JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE STRUCTURE & SYLLABUS M.Tech ME for CAD/ CAM Programme

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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KAKINADA - 533 003, Andhra Pradesh, India

I SEMESTER

S.No	Course Code	Course Name	L	T	P	Credits
1	CA 101	Geometric Modeling	3	0	0	3
2	CA 102	Computer Aided Manufacturing	3	0	0	3
3	CA 103	**Program Elective – 1**	3	0	0	3
	CA 1031	Computational Methods in Engineering				
	CA 1032	Materials Technology				
	CA 1033	Mechanical Vibrations				
4	CA 104	**Program Elective – 2**	3	0	0	3
	CA 1041	Mechatronics				
	CA 1042	Industrial Robotics				
	CA 1043	Simulation of Manufacturing Systems				
5	CA 105	Advanced CAD Lab	0	0	4	2
6	CA 106	Advanced Manufacturing Lab	0	0	4	2
7	CA 107	Research Methodology and IPR	2	0	0	2
8	CA 108	Writing Skills for Scientific Communication	2	0	0	0
					Total	**18**

II SEMESTER

S.No	Course Code	Course Name	L	T	P	Credits
1	CA 201	Theory of Elasticity and Plasticity	3	0	0	3
2	CA 202	Advanced Manufacturing Processes	3	0	0	3
3	CA 203	**Program Elective – 3**	3	0	0	3
	CA 2031	Advanced Finite Element Methods				
	CA 2032	Fracture mechanics				
	CA 2033	Product Design and Development				
4	CA 204	**Program Elective – 4**	3	0	0	3
	CA 2041	Materials Characterization Techniques				
	CA 2042	Optimization & Reliability				
	CA 2043	Additive Manufacturing				
5	CA 205	Material Characterization Lab	0	0	4	2
6	CA 206	Simulation of Manufacturing Systems Lab	0	0	4	2
7	CA 207	Mini Project With Seminar	2	0	0	2
8	CA 208	Personality development through life enlightenment skills	2	0	0	0
					Total	**18**

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III SEMESTER

S.No	Course Code	Course Name	T	P	Credits
1	CA 301	**Program Elective - 5**	3	0	3
	CA 3011	Non destructive Evaluation			
	CA 3012	Quality engineering in manufacturing			
	CA 3013	Green Manufacturing			
	CA 3014	MOOCS/ NPTEL *			
2	CA 302	**Open Elective**	3	0	3
	CA 3021	Nano Technology			
	CA 3022	Optimization Techniques			
	CA 3023	Product Design and Manufacturing			
3		**Project /Dissertation Phase-I**	0	20	10
				Total	**16**

***MOOCS/NPTEL** certification courses as per the approved list of internal BoS at the time of registration.

IV SEMESTER

S.No	Course Code	Course Name	L	T	P	Credits
1		Project /Dissertation Phase-II	0	0	32	16
					Total	**16**

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I Year I Semester	GEOMETRIC MODELING	L	P	C
		3	0	3

Unit - I

Cubic splines –I Definition, Explicit and implicit equations, parametric equations, Algebraic and geometric form of cubic spline, Hermite cubic spline, tangent vectors, parametric space of a curve, blending functions.

Unit - II

Cubic Splines-II:

four point form, reparametrization, truncating and subdividing of curves. Graphic construction and interpretation, composite pc curves.

Bezier Curves: Bernstein basis, equations of Bezier curves, properties, derivatives.

Unit - III

B-Spline Curves: B-Spline basis, equations, knot vectors, properties, and derivatives.

Unit – IV

Surfaces: Bicubic surfaces, Coon's surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, Sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, Gaussian curvature.

Unit – V

Solids: Tricubic solid, Algebraic and geometric form.

Solid modeling concepts: Wire frames, Boundary representation, Half space modeling, spatial cell, cell decomposition, classification problem.

TEXT BOOKS:

1. Elements of Computer Graphics by Roger & Adams Tata McGraw Hill.
2. Geometric Modeling by Micheal E. Mortenson, McGraw Hill Publishers

REFERENCES:

1. Computer Aided Design and Manufacturing, K.Lalit Narayan, K.Mallikarjuna Rao, MMM Sarcar, PHI Publishers

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I Year I Semester	COMPUTER AIDED MANUFACTURING	L	P	C
		3	0	3

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. Programmable 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.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems / Yoram Koren / Mc Graw Hill. 1983.
2. CAD/CAM Principles and Applications, P.N.Rao, TMH

REFERENCES:

1. Computer Aided Design Manufacturing – K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, PHI, 2008.
2. CAD / CAM Theory and Practice,/ Ibrahim Zeid,TMH
3. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
4. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson
5. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year I Semester	COMPUTATIONAL METHODS IN ENGINEERING (ELECTIVE I)	L	P	C
		3	0	3

Unit – I

Introduction to numerical methods applied to engineering problems: Examples, solving sets of equations – Matrix notation – Determinants and inversion – Iterative methods – Relaxation methods – System of non-linear equations. Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression - computer programs.

Unit – II

Boundry value problems and charecteristic value problems: Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.

Unit – III

Transformation Techniques: Continuous fourier series, frequency and time domains, laplace transform, fourier integral and transform, discrete fourier transform (DFT), Fast fourier transform (FFT).

Unit – IV

Numerical solutions of partial differential equations: Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

Unit – V

Partial differential equations: Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria. Solving wave equation by finite differences-stability of numerical method –method of characteristics-wave equation in two space dimensions-computer programs.

TEXT BOOKS:

1. Steven C.Chapra, Raymond P.Canale "Numerical Methods for Engineers" Tata Mc-Graw Hill 2.Curtis F.Gerald, Partick.O.Wheatly,"Applied numerical analysis"Addison-Wesley,1989 3.Douglas J.Faires,Riched Burden"Numerical methods", Brooks/Cole publishing company,1998.Second edition.

REFERENCES:

1. Ward Cheney and David Kincaid "Numerical mathematics and computing" Brooks/Cole publishing company1999, Fourth edition.
2. Riley K.F,. M.P.Hobson and Bence S.J,"Mathematical methods for physics and engineering", Cambridge University press,1999.
3. Kreysis, Advanced Mathematics

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I Year II Semester	MATERIALS TECHNOLOGY (ELECTIVE IV)	L	P	C
		3	0	3

UNIT I:

Elasticity in metals, mechanism of plastic deformation, slip and twinning, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening. Poly phase mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, Yield criteria: Von-mises and Tresca criteria.

UNIT II:

Griffth's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson – Miller parameter, Deformation and Fracture mechanism maps.

UNIT III:

Fatigue, fatigue limit, features of fatigue fracture,Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis. Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep.

UNIT IV:

MODERN METALLIC MATERIALS: Dual Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Inter metallics, Ni and Ti Aluminides. Processing and applications of Smart Materials, Shape Memory alloys, Metallic Glass Quasi Crystal and Nano Crystalline Materials.

UNIT V:

NONMETALLIC MATERIALS: Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, structure, Properties and Applications of Engineering Polymers, Advanced Structural Ceramics WC, TiC, TaC, $A1_2O_3$, SiC, Si_3N_4, CBN and Diamond – properties, Processing and applications.

TEXT BOOKS:

1. Mechanical Behavior of Materials/Thomas H. Courtney/ McGraw Hill/2 nd Edition/2000
2. Mechanical Metallurgy/George E. Dicter/McGraw Hill, 1998.

REFERENCES:

1 Selection and use of Engineering Materials 3e/Charles J.A/Butterworth Heiremann.
2 Engineering Materials Technology/James A Jacob Thomas F Kilduff/Pearson
3 Material Science and Engineering/William D Callister/John Wiley and Sons
4 Plasticity and plastic deformation by Aritzur.
5 Introduction to Ceramics, 2nd Edition by W. David Kingery, H. K. Bowen, Donald R. Uhlmann

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year I Semester	MECHANICAL VIBRATIONS (ELECTIVE I)	L	P	C
		3	0	3

Unit I

Single degree of Freedom systems: Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation, Vibration isolation and transmissibility, Vibrometers, velocity meters & accelerometers.

Unit II

Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

Unit III

Multi degree freedom systems: Principal modes – undamped and damped free and forced vibrations ; undamped vibration absorbers, Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

Unit IV

Numerical Methods: Rayliegh's, Stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods

Unit V

Application of concepts: Free vibration of strings – longitudinal oscillations of bars-transverse vibrations of beams- Torsional vibrations of shafts. Critical speeds without and with damping, secondary critical speed.

Text books:

1. Elements of Vibration Analysis by Meirovitch.
2. Mechanical Vibrations by G.K. Groover.

References:

1. Vibrations by W.T. Thomson
2. Mechanical Vibrations – Schaum series.
3. Vibration problems in Engineering by S.P. Timoshenko.
4. Mechanical Viabrations – V.Ram Murthy.

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I Year I Semester	MECHATRONICS (ELECTIVE II)	L	P	C
		3	0	3

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.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP 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.

REFERENCES:

1 Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2 Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3 Mechatronics System Design / Devdas shetty/Richard/Thomson.
4 Mechatronics/M.D.Singh/J.G.Joshi/PHI.
5 Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton
6 Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print

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I Year I Semester	INDUSTRIAL ROBOTICS	L	P	C
		3	0	3

UNIT - I

INTRODUCTION: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation scheme, work volume, robot drive systems, control systems and dynamic performance, precision of movement.

CONTROL SYSTEM AND COMPONENTS: basic concepts and motion controllers, control system analysis, robot actuation and feedback components, Positions sensors, velocity sensors, actuators, power transmission systems, robot joint control design.

UNIT - II

MOTION ANALYSIS AND CONTROL: Manipulator kinematics, position representation, forward and inverse transformations, homogeneous transformations, manipulator path control, robot arm dynamics, configuration of a 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, Robotic application.

UNIT - IV

ROBOT PROGRAMMING: Lead through programming, Robot program as a path in space, Motion interpolation, WAIT, SIGNAL AND DELAY commands, Branching, capabilities and Limitations of lead through methods.

ROBOT LANGUAGES: Textual robot Languages, Generations of robot programming languages, Robot language structures, Elements and 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 detection, Work cell controller.

ROBOT APPLICATION: Material transfer, Machine loading/unloading, Processing operation, Assembly and Inspection, Future Application.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.

REFERENCES:

1 Robotics / Fu K S/ McGraw Hill.
2 Robotic Engineering / Richard D. Klafter, Prentice Hall
3 Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4 Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley
5 Introduction to Robotics by SK Saha, The McGrah Hill Company, 6th, 2012
6 Robotics and Control / Mittal R K & Nagrath I J / TMH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year II Semester	MODELING AND SIMULATION OF MANUFACTURING SYSTEMS	L	P	C
		3	0	3

Unit-I

Introduction to System and simulation: Concept of system and elements of system, Discrete and continuous system, Models of system and Principles of modeling and simulation, Monte carlo simulation, Types of simulation, Steps in simulation model, Advantages, limitations and applications of simulation, Applications of simulation in manufacturing system

Unit-II

Review of statistics and probability: Types of discrete and continuous probability distributions such as Geometric, Poisson, Uniform, Geometric distribution with examples, Normal, Exponential distribution with examples.

Unit-III

Random numbers: Need for RNs, Technique for Random number generation such as Mid product method, Mid square method, and Linear congruential method with examples

Test for Random numbers: Uniformity - Chi square test or Kolmogorov Smirnov test, Independency- Auto correlation test

Random Variate generation: Technique for Random variate generation such as Inverse transforms technique or Rejection method

Unit-IV

Analysis of simulation data: Input data analysis, Verification and validation of simulation models, Output data analysis

Simulation languages: History of simulation languages, Comparison and selection of simulation languages

Design and evaluation of simulation experiments: Development and analysis of simulation models using simulation language with different manufacturing systems

Unit-V

Queueing models: An introduction, M/M/1 and M/M/m Models with examples, Open Queueing and Closed queueing network with examples

Markov chain models and others: Discrete time markov chain with examples, Continues time markov chain with examples, stochastic process in manufacturing, Game theory

TEXT BOOKS:

1. J.Banks, J.S. Carson, B. L. Nelson and D.M. Nicol, “Discrete Event System Simulation”, PHI, New Delhi, 2009.

2. A.M. Law and W.D.Kelton, “Simulation Modeling and Analysis”, Tata McGraw Hill Ltd, New Delhi, 2008.

3. N. Viswanadham and Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", PHI, New Delhi, 2007

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I Year I Semester	ADVANCED CAD LAB	L	P	C
		0	4	2

Students shall carry out the modeling and FE analysis of the following to predict deflection and stress distributions :

1. Trussess – 2D and 3D
2. Beams
3. Plate with Plane stress condition
4. Plate with Plane strain condition
5. Cylinders – Axi-symmetric condition
6. Natural frequencies of Beam

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I Year I Semester	ADVANCED MANUFACTURING LAB	L	P	C
		0	4	2

1. Casting processes - Study of Solidification, temperatures, metallurgical phases.
2. Forging processes - Study of hot working processes and extrusion
3. Forming Processes – Study of blanking, bending and deep drawing
4. Welding Processes – Study of arc, and spot welding processes
5. Powder metallurgy- Study of Green Density and sintering density
6. Additive Manufacturing – Study of simple parts in 3D printing
7. Machining- Estimation of chip reduction coefficient and shear angle in orthogonal turning, Measurement of cutting forces and average cutting temperature, and Estimation of tool life of a single point turning tool.

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I Year I Semester	RESEARCH METHODOLOGY AND IPR	L	P	C
		2	0	2

Unit 1: 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 2: Effective literature studies approaches, analysis Plagiarism, Research ethics, 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 3: 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 4: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 5: 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.

References:

(1) Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"

(2) Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

(3) Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

(4) Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

(5) Mayall, "Industrial Design", McGraw Hill, 1992.

(6) Niebel, "Product Design", McGraw Hill, 1974.

(7) Asimov, "Introduction to Design", Prentice Hall, 1962.

(8) (8) Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

(9) T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

COURSE OUTCOMES: At the end of this course, students will be able to

CO1: Understand research problem formulation.

CO2: Analyze research related information

CO3: Follow research ethics

CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO5: 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.

CO6: 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.

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I Year I Semester	WRITING SKILLS FOR SCIENTIFIC COMMUNICATION	L	P	C
		2	0	0

Unit-1:
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness**,** Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising.

Unit-2: Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit-3:
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-4:
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.

Unit-5:
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:
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'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

COURSE OUTCOMES: The Students will be able to
CO1. Understand that how to improve your writing skills and level of readability
CO2. Learn about what to write in each section
CO3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

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I Year II Semester	THEORY OF ELASTICITY AND PLASTICITY	L	P	C
		3	0	3

UNIT-I

INTRODUCTION: Elasticity –Notation for forces and stresses-Components of stresses –components of strain –Hooke's law.

PLANE STRESS AND PLANE STRAIN ANALYSIS: Plane stress-plane strain-Differential equations of equilibrium- Boundary conditions- Compatibility equations-stress function-Boundary conditions.

UNIT-II

TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES: Solution by polynomials-Saint Venant's principle-Determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems - gravity loading.

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES : General Equation in polar co-ordinates - stress distribution symmetrical about an axis –Pure bending of curved bars- strain components in polar coordinates-Displacements for symmetrical stress distributions-simple symmetric and asymmetric problems-General solution of two dimensional problem in polar coordinates-Application of the general solution of two dimensional problem in polar coordinates-Application of the general solution in polar coordinates.

UNIT-III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS: Principle stress - ellipsoid and stress-director surface-Determination of principle stresses- Maximum shear stresses-Homogeneous deformation-principle axis of strain rotation.

GENERAL THEOREMS: Balance laws - Differential equations of equilibrium- conditions of compatibility - Determination of displacement-Equations of equilibrium in terms of displacements-principle of superposition-Uniqueness of solution –the Reciprocal theorem.

UNIT-IV

TORSION OF PRISMATIC BARS: General solution of problems by displacement (St. Venant's warping function) & force (Prandtl's stress function) approaches - Membrane analogy - Torsion of circular and non-circular (elliptic and rectangular) sections - Torsion of thin rectangular section and hollow thin walled section - Single and multi-celled sections.

UNIT-V

THEORY OF PLASTICITY: Stress-strain curve - Theories of strength and failure –Yield Criteria - Yield Surface – Plastic Flow – Plastic Work – Plastic Potential – Strain hardening

Text Books:

1. Timoshenko, S., Theory of Elasticity and Plasticity, MC Graw Hill Book company.
2. Sadhu Singh, Theory of Elasticity and Plasticity, Khanna Publishers.

Reference Books:

1. Papov, Advanced Strength of materials, MC Graw Hill Book Company.
2. Chen, W.F. and Han, D.J, Plasticity for structural Engineers, Springer-Verlag, New York.
3. Lubliner, J., Plasticity Theory, Mac Millan Publishing Co., New York.

4.Y.C.Fung., Foundations of Solid Mechanics, Prentice Hall India

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I Year II Semester	ADVANCED MANUFACTURING PROCESSES	L	P	C
		3	0	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

ADVANCED MACHINING PROCESSES: EDM, WireEDM, ECM, LBM, EBM, AJM, WJM – Principle, working, limitations and applications.

UNIT -V

RAPID PROTOTYPING: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method, Applications and Limitations, Rapid tooling, Techniques of rapid manufacturing

TEXT BOOKS:

1. Manufacturing Engineering and Technology *I* Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.

REFERENCES:

1 Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,

2 MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH

3 Advanced Machining Processes / V.K.Jain / Allied Publications.

Introduction to Manufacturing Processes / John A Schey *I* Mc Graw Hill

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I Year II Semester	FINITE ELEMENT METHOD	L	P	C
		3	0	3

UNIT - I

Formulation Techniques: Methodology, Engineering problems and governing differential equations, f inite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions.

UNIT – II

One-dimensional elements: Bar, trusses, beams and frames, displacements, stresses and temperature effects.

UNIT – III

Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

UNIT – IV

Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration, Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, Pascal's triangle, Patch test.

UNIT – V

Finite elements in Structural Analysis: Static and dynamic analysis, eigen value problems, and their solution methods, case studies using commercial finite element packages.

TEXT BOOK :

1. Finite element methods by Chandrupatla & Belagundu.

REFERENCES:

1. J.N. Reddy, Finite element method in Heat transfer and fluid dynamics, CRC press,1994
2. Zienckiwicz O.C. & R. L. Taylor, Finite Element Method, McGraw-Hill,1983.
3. K. J. Bathe, Finite element procedures, Prentice-Hall, 1996

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year II Semester	FRACTURE MECHANICS (ELECTIVE III)	L	P	C
		3	0	3

UNIT-I

Introduction: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behaviour. Fracture in brittle and ductile materials – characteristics of fracture surfaces; inter-granular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, The ductile/brittle fracture transition temperature for notched and unnotched components. Fracture at elevated temperature.

UNIT-II

Griffiths analysis: Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves.

Linear Elastic Fracture Mechanics, (LEFM). Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor, crack tip plasticity, effect of thickness on fracture toughness.

UNIT-III

Elastic-Plastic Fracture Mechanics; (EPFM). The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

UNIT-IV

Fatigue: definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodmans rule and Miners rule. Micromechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

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. T.L. Anderson, Fracture Mechanics Fundamentals and Applications, 2nd Ed. CRC press, (1995)
2. J.F. Knott, Fundamentals of Fracture Mechanics, Butterworths (1973)
3. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, (1988)
4. S. Suresh, Fatigue of Materials, Cambridge University Press, (1998)

REFERENCES:

1. B. Lawn, Fracture of Brittle Solids, Cambridge Solid State Science Series 2nd ed1993.
2. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials.
3. H.L.Ewald and R.J.H. Wanhill Fracture Mechanics, Edward Arnold, (1984).
4. L.B. Freund and S. Suresh, Thin Film Materials Cambridge University Press,(2003).
9. D.C. Stouffer and L.T. Dame, Inelastic Deformation of Metals, Wiley (1996)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year II Semester	PRODUCT DESIGN AND DEVELOPMENT	L	P	C
		3	0	3

UNIT I

Introduction:Classification/Specifications of Products, Product life cycle. Product mix, Introduction to product design, Modern product development process, Innovative thinking.

UNIT II

Morphology of design. Conceptual Design: Generation, selection & embodiment of concept.Product architecture, Industrial design: process, need, Robust Design: Taguchi Designs & DOE, Design Optimization.

UNIT III

Design for Mfg& Assembly: Methods of designing for Manufacturing and assembly, Designs for Maintainability, Designs for Environment, Product costing, Legal factors and social issues, Engineering ethics and issues of society related to design of products. Value Engineering / Value Analysis. : Definition. Methodology, Case studies.

UNIT IV

Economic analysis: Qualitative & Quantitative. Ergonomics / Aesthetics: Gross human autonomy, Anthropometry, Man-Machine interaction, Concepts of size and texture, colour .Comfort criteria, Psychological & Physiological considerations.

UNIT V

Creativity Techniques: Creative thinking, conceptualization, brain storming, primary design, drawing, simulation, detail design. Concurrent Engineering, Rapid prototyping, Tools for product design – Drafting / Modeling software, CAM Interface, Patents & IP Acts. Overview, Disclosure preparation.

Text Books:

1. Karl T Ulrich, Steven D Eppinger , " Product Design & Development." Tata McGrawhill New Delhi 2003.
2. David G Ullman, "The Mechanical Design Process." McGrawhill Inc Singapore 1992 N J M Roozenberg , J Ekels , N F M Roozenberg " Product Design Fundamentals and Methods ." John Willey & Sons 1995.
3. Kevin Otto & Kristin Wood Product Design: "Techniques in Reverse Engineering and New Product Development." 1 / e 2004 , Pearson Education New Delhi. References:
4. L D Miles "Value Engineering."
5. Hollins B & Pugh S "Successful Product Design." Butter worths London.
6. Baldwin E N &Neibel B W "Designing for Production." Edwin Homewood Illinois
7. Jones J C "Design Methods." Seeds of Human Futures. John Willey New York.
8. Bralla J G "Handbook of Product Design for Manufacture, McGrawhillNewYork

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I Year II Semester	MATERIALS CHARACTERIZATION TECHNIQUES	L	P	C
		3	0	3

UNIT I

Introduction to materials and Techniques,Structure analysis tools: X-ray diffraction: phase identification, indexing and lattice parameter determination, Analytical line profile fitting using various models, Neutron diffraction, Reflection High Energy Electron Diffraction, and Low Energy Electron Diffraction.

UNIT II

Microscopy techniques: Optical microscopy, transmission electron microscopy (TEM), energy dispersive X-ray microanalysis (EDS), scanning electron microscopy (SEM), Rutherford backscattering spectrometry (RBS), atomic force microscopy (AFM) and scanning probe microscopy (SPM).

UNIT III

Thermal analysis technique: Differential thermal analysis (DTA), Differential Scanning Calorimetry (DSC), Thermogravimetric analysis (TGA); Electrical characterization techniques: Electrical resistivity, Hall effect, Magnetoresistance.

UNIT IV

Magnetic characterization techniques: Introduction to Magnetism, Measurement Methods, Measuring Magnetization by Force, Measuring Magnetization by Induction method, Types of measurements using magnetometers: M-H loop, temperature dependent magnetization, time dependent magnetization, Measurements using AC susceptibility, Magneto-optical Kerr effect, Nuclear Magnetic Resonance, Electron Spin Resonance.

UNIT V

Optical and electronic characterization techniques: UV-VIS spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy, X-ray photoelectron spectroscopy.

TEXT BOOKS:

1. Characterization of Materials (Materials Science andTechnology:A Comprehensive Treatment, Vol 2A & 2B,VCH (1992).
2. Semiconductor Material and Device Characterization, 3rdEdition, D. K. Schroder, Wiley-IEEE Press (2006).
3. Materials Characterization Techniques, S Zhang, L. Li andshok Kumar, CRC Press (2008).

REFERENCES:

1. Physical methods for Materials Characterization, P. E. J.Flewitt and R K Wild, IOP Publishing (2003).
2. Characterization of Nanophase materials, Ed. Z L Wang,Willet-VCH (2000).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year II Semester	OPTIMIZATION AND RELIABILITY	L	P	C
		3	0	3

UNIT - I

CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques.

UNIT - II

NUMERICAL METHODS FOR OPTIMIZATION: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods.

UNIT - III

GENETIC ALGORITHM (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

GENETIC PROGRAMMING (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

MULTI-OBJECTIVE GA: Pareto's analysis, Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems .

UNIT – IV

APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

UNIT V

RELIABILITY: Concepts of Engineering Statistics, risk and reliability, probabilistic approach to design, reliability theory, design for reliability, numerical problems, hazard analysis.

TEXT BOOKS:

1. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
2. Engineering Optimization – S.S.Rao, New Age Publishers
3. Reliability Engineering by L.S.Srinath
4. Multi objective genetic algorithm by Kalyanmoy Deb, PHI Publishers.

REFERENCES:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers
3. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
4. An Introduction to Reliability and Maintainability Engineering by CE Ebeling, Waveland Printers Inc., 2009
5. Reliability Theory and Practice by I Bazovsky, Dover Publications, 2013

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KAKINADA - 533 003, Andhra Pradesh, India

I Year II Semester	ADDITIVE MANUFACTURING	L	P	C
		3	0	3

UNIT I

Additive Manufacturing Process: Basic Principles of the Additive Manufacturing Process, Generation of Layer Information, Physical Principles for Layer Generation. Elements for Generating the Physical Layer, Classification of Additive Manufacturing Processes, Evaluation of the Theoretical Potentials of Rapid Prototyping Processes.

UNIT II

Machines for Rapid Prototyping: Overview of Polymerization: Stereolithography (SL), Sintering/Selective Sintering: Melting in the Powder Bed, Layer Laminate Manufacturing (LLM) and Three-Dimensional Printing (3DP).

UNIT III

Rapid Prototyping: Classification and Definition, Strategic Aspects for the Use of Prototypes, Applications of Rapid Prototyping in Industrial Product Development. Rapid Tooling: Classification and Definition of Terms, Properties of Additive Manufactured Tools, Indirect Rapid

UNIT IV

Tooling Processes: Molding Processes and Follow-up Processes, Indirect Methods for the Manufacture of Tools for Plastic Components, Indirect Methods for the Manufacture of Metal Components.

UNIT V

Direct Rapid Tooling Processes: Prototype Tooling: Tools Based on Plastic Rapid Prototyping Models and Methods, Metal Tools Based on Multilevel AM Processes, Direct Tooling: Tools Based on Metal Rapid Prototype Processes.

Text Books:

1. Andreas Gebhardt Jan-Steffen Hötter, Additive Manufacturing: 3D Printing for Prototyping and Manufacturing, Hanser Publications, 6915 Valley Avenue, Cincinnati, Ohio.
2. Ian Gibson, David Rosen, Brent Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Second Edition, Springer New York Heidelberg Dordrecht London.

References:

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

3. Hilton P.D. and Jacobs P.F., "Rapid

3. Tooling: Technologies and Industrial Applications", CRC press, 2000.

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I Year II Semester	MATERIAL CHARACTERIZATION LAB	L	P	C
		0	4	2

COURSE OUTCOMES:

(1) Microscopy: Different microscopy techniques, Resolution, Magnification, Depth of field Imaging – theory and concepts.

(2) Optical Microscopy: Grain size estimation, Phase Percentage Estimation

(3) Micro hardness evaluation of Ferrous and Non ferrous metals.

(4) Testing of Tensile Properties of mild steel material

(5) Testing of Compression Properties

(6) Testing of Flexural Strength on Ferrous metals.

(7) Evaluation of Tribological properties of Ferrous and Non ferrous metals through Pin on Disc Tester.

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I Year II Semester	SIMULATION OF MANUFACTURING SYSTEMS LAB	L	P	C
		0	4	2

1. Casting processes - Simulation of Solidification, temperatures, Residual stresses, metallurgical phases etc.
2. Bulk Forming processes - Simulation of cold working and hot working processes for extrusion, drawing, rolling, etc.
3. Sheet Metal Forming Processes – Simulation of blanking, bending, deep drawing, etc.
4. Welding Processes – Simulation of arc, spot, laser welding, etc
5.Machining Processes- Simulation of Turning, Milling and Shaping operations.

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I Year II Semester	MINI PROJECT WITH SEMINAR	L	P	C
		2	0	2

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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I Year II Semester	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	P	C
		2	0	0

UNIT I

Introduction to Personality Development The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

UNIT II

Attitude & Motivation Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation

UNIT III

Self-esteem Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low selfesteem - Symptoms - Personality having low self esteem - Positive and negative self esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV

Other Aspects of Personality Development Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.

UNIT V

Employability Quotient Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

Text Books:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

Reference Books:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

II Year I Semester	NON DESTRUCTIVE EVALUATION	L	P	C
		3	0	3

UNIT – I

General Methods: Flaw Detection Using Dye Penetrants. Magnetic Particle Inspection introduction to electrical impedance, Principles of Eddy Current testing, Flaw detection using eddy currents.

UNIT – II

X-Ray Radiography: The Radiographic process, X-Ray and Gamma-ray sources, Geometric Principles, Factors Governing Exposure, Radio graphic screens, Scattered radiation, Arithmetic of exposure, Radiographic image quality and detail visibility, Industrial X-Ray films, Fundamentals of processing techniques, Process control, The processing Room, Special Processing techniques, Paper Radiography, Sensitometric characteristics of x-ray films, Film graininess signal to noise ratio in radiographs, The photographic latent image, Radiation Protection,

UNIT – III

Generation of ultrasonic waves, Horizontal and shear waves, Near field and far field acoustic wave description, Ultrasonic probes- straight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media, Transmission and pulse echo methods, A-scan, B-scan, C-scan, F-scan and P-scan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, Zonal method using focused beam. Flow location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echos and noise. Ultrasonic flaw evaluation.

UNIT – IV

Holography: Principles and practices of Optical holography, acoustical, microwave, x-ray and electron beam holography techniques.

UNIT – V

Applications: NDT in flaw analysis of Pressure vessels, piping, NDT in Castings, Welded constructions, etc., Case studies.

TEXT BOOKS:

1. Ultrasonic testing by Krautkramer and Krautkramer
2. Ultrasonic inspection 2 Training for NDT : E. A. Gingel, Prometheus Press,
3. ASTM Standards, Vol 3.01, Metals and alloys

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
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II Year I Semester	QUALITY ENGINEERING IN MANUFACTURING (ELECTIVE III)	L	P	C
		3	0	3

UNIT - I

QUALITY VALUE AND ENGINEERING: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT II:

TOLERANCE DESIGN AND TOLERANCING: Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT – III

ANALYSIS OF VARIANCE (ANOVA): Introduction to ANOVA, Need for ANOVA, NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV

ORTHOGONAL ARRAYS: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V

SIX SIGMA AND THE TECHNICAL SYSTEM: Six sigma DMAIC methodology, tools for process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

TEXT BOOK:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.

REFERENCES:

1. Quality Engineering in Production systems by G. Taguchi, A. Elsayed et al, McGraw Hill Intl. Pub 1989.
2. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi *I* Prentice Hall Pvt.Ltd. New Delhi

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II Year I Semester	GREEN MANUFACTURING	L	P	C
		3	0	3

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II Year I Semester	**MOOCS/ NPTEL**	**L**	**P**	**C**
		3	**0**	**3**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

II Year I Semester	NANO TECHNOLOGY (ELECTIVE I)	L	P	C
		3	0	3

UNIT-I Introduction,Size and shape dependence of material properties at the nanoscale, scaling relations, can nanorobots walk and nanoplanes fly, Nano scale elements in conventional technologies, Mechanics at nanoscale Enhancement of mechanical properties with decreasing size, Nanoelectromechanical systems, nano machines, Nano fluidics, filtration, sorting, Molecular motors, Application of Nano Technology.

UNIT-II

Nano material Synthesis Techniques: Top-down and bottom-up nanofabrication, Synthesis of nano composites, The Intel-IBM approach to nanotechnology: lithography, etching, ion implantation, thin film deposition, nano coatings and nano indentation, Electron beam lithography, Soft lithography: nanoimprinting and micro-contact printing, Solution/plasma-phase nanofabrication, sol-gel methods, template techniques.

UNIT-III

Imaging/characterization of nanostructures General considerations for imaging, Scanning probe techniques: XRD, SEM, TEM, AFM and NSOM.

UNIT-IV

Metal and semiconductor nanoparticles Synthesis, stability, control of size, Optical and electronic properties, Ultra-sensitive imaging and detection with nano particles, bioengineering applications, Catalysis. Semiconductor and metal nanowires Vapor/liquid/solid growth and other synthesis techniques, Nanowire transistors and sensors.

UNIT-V

Carbon nanotubes

Structure and synthesis, Electronic, vibrational, and mechanical properties, How can C nanotubes enable faster computers, brighter TV screens, and stronger mechanical reinforcement?

TEXT BOOKS:

1. Nanoscale Science and Technology by Kelsall, Hamley, and Geoghegan, Wiley (2005)
2. Introduction to Nanoscale Science and Technology by Di Ventra, Evoy, and Heflin, Kluwer Academic Publishers (2004).

REFERENCES:

1. Introduction to Nanotechnology by Poole and Owens, Wiley (2003)
2. Nanochemistry: A Chemical Approach to Nanomaterials, Ozin and Arsenault, RSC Publishing (2006).

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II Year I Semester	**OPTIMIZATION TECHNIQUES**	**L**	**P**	**C**
		3	**0**	**3**

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		L	P	C
II Year I Semester	**PRODUCT DESIGN AND MANUFACTURING**	**3**	**0**	**3**

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		L	P	C
II Year I Semester	**PROJECT /DISSERTATION PHASE-I**	**0**	**20**	**10**

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II Year II Semester	**PROJECT /DISSERTATION PHASE-II**	**L**	**P**	**C**
		0	**32**	**16**