.

UNIT - II
Multi variable non-linear unconstrained optimization: Direct search method – Univariant method - pattern search methods – Powell's- Hook -Jeeves, Rosenbrock search methods- gradient methods, gradient of function, steepest decent method, Fletcher Reeves method, variable metric method.

UNIT- III
Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.
Simulation – Introduction – Types- steps – application – inventory – queuing systems

UNIT - IV
Integer Programming: Introduction – formulation – Gomory 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, dynamic programming.

UNIT- V
Geometric Programming: Polynomials – arithmetic - geometric inequality – unconstrained G.P- constrained G.P (<= TYPE ONLY)
Non-traditional optimization Techniques: Genetic Algorithms-Steps-Solving simple problems- Comparitions of similarities and dissimilarities between traditional and non-traditional techniques-Particle Swarm Optimization (PSO)- Steps(Just understanding)-Simulated Annealing-Steps-Simple problems.

REFERENCES:
1. Optimization theory & Applications / S. S. Rao / New Age International.
2. Engineering Optimization-Kalyan Deb/ PHI
3. Introductory to operation Research / Kasan & Kumar / Springer
4. Optimization Techniques theory and practice / M. C. Joshi, K. M. Moudgalya/ Narosa Publications
5. Operation Research / H. A. Taha /TMH
6. Optimization in operations research / R. L Rardin
7. Optimization Techniques /Benugundu & Chandraputla / Pearson Asia

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech – I year II Sem. (CAD/CAM)

ADVANCED MECHATRONICS (Professional Elective – 4)

UNIT - I
Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT - II
Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT - III
Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT - IV
Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT - V
System and interfacing and data acquisition, DAQS, SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

REFERENCES:
1. MECHATRONICS Integrated Mechanical Electronics Systems/K P Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
3. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
4. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
5. Mechatronics System Design / Devdas shetty/Richard/Thomson.
6. Mechatronics/M. D. Singh/J. G. Joshi/PHI.
7. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton
8. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print

MEMS AND MICRO SYSTEMS: DESIGN AND MANUFACTURE (Professional Elective – 4)

UNIT - I:
Overview and Working Principles of MEMS and Microsystems
MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidies.

UNIT - II:
Engineering Science for Microsystems Design and Fabrication:
Atomic structure of Matter, Ions and Ionization, Molecular Theory of Mater and Intermolecular Force, Doping of Semiconductors, The diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

UNIT - III:
Engineering Mechanics for Microsystems Design:
Static Bending of thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis

UNIT - IV:
Thermo Fluid Engineering & Microsystems Design:
Overview of Basics of Fluid Mechanics in Macro and Meso scales, Basic equations in Continuum Fluid dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid Flow in Sub micrometer and Nano scale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical Design using FEM, Design of a Silicon Die for a Micro pressure Sensor.

UNIT - V:
Materials for MEMS & Microsystems and Their Fabrication:
Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, chemical and physical vapor deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process

REFERENCES:
1. MEMs & Microsystems: Design & Manufacture/ Tai-Ran Hsu/Tata Mc-Graw Hill., ed./2002
2. An Introduction to Microelectromechanical Systems Engineering/ Maluf, M./ Artech House, Boston, 2000
3. Micro robots and Micromechanical Systems/ Trimmer, W.S.N/ Sensors & Actuators, vol19, no.1989.
4. Applied Partial Differential Equations/ Trim, D.W/ PWS-Kent Publishing/ Boston 1990.
5. Fundamentals of Microfabrication. Madou, M/ CRC Press, Boca Raton, 1997.
6. The Finite Element Method in Thermomechanics/ Hsu, T.R / Alien & Unwin, London.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.Tech – I year II Sem. (CAD/CAM)

FUZZY LOGIC AND NEURAL NETWORKS (Professional Elective – 4)

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 Net works:
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. (CAD/CAM)

MANUFACTURING SIMULATION & PRECISION ENGINEERING LAB

A. MANUFACTURING SIMULATION

The students will be given training on the use and application of the following software to manufacturing problems:
1. Auto MOD Software.
2. PROMODEL
3. SLAM-II
4. CAFIMS
5. Flexsim

They also learn how to write sub routines in C-language and interlinking with the above packages.
Problems for modelling and simulation experiments:
1. AGV planning
2. ASRS simulation and performance evaluation
3. Machines, AGVs and AS/RS integrated problems
4. JIT system
5. Kanban flow
6. Material handling systems
7. M.R.P. Problems
8. Shop floor scheduling etc.

B. PRECISION ENGINEERING

1. Hydraulic and Pneumatic circuits
2. Closed loop control systems
3. Study of the chip formation in turning process
4. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
5. Determination of cutting forces in turning
6. Experiments in unconventional manufacturing processes-AJM and study of USM, EDM, Laser Machining and Plasma spraying
7. Inspection of parts using tool makers microscope, roughness and form tester
8. Study of micro-controllers, programming on various CNC machine tools and also controllers
9. Studies on PLC programming
10. Study and programming of robots
11. Condition monitoring in machining process using acoustic emission.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. I YEAR II SEMESTER

List of Open Electives Offered by Various Departments, Effective from AY 2017 - 18

S. No	Name of the Department	Open Elective (S) Offered for Other Departments
1	Civil Engineering (Open Elective – II)	1. Finite Element Method 2. Optimization Techniques
2	Electronics and Communication Engineering (Open Elective – II)	1. Industrial Instrumentation 2. Principles of Computer Communications and Networks
3	Electrical and Electronics Engineering (Open Elective – II)	1. Energy From Waste 2. Distributed Generation and Microgrid 3. Reliability Engineering
4	Mechanical Engineering (Open Elective – II)	1. Engineering Research Methodology
5	Computer Science and Engineering (Open Elective – II)	1. Machine Learning

*Open Elective subject must be chosen from the list of open electives offered by OTHER departments.

Ex: A M.Tech ECE student cannot take Open Elective – II offered by ECE Dept, but can select from open electives offered by OTHER departments.

CIVIL ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

FINITE ELEMENT METHOD (Open Elective – II)

Course Objectives: To impart knowledge about various finite element techniques and development of finite element code.

Course Outcome: The learner will be able to solve continuum problems using finite element analysis.

UNIT - I
Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles –
Discretization - Raleigh - Ritz method of functional approximation.
Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT - II
One dimensional FEM:Stiffness matrix for beam and bar elements - shape functions for 1-D elements.
Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

UNIT - III
Isoparametric formulation:Concept - different isoparametric elements for 2D analysis -formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements.
Axi Symmetric Analysis:bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.
Three dimensional FEM:Different 3-D elements-strain-displacement relationship –formulation of hexahedral and isoparametric solid element.

UNIT - IV
Introduction to Finite Element Analysis of Plates:Basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

UNIT - V
Introduction to non – linear finite analysis – basic methods – application to Special structures.

TEXT BOOKS:
1. A First Course in a Finite Element by Daryl L .Logan, CL Engineers.
2. Concepts and Applications of Finite Element Analysis by Robert D.Cook, DavidS. Malkus and Michael E. Plesha, John Wiley & Sons.

REFERENCES:
1. Introduction to Finite element Method by Tirupathi Chandra Patla and Belugunudu
2. Finite element Methods by OC Zienkiewicz
3. Finite element analysis, theory and progarmming by GS Krishna Murthy.
4. Introduction to Finite element Method by JN Reddy.

CIVIL ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

OPTIMIZATION TECHNIQUES (Open Elective – II)

Course Objectives: To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems

Course Outcomes: The student will be able to understand the basic principles of optimization, and in a position to formulate optimization models for a wide range of civil engineering problems and able to solve them.

Unit-I
Linear Programming: Introduction and need for optimization in engineering design, formulating linear programs, graphical solution of linear programs, special cases of linear programming.

UNIT - II
The Simplex Method: Converting a problem to standard form, the theory of the simplex method, the simplex algorithm, special situations in the simplex algorithm, obtaining initial feasible solution.

UNIT - III
Duality and Sensitivity Analysis: Sensitivity analysis, shadow prices, dual of a normal linear program, duality theorems, dual simplex method. Integer Programming: Formulating integer programming problems, the branch-and-bound algorithm for pure integer programs, the branch-and-bound algorithm for mixed integer programs.

UNIT - IV
Non-linear Programming: Introduction to non-linear programming (NLP), Convex and concave functions, NLP with one variable, Line search algorithms, Multivariable unconstrained problems, constrained problems, Lagrange Multiplier, The Karush-Kuhn-Tucker (KKT) conditions, the method of steepest ascent, convex combination method, penalty function, Quadratic programming,

UNIT - V
Dynamic programming: Evolutionary algorithms: Genetic Algorithm, concepts of multiobjective optimization, Markov Process, Queuing Models.

TEXT BOOK:
1. S.S. Rao, Engineering Optimization: Theory and Practice, Wiley & Sons, New Jersey, 2009.

REFERENCES:
1. F.H. Hiller and G.J. Liberman, Introduction to Operations Research, Tata-McGraw-Hill, 2010.
2. W.L. Winston, Operations Research: Applications and Algorithm, 4th Edition, Cengage Learning, 1994.
3. K.Deb, Optimization for Engineering Design, Prentice Hall, 2013.
4. M.C. Joshi and K.M. Moudgalay, Optimization: Theory and Practice, Narosa, 2004.
5. K. Deb, Multi-Objective Optimization using evolutionary algorithms, John Wiley and Sons, 2009.

ELECTRONICS AND COMMUNICATION ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

INDUSTRIAL INSTRUMENTATION (Open Elective – II)

UNIT - I
METROLOGY, VELOCITY AND ACCELERATION MEASUREMENT: Measurement of length - Gauge blocks – Plainness – Area using Simpson's rule, Plain meter – Diameter – Roughness – Angle using Bevel protractor, sine bars and Clinometer – Mechanical, Electrical, Optical and Pneumatic Comparators. Optical Methods for length and distance measurements using Optical flats and Michelson Interferometer.
Relative velocity – Translational and Rotational velocity measurements – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers-different types, Gyroscopes-applications.

UNIT - II
 FORCE AND PRESSURE MEASUREMENT: Force measurement – Different methods –Gyroscopic Force Measurement – Vibrating wire Force transducer. Basics of Pressure measurement –Manometer types – Force-Balance and Vibrating Cylinder Transducers – High and Low Pressure measurement – McLeod Gauge, Knudsen Gauge, Momentum Transfer Gauge, Thermal Conductivity Gauge, Ionization Gauge, Dual Gauge Techniques, Deadweight Gauges, Hydrostatic Pressure Measurement

UNIT - III
FLOW MEASUREMENT AND LEVEL MEASUREMENT: Flow Meters- Head type, Area type (Rota meter), electromagnetic type, Positive displacement type, mass flow meter, ultrasonic type, vertex shedding type, Hotwire anemometer type, Laser Doppler Velocity-meter. Basic Level measurements – Direct, Indirect, Pressure, Buoyancy, Weight, Capacitive Probe methods

UNIT - IV
DENSITY, VISCOSITY AND OTHER MEASUREMENTS: Density measurements – Strain Gauge load cell method – Buoyancy method - Air pressure balance method – Gamma ray method – Vibrating probe method. Units of Viscosity, specific gravity scales used in Petroleum Industries, Different Methods of measuring consistency and Viscosity –Two float viscorator –Industrial consistency meter. Sound-Level Meters, Microphones, Humidity Measurement

UNIT - V
CALIBRATION AND INTERFACING: Calibration using Master Sensors, Interfacing of Force, Pressure, Velocity, Acceleration, Flow, Density and Viscosity Sensors, Variable Frequency Drive

TEXT BOOKS:
1. Doeblin E.O., "Measurement Systems – Applications and Design", 4th Edition, McGraw Hill International, 1990.
2. Patranabis D, "Principles of Industrial Instrumentation", TMH. End edition 1997

REFERENCES:
1. Considine D. M., "Process Instruments and Control Handbook", 4th Edition, McGraw Hill International, 1993
2. Jain R.K., "Mechanical and Industrial Measurements", Khanna Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

PRINCIPLES OF COMPUTER COMMUNICATIONS AND NETWORKS (Open Elective – II)

Prerequisite: Nil

Course Objectives:
- To understand the concept of computer communication.
- To learn about the networking concept, layered protocols.
- To understand various communications concepts.
- To get the knowledge of various networking equipment.

Course Outcomes: The student:
- Can get the knowledge of networking of computers, data transmission between computers.
- Will have the exposure about the various communication concepts.
- Will get awareness about the structure and equipment of computer network structures.

UNIT - I
Overview of Computer Communications and Networking: Introduction to Computer Communications and Networking, Introduction to Computer Network, Types of Computer Networks, Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards, The Telephone System and Data Communications.

UNIT - II
Essential Terms and Concepts: Computer Applications and application protocols, Computer Communications and Networking models, Communication Service Methods and data transmission modes, analog and Digital Communications , Speed and capacity of a Communication Channel, Multiplexing and switching, Network architecture and the OSI reference model.

UNIT - III
Analog and Digital Communication Concepts: Representing data as analog signals, representing data as digital signals, data rate and bandwidth reduction , Digital Carrier Systems.

UNIT - IV
Physical and data link layer Concepts: The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer , the logical link control and medium access control sub-layers.

UNIT - V
Network Hardware Components: Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.

TEXT BOOKS:
1. Computer Communications and Networking Technologies, Michel A. Gallo and William H. Hancock, Thomson Brooks / Cole.

REFERENCE BOOKS:
1. Principles of Computer Networks and Communications, M. Barry Dumas, Morris Schwartz, Pearson.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ENERGY FROM WASTE (Open Elective – II)

Prerequisite: Renewable Energy Sources, Physics, Environmental Studies

Course Objectives:
- To classify solid waste sources
- To identify methods of solid waste disposal
- To study various energy generation methods
- To analyse biogas production methods and recycling of e-waste

Course Outcomes: Upon the completion of the subject, the student will be able to
- Understand technologies for generation of energy from solid waste
- Compare methods of solid waste disposal
- Identify sources of energy from bio-chemical conversion
- Analyze methods for management of e-waste

UNIT- I
Solid Waste Sources Solid Waste Sources, types, composition, Properties, Global warming, Municipal Solid Waste: Physical, chemical and biological properties , Waste Collection and, Transfer stations, Waste minimization and recycling of municipal waste, Segregation of waste, Size Reduction , Managing Waste. Status of technologies for generation of Energy from Waste Treatment and Disposal Aerobic composting, incineration, Furnace type and design, Medical waste /Pharmaceutical waste treatment Technologies, incineration, Environmental impacts, Measures to mitigate environmental effects due to incineration .

UNIT - II
Land Fill method of Solid waste disposal Land fill classification, Types, methods and Sitting consideration, Layout and preliminary design of landfills: Composition, characteristics, generation, Movement and control of landfill leach ate and gases, Environmental monitoring system for land fill gases.

UNIT - III
Energy Generation from Waste Bio-chemical Conversion: Sources of energy generation, anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, Industrial waste, agro residues, Anaerobic Digestion.

UNIT - IV
Biogas production, Land fill gas generation and utilization, Thermo-chemical conversion: Sources of energy generation, Gasification of waste using Gasifiers, Briquetting, Utilization and advantages of briquetting, Environmental benefits of Bio-chemical and Thermo- chemical conversion.

UNIT - V
E-waste: e-waste in the global context – Growth of Electrical and Electronics Industry in India – Environmental concerns and health hazards – Recycling e-waste: a thriving economy of the unorganized sector – Global trade in hazardous waste – impact of hazardous e-waste in India. Management of e-waste: e-waste legislation, Government regulations on e-waste management – International experience – need for stringent health safeguards and environmental protection laws of India.

TEXT BOOKS:
1. Nicholas P. Cheremisinoff. Handbook of Solid Waste Management and Waste Minimization Technologies. An Imprint of Elsevier, New Delhi (2003).
2. P. Aarne Vesilind, William A. Worrell and Debra R. Reinhart. Solid Waste Engineering. Thomson Asia Pte Ltd. Singapore (2002)
3. M. Dutta , B. P. Parida, B. K. Guha and T. R. Surkrishnan. Industrial Solid Waste Management and Landfilling practice. Narosa Publishing House, New Delhi (1999).

4. "E-waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011"
5. Amalendu Bagchi. Design, construction and Monitoring of Landfills. John Wiley and Sons. New York. (1994)
6. M. L. Davis and D. A. Cornwell. Introduction to environmental engineering. Mc Graw Hill International Edition, Singapore (2008)
7. C. S. Rao. Environmental Pollution Control Engineering. Wiley Eastern Ltd. New Delhi (1995)
8. S. K. Agarwal. Industrial Environment Assessment and Strategy. APH Publishing Corporation. New Delhi (!996)
9. Sofer, Samir S. (ed.), Zaborsky, R. (ed.), "Biomass Conversion Processes for Energy and Fuels", New York, Plenum Press, 1981
10. Hagerty, D.Joseph; Pavoni, Joseph L; Heer, John E., "Solid Waste Management", New York, Van Nostrand, 1973
11. George Tchobanoglous, Hilary Theisen and Samuel Vigil Prsl: Tchobanoglous, George Theisen, Hillary Vigil, Samuel, "Integrated Solid Waste management: Engineering Principles and Management issues", New York, McGraw Hill, 1993.

REFERENCES:
1. C Parker and T Roberts (Ed), Energy from Waste - An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985
2. KL Shah, Basics of Solid and Hazardous Waste Management Technology, Prentice Hall, 2000 3. M Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House, 1997
3. G Rich et.al, Hazardous Waste Management Technology, Podvan Publishers, 1987
4. AD Bhide, BB Sundaresan, Solid Waste Management in Developing Countries, INSDOC, New Delhi,1983 FUEL CELL AND
5. **Google books:**
   (i) e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams
   Tech. & Engg.-2013(Publisher: Earthscan 2013).
   (ii) What is the impact of E-waste: Tamara Thompson
   (iii) E-waste poses a Health Hazard: Sairudeen Pattazhy
6. **Weblinks :**
   www.unep.org
   www.routledge.com
   www.amazon.com
   www.bookdepository.com
   www.ecoactiv.com

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

DISTRIBUTED GENERATION AND MICROGRID (Open Elective – II)

Course Objectives
- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Micro grid and its configuration
- To find optimal size, placement and control aspects of DGs

Course Outcomes: Upon the Completion of the course student will be able to
- Find the size and optimal placement DG
- Analyze the impact of grid integration and control aspects of DGs
- Model and analyze a micro grid taking into consideration the planning and operational issues of the DGs to be connected in the system
- Describe the technical impacts of DGs in power systems

UNIT - I
Need for distributed generation - Renewable sources in distributed generation - Current scenario in distributed generation - Planning of DGs – Siting and sizing of DGs – Optimal placement of DG sources in distribution systems.

UNIT - II
Grid integration of DGs – Different types of interfaces - Inverter based DGs and rotating machine based interfaces - Aggregation of multiple DG units - Energy storage elements - Batteries, ultra-capacitors, flywheels.

UNIT - III
Technical impacts of DGs – Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems.

UNIT-IV
Economic and control aspects of DGs – Market facts, issues and challenges - Limitations of DGs - Voltage control techniques, Reactive power control, Harmonics, Power quality issues - Reliability of DG based systems – Steady state and Dynamic analysis.

UNIT - V
Introduction to micro-grids – Types of micro-grids – Autonomous and non-autonomous grids – Sizing of micro-grids - Modeling & analysis - Micro-grids with multiple DGs – Micro-grids with power electronic interfacing units - Transients in micro-grids - Protection of micro-grids – Case studies.

TEXT BOOKS:
1. H. Lee Willis, Walter G. Scott , 'Distributed Power Generation – Planning and Evaluation', Marcel Decker Press, 2000.
2. M.Godoy Simoes, Felix A.Farret, 'Renewable Energy Systems – Design and Analysis with Induction Generators', CRC press.
3. Robert Lasseter, Paolo Piagi, ' Micro-grid: A Conceptual Solution', PESC 2004, June 2004.
4. F. Katiraei, M.R. Iravani, 'Transients of a Micro-Grid System with Multiple Distributed Energy Resources', International Conference on Power Systems Transients (IPST'05) in Montreal, Canada on June 19-23, 2005.
5. Z. Ye, R. Walling, N. Miller, P. Du, K. Nelson, 'Facility Microgrids', General Electric Global Research Center, Niskayuna, New York, Subcontract report, May 2005.

ELECTRICAL AND ELECTRONICS ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

RELIABILITY ENGINEERING (Open Elective – II)

Course Objectives:
- To comprehend the concept of Reliability and Unreliability
- Derive the expressions for probability of failure, Expected value and standard deviation of Binominal distribution, Poisson distribution, normal distribution and weibull distributions.
- Formulating expressions for Reliability analysis of series-parallel and Non-series parallel systems
- Deriving expressions for Time dependent and Limiting State Probabilities using Markov models.

Course Outcomes: Upon the completion of this course, the student will be able to
- Apply fundamental knowledge of Reliability to modeling and analysis of series-parallel and Non-series parallel systems.
- Solve some practical problems related with Generation, Transmission and Utilization of Electrical Energy.
- Understand or become aware of various failures, causes of failures and remedies for failures in practical systems.

UNIT – I
Rules for combining probabilities of events, Definition of Reliability. Significance of the terms appearing in the definition. Probability distributions: Random variables, probability density and distribution functions. Mathematical expectation, Binominal distribution, Poisson distribution, normal distribution, weibull distribution.

UNIT - II
Hazard rate, derivation of the reliability function in terms of the hazard rate. Failures: Causes of failures, types of failures (early failures, chance failures and wear-out failures). Bath tub curve. Preventive and corrective maintenance. Modes of failure. Measures of reliability: mean time to failure and mean time between failures.

UNIT - III
Classification of engineering systems: series, parallel and series-parallel systems- Expressions for the reliability of the basic configurations.
Reliability evaluation of Non-series-parallel configurations: Decomposition, Path based and cutest based methods, Deduction of the Paths and cutsets from Event tree.

UNIT - IV
Discrete Markov Chains: General modeling concepts, stochastic transitional probability matrix, time dependent probability evaluation and limiting state probability evaluation of one component repairable model. Absorbing states.
Continuous Markov Processes: Modeling concepts, State space diagrams, Stochastic Transitional Probability Matrix, Evaluating time dependent and limiting state Probabilities of one component repairable model. Evaluation of Limiting state probabilities of two component repairable model.

UNIT - V
Approximate system Reliability analysis of Series systems, parallel systems with two and more than two components, Network reduction techniques. Minimal cutest/failure mode approach.

TEXT BOOKS:
1. "Reliability evaluation of Engineering systems", Roy Billinton and Ronald N Allan, BS Publications.
2. "Reliability Engineering", Elsayed A. Elsayed, Prentice Hall Publications.

REFERENCES:

1. "Reliability Engineering: Theory and Practice", By Alessandro Birolini, Springer Publications.
2. "An Introduction to Reliability and Maintainability Engineering", Charles Ebeling, TMH Publications.
3. "Reliability Engineering", E. Balaguruswamy, TMH Publications.

MECHANICAL ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ENGINEERING RESEARCH METHODOLOGY (Open Elective – II)

UNIT - I
Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general.
Defining the Research Problem: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

UNIT - II
Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. **Literature Review**: Need of Review, Guidelines for Review, Record of Research Review.

UNIT - III
Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes.

UNIT - IV
Data Collection: Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Sample Design, Need for sampling, some important sampling definitions, Estimation of population, Role of Statistics for Data Analysis, Parametric V/s Non Parametric methods, Descriptive Statistics, Measures of central tendency and Dispersion, Hypothesis testing, Use of Statistical software.
Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student's t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

UNIT - V
Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. **Research Proposal Preparation**: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

REFERENCES:
1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers, 2004
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2011
3. Ratan Khananabis and Suvasis Saha, Research Methodology, Universities Press, Hyderabad, 2015.
4. Y. P. Agarwal, Statistical Methods: Concepts, Application and Computation, Sterling Publs., Pvt., Ltd., New Delhi, 2004
5. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
6. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.
7. Naval Bajjai "Business Research Methods" Pearson 2011.
8. Prahalad Mishra " Business Research Methods " Oxford 2016

COMPUTER SCIENCE AND ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

MACHINE LEARNING (Open Elective - II)

Prerequisites:
- Data Structures
- Knowledge on statistical methods

Course Objectives:
- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory.
- To study the pattern comparison techniques.

Course Outcomes:
- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
- Understand the Neural Networks and its usage in machine learning application.

UNIT - I
Introduction - Well-posed learning problems, designing a learning system Perspectives and issues in machine learning
Concept learning and the general to specific ordering – Introduction, A concept learning task, concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias.
Decision Tree Learning – Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

UNIT - II
Artificial Neural Networks Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm.
Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition
Evaluation Hypotheses – Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.

UNIT - III
Bayesian learning - Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle , Bayes Optimal Classifier, Gibs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EM Algorithm.
Computational Learning Theory – Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake Bound Model of Learning.
Instance-Based Learning – Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

UNIT - IV
Pattern Comparison Techniques, Temporal patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization
Pattern Classification: Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech recognition and Image Processing

UNIT - V

Analytical Learning – Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations.

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis.

TEXT BOOKS:
1. Machine Learning – Tom M. Mitchell,- MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

REFERENCE BOOK:
1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis