Vision of the Institution

To ignite the minds of the students through academic excellence so as to bring about social transformation and prosperity.

Mission of the Institution

- To expand the frontiers of knowledge through Quality Education.
- To provide valued added Research and Development.
- To embody a spirit of excellence in Teaching, Creativity, Scholarship and Outreach.
- To provide a platform for synergy of Academy, Industry and Community.
- To inculcate high standards of Ethical and Professional Behavior.

Vision of Mechanical Engineering Department

To foster prosperity through technological development by means of education, innovation and collaborative research.

Mission of Mechanical Engineering Department

- To produce effective and responsible graduate and post-graduate engineers for global requirements by imparting quality education.
- To improve the Department's infrastructure to facilitate research productivity and success.
- To integrate teaching and research for preservation and effective application of knowledge and skills.
- To strengthen and expand collaboration and partnerships with industry and other organizations.
- To provide consultancy to the neighborhood and inculcate a spirit of entrepreneurship.
- To serve society through innovation and excellence in teaching and research.

Program Educational Objectives(PEOs)

PEO1: Graduates apply a deep working knowledge of technical fundamentals in areas such as Design, Thermal, Production, Industrial and related fields to address needs of the customer and society.

PEO2: Graduates pursue advanced education, Research and Development in Engineering, Technology and other professional careers.

PEO3: Perform themselves in a responsible, professional and ethical manner.

PEO4: Graduates participate as leaders in their fields of specialization and in activities that contribute to service and overall economic development of society.

Program Outcomes(POs) of Mechanical Engineering Department

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's):

PSO1: Able to apply the knowledge learned as a part of the curriculum to provide solutions for problems related to Mechanical Engineering.

PS**O**2: Think innovatively, design and develop products with modern CAD/CAM tools and with optimized manufacturing processes.

S.No.	Subject	L	P	C
1	**Programme Elective V** Advances in CNC Technologies Design for Manufacturing and Assembly Advanced Materials	3	--	3
2	**Open Elective** Quality Engineering in Manufacturing ReliabilityEngineering Design of Experiments	3	--	3
3	Dissertation Phase – I	--	20	10
	Total	6	20	**16**

III Semester

	ADVANCES IN CNC TECHNOLOGIES (PROGRAMME ELECTIVE – V)	L	P	C
		3	0	3

UNIT I

Features of NC Machines Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of NC Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy. Systems Drives and Devices: Hydraulic motors, DC motors, stepping motors and AC motors, feedback devices, encoders, Induction tachometers.

UNIT II

NC Part Programming: Manual programming- Basic concepts, Point to Point contour programming, canned cycles, parametric programming. Computer-Aided Programming: General information, APT programming, Examples APT programming problems (2D machining only). NC programming on CAD/CAM systems,

UNIT III

Post Processors: Introduction to post processors, necessity of post processors, general structure of a post processor, functions of a post processor. Automatic tool path generation.

Interpolators: DDA integrator, hardware interpolators for linear and circular interpolator, CNC software interpolators, the reference pulse technique, sample- data technique.

UNIT IV

Tooling for CNC machines: Inter changeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC SYSTEMS AND Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding

UNIT V

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory, counters, timers and serial data I/O interrupts. Programmable Logic Controllers (PLC's): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Applications of PLC are in CNC Machines.

Text Books:

1. Computer Control of Manufacturing Systems / YoramKoren / McGraw Hill Int.1983.
2. Machining Tools Hand Book Vol 3, (Automation & Control)/ Manfred Weck / John Wiley and Sons,1984.

III Semester

	DESIGN FOR MANUFACTURING AND ASSEMBLY (PROGRAMME ELECTIVE – V)	L	P	C
		3	0	3

UNIT - I

Introduction to DFM, DFMA: How Does DFMA Work? Reasons for Not Implementing DFMA, What Are the Advantages of Applying DFMA During Product Design?Typical DFMA Case Studies, Overall Impact of DFMA on Industry.

Design for Manual Assembly: General Design Guidelines for Manual Assembly, Development Of the Systematic DFA Methodology, Assembly Efficiency, and Effect of Part Symmetry, Thickness, and Weight on Handling Time, Effects of Combinations of Factors, Application of the DFA Methodology.

UNIT - II

Design for machining: Introduction to machining, Recommended materials for machinability, Design recommendations, Design for tuning operation: Process description, Typical characteristics and applications, Suitable materials, Design recommendations, Parts produced by milling: Process description, Characteristics and applications of parts produced on milling machines, Design recommendations for milling, Dimensional factors and tolerances, Parts produced by planning, shaping and slotting: Process description, Design recommendation planning, Design for broached parts: Process description, Typical characteristics of broached parts, Suitable materials for broaching, Design recommendations.

UNIT - III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, and deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Design for powder metal processing: Introduction to powder metal processing, typical characteristics and applications, Limitations, Design recommendations.

UNIT - IV

Metal joining: Appraisal of various welding process factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT – V

Design for Assembly Automation: Fundamentals of automated assembly systems, System configurations, parts delivery system at workstations, various escapement and placement devices used in automated assembly systems, Quantitative analysis of Assembly systems, Multi station assembly systems, and single station assembly lines.

Design for Fasteners: Introduction, Design recommendation for fasteners.

TEXT BOOKS:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,
3. Design for manufacture, James Bralla

REFERENCES:

1. ASM Hand book Vol.20
2. GeoffreyBoothroyd, Peter Dewhurst and Winston Knight (2002) Product Design for Manufacture and Assembly, Second Edition, CRC press, Taylor & Francis, Florida, USA.
3. GeoffreyBoothroyd (2005) Assembly Automation and Product Design, Second Edition, CRC press, Taylor & Francis, Florida, USA.
4. A.K. Chitale and R.C. Gupta, (1999) Product design and Manufacturing, Prentice Hall of India, New Delhi.

III Semester

	ADVANCED MATERIALS (PROGRAMME ELECTIVE – V)	L	P	C
		3	0	3

UNIT-I

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrixcomposites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiberreinforcedcomposites and nature-made composites, and applications .

REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and born carbidefibres.

UNIT-II

MANUFACTURING METHODS: Autoclave, tape production, moulding methods, filament winding, handlayup, pultrusion, RTM.

UNIT-III

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials-classification-differentsystems-preparation-properties and applications of functionally graded materials.

UNIT-IV

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloyscomposition-properties and applications of shape memory alloys.

UNIT-V

NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages-applications incomparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced- topicdelivered by student.

Text Books:

1. Nano material /A.K. Bandyopadyay/New age Publishers
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH
3. Engineering Mechanics of Composite Materials / Isaac and M Daniel/Oxford University Press

References:

1. Mechanics of Composite Materials / R. M. Jones/ McGraw Hill Company, New York, 1975.
2. Analysis of Laminated Composite Structures / L. R. Calcote/Van NostrandRainfold,NY 1969
3. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience,New York, 1980
4. Mechanics of Composite Materials - Second Edition (Mechanical Engineering) /AutarK.Kaw / CRC Press

III Semester

	QUALITY ENGINEERING IN MANUFACTURING (OPENELECTIVE)	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 fpr process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology. Taguchi methods for process improvement – six sigma.

REFERENCES:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.
2. Quality Engineering in Production systems *I* G. Taguchi, A. Elsayed et al/Mc.Graw Hill Intl. Edition, 1989**.**
1. Taguchi Methods explained: Practical steps to Robust Design /Papan P. Bagchi*I* Prentice Hall Pvt. Ltd., New Delhi.

III Semester

	RELIABILITY ENGINEERING (OPENELECTIVE)	L	P	C
		3	0	3

UNIT-I: Reliability Concepts

Reliability Engineering- Introduction, reliability, maintainability, availability and quality, reliability vs quality, Reliability Function, Mean Time to Failure, Hazard rate function, Bath-tub curve, conditional reliability.

UNIT -II: Reliability Mathematics

Probability theory: Properties, theorems and Axioms, Random variables, Probability density function (pdf), cumulative density function (CDF), relationship between pdf and CDF, Joint Probability Distribution, mean life, median life, modal life, Bayes' Theorem.

Statistical Distributions: Discrete – Uniform, Bernoulli, Binomial, Geometric, Poisson, Continuous: Normal, Exponential, Weibull, Lognormal.

UNIT -III: Basic Reliability Models

Constant Failure rate model: Exponential reliability model, Failure modes, Two parameter Exponential distribution, Poisson process and redundancy.

Time-dependent failure rate model: The Weibull distribution, Three parameter Weibull distribution, Normal Distribution, Lognormal distribution

UNIT-IV: Reliability of Systems

System Reliability Modelling and Evaluation Techniques-I: Series, Parallel, Series-Parallel, Parallel-Series, *k*-out-of-*m*, Standby model.

Evaluation Techniques II: Event Space, Decomposition, Minimal Path sets and Cut sets, Common Mode Failures and Three State Devices.

UNIT-V: Data Analysis and Reliability Estimation

Point Estimation and Interval Estimation, Goodness-of-Fit test, Moment Estimation, Maximum Likelihood Estimator, Least Square Estimates.Parametric Reliability Estimations and Models Estimation Method of Moments, Likelihood functions, Method of Least Square. Reliability Models: Historical data, Operational life testing, Burn-in testing, Accelerated Life testing, Types of Censoring.

TEXT BOOKS:

1. Elsayed A. Elsayed, Reliability Engineering, John Wiley, 2nd Ed, 2012
2. Charles E. Ebling, Reliability and Maintainability Engineering, TMH, 9th Reprint, 2008.
3. V. N. A. Naikan, Reliability Engineering and Life Testing, PHI, 2008

REFERENCE BOOKS:

1. K. C. Kapur and L. R. Lamberson, Reliability in Engineering Design, Wiley India, 2009.
2. K. K. Agrawal, Reliability Engineering, Springer-Science+Business Media, 1993.

III Semester

	DESIGN OF EXPERIMENTS (OPENELECTIVE)	L	P	C
		3	0	3

UNIT – I: Fundamentals of Experimentation:

Role of experimentation in rapid scientific progress, historical perspective of experimental approaches, Steps in experimentation, principles of experimentation

UNIT – II: Simple comparative experiments:

Basic concepts of probability & statistics, comparison of two means and two variances, comparison of multiple (more than two) means and ANOVA

UNIT – III: Experimental designs:

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

UNIT – IV: Response surface methodology:

Concept, linear model, steepest ascent, second order model, regression.

UNIT – V: Taguchi's Parameter Design:

Concept of robustness, noise factor, objective function & S/N ratios, inner array & outer array design, data analysis

TEXT BOOKS:

1. Design and Analysis of Experiments/Douglas C. Montgomery/John Wiley and sons, 2012.

REFERENCE BOOKS:

1 Statistics for Experimenters: Design, Innovation, and Discovery. /G. E. /Hunter/W.G., Hunter/ J.S./Hunter/W.G./ 2nd Edition/Wiley/2005.

2. Design of Experiments and Taguchi Methods/Krishnaiah K/Shahabudeen P/Applied/PHI/ India/2011.

3. Taguchi Techniques for Quality Engineering Phillip J. Ross/Tata McGraw-Hill/India, 2005.

III Semester

		L	P	C
	DISSERTATION PHASE – I	**0**	**20**	**10**

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.