JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. (CAD/CAM)

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 CAD	3	0	0	3
Professional Core - II	Computer Aided Manufacturing	3	0	0	3
Professional Elective - I	1. Mechanical Behaviour of Materials 2. Experimental Stress Analysis 3. Additive Manufacturing Technologies	3	0	0	3
Professional Elective - II	1. Automation in Manufacturing 2. Computer Aided Process Planning 3. Industrial Robotics	3	0	0	3
MC	Research Methodology & IPR	2	0	0	2
Lab - I	Advanced Computer Aided Design Lab	0	0	4	2
Lab - II	Computer Aided Manufacturing Lab	0	0	4	2
Audit - I	Audit Course- I	2	0	0	0
	Total Credits	**16**	**0**	**8**	**18**

I Year II Semester

Course Code	Course Title	L	T	P	Credits
Professional Core - III	Advanced Finite Element and Boundary Element Methods	3	0	0	3
Professional Core - IV	Manufacturing Systems: Simulation Modelling & Analysis	3	0	0	3
Professional Elective - III	1. Intelligent Manufacturing Systems 2. Advanced Manufacturing Processes 3. Optimization Techniques & Applications	3	0	0	3
Professional Elective - IV	1. Advanced Mechatronics 2. MEMS : Design and Manufacturing 3. Fuzzy Logic & Neural Networks	3	0	0	3
	Mini Project with Seminar	0	0	4	2
Lab - III	Simulation of Manufacturing Systems Lab	0	0	4	2
Lab - IV	Computer Aided Engineering Lab	0	0	4	2
Audit - II	Audit Course- II	2	0	0	0
	Total Credits	**14**	**0**	**12**	**18**

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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. (CAD/CAM)

ADVANCED CAD (Professional Core- I)

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 3D Modeling, Geometric models, Geometric construction methods, Modelling facilities desired.

UNIT- II:
Geometric Modeling: 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-Sp line 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, feature modeling.

UNIT- V:
Transformations: 2-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).

TEXT BOOKS:
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

REFERENCES BOOKS:
1. CAD/CAM /Groover M.P./ Pearson education
2. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age
3. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson
4. 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 (Professional Core- II)

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. ATC, 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, Flexible manufacturing, cellular manufacturing.

TEXT BOOKS:
1. Computer Control of Manufacturing Systems / Yoram Koren / McGraw Hill. 1983.
2. Computer Aided Design Manufacturing – K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, PHI, 2008.
3. CAD/CAM Principles and Applications, P.N. Rao, TMH.
4. Alavala, CAD/CAM PHI.

REFERENCES:
1. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
2. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson
3. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (CAD/CAM)

MECHANICAL BEHAVIOR OF MATERIALS (Professional Elective - I)

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

UNIT-II:
Theory of Elasticity and Plasticity:
Elasticity Theory: The State of Stress and strain, elastic stress-strain relation, anisotropy, elastic behaviour of metals, ceramics and polymers.
Plasticity: Hydrostatic and Deviatoric stress, Octahedral stress, yield criteria and yield surface, texture and distortion of yield surface, true stress and true strain, flow rules, strain hardening, Ramberg Osgood equation, stress -strain relation in plasticity, plastic deformation of metals and polymers

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. (CAD/CAM)

EXPERIMENTAL STRESS ANALYSIS (Professional Elective - 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.

TEXT BOOKS:
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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (CAD/CAM)

ADDITIVE MANUFACTURING TECHNOLOGIES (Professional Elective - I)

Prerequisites: Basics of Manufacturing, Basic knowledge in Calculus, Physics, Thermodynamics, and Chemistry

Course Objectives: The objective of the Course is to study methods used in additive manufacturing, theories governing the additive manufacturing, give information on materials, explain relations between materials to be processed and methods of additive manufacturing with introduction to common machines used for the technology and show applications and business opportunities with future directions.

Course outcomes:
- Understand the fundamentals for additive manufacturing and how it is different and discuss about various types of liquid based, solid based and powder-based AM technologies.
- Understand the various types of Pre-processing, processing, post-processing errors in AM. Also to know the various types of data formats and software's used in AM.
- Know the various applications of AM in design analysis, aerospace, automotive, biomedical and other fields.

UNIT–I:
Introduction: Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

UNIT–II:
Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Poly jet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Micro fabrication.
Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT–III:
Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three-dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.
Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies
Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment

Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT–IV:

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques.

AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, Surgi Guide, 3-matic, Simplant, Mesh Lab.

UNIT–V:

AM Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Web Based Rapid Prototyping Systems

TEXT BOOK:
1. Rapid prototyping: Principles and Applications by Chua C.K., Leong K.F. and LIM C.S, World Scientific publications, Third Edition, 2010.

REFERENCE BOOKS:
1. Rapid Manufacturing by D.T. Pham and S.S. Dimov, Springer, 2001.
2. Wholers Report 2000 by Terry Wohlers, Wohlers Associates, 2000.
3. Rapid Prototyping & Engineering Applications by Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (CAD/CAM)

AUTOMATION IN MANUFACTURING (Professional Elective - II)

Prerequisites: Production Technology, Machine Tools, Operations Research

Course Objectives:
- Lower Cost and Improve Time-to-Market
- Automation investment life-cycle analysis
- Empowered teams of talented employees
- Partnering with automation suppliers
- On-line process analysis
- Procedural process control
- Information integration and data warehousing

Course Outcomes: Upon completion of this course the student will be able to:
- Illustrate the basic concepts of automation in machine tools.
- Analyze various automated flow lines, Explain assembly systems and line balancing methods.
- Describe the importance of automated material handling and storage systems.
- Interpret the importance of adaptive control systems, automated inspection systems.

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

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

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

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

UNIT- V

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

TEXT BOOKS:
1. Automation, Production systems and computer integrated manufacturing by Mikel P. Groover, Pearson Education.

REFERENCE BOOKS:
1. CAD CAM: Principles, Practice and Manufacturing Management by Chris Mc Mohan, Jimmie Browne, Pearson edu. (LPE)
2. Automation by Buckinghsm W, Haper & Row Publishers, New York, 1961
3. Automation for Productivity by Luke H.D, John Wiley & Sons, New York, 1972.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (CAD/CAM)

COMPUTER AIDED PROCESS PLANNING (Professional Elective - 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 modelling 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

Text 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.

References:
1. Chang, T.C., "An Expert Process Planning System", Prentice Hall,1985
2. Nanua Singh, "Systems Approach to Computer Integrated Design and Manufacturing", John Wiley &Sons,1996
3. 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)

INDUSTRIAL ROBOTICS (Professional Elective - II)

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 notation, 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 I Sem. (CAD/CAM)

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.

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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. (CAD/CAM)

ADVANCED COMPUTER AIDED DESIGN LAB (Lab - I)

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

1. Two- dimensional drawing using CAD software.
2. Three-dimensional drawing using CAD software.
3. Various Dimensioning and tolerancing techniques on typical products using CAD software.
4. Assembly and animation of simple assemblies like screw jack, bolt-nut mechanism, etc.
5. Truss analysis using FEA software.
6. Beam analysis using FEA software.
7. Frame analysis using FEA software.
8. Buckling analysis of columns using FEA software.
9. Harmonic analysis using FEA software.
10. Fracture analysis using FEA software.
11. Analysis of laminated composites using FEA software.
12. Couple-field analysis using FEA software.
13. Modal Analysis
14. Transient dynamic analysis.
15. Spectrum analysis.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. TECH. I Year I Sem. (CAD/CAM)

COMPUTER AIDED MANUFACTURING LAB (Lab - II)

List of Experiments:

1. CNC programs for turning- 4 exercises
2. CNC programs for milling- 4 exercises
3. Robot programming- Lead through programming using teach product, forward kinematics, inverse kinematics, trajectory planning.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech. (CAD/CAM)

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. (CAD/CAM)

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. (CAD/CAM)

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. (CAD/CAM)

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. (CAD/CAM)

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. (CAD/CAM)

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. (CAD/CAM)

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. (CAD/CAM)

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.