

**Department of Mechanical Engineering  
JIS COLLEGE OF ENGINEERING  
M. Tech. in Mechanical Engineering**

**Course Structure and Scheme of Evaluation -  
Effective from 2016-20 Batch**

**First Semester**

Sl No	Subject code	Name of the Subject	Hrs/Week			Credits
			Lecturer	Tutorial	Practical	
<b>THEORY</b>						
1	MME 101	Advanced Engineering Mathematics	3	1	0	4
2	MME 102	Engineering Management	4	0	0	4
3	MME 103	Advanced Material Science	4	0	0	4
4	MME 104	Generative manufacturing Process (GMP)	3	0	0	3
5	MME 105	Design of machine Tools & Theory of Metal Cutting	3	0	0	3
6	MME 106	Elective I	3	0	0	3
Total of Theory						21
<b>SESSIONAL</b>						
7	MME 191	Advanced manufacturing lab-I	0	0	3	2
8	MME 192	Seminar I	0	2	0	2
Total of Sessional						4
<b>Total of Theory &amp; Sessional</b>						<b>25</b>

**Second Semester**

Sl No	Subject code	Name of the Subject	Hrs/Week			Credits
			Lecturer	Tutorial	Practical	
<b>THEORY</b>						
1	MME 201	Mechatronics Systems-Applications & Control	4	0	0	4
2	MME 202	Concurrent/Simultaneous Engineering.	4	0	0	4
3	MME 203	Recent Advances in Non Traditional Material Removal	4	0	0	4
4	MME 204	Elective II (any one)	3	0	0	3
5	MME 205	Elective III (any one)	3	0	0	3
Total of Theory						18
<b>SESSIONAL</b>						
6	MME 291	Advanced manufacturing lab-II	0	0	3	2
7	MME 292	Seminar II	0	2	0	2
8	MME 293	Comprehensive Viva-Voce	0	0	0	4
Total of Sessional						8
<b>Total of Theory &amp; Sessional</b>						<b>26</b>

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**Third Semester**

Sl No	Subject code	Name of the Subject	Hrs/Sem			Credits
			Lecturer	Tutorial	Practical	
1	MME 301	Elective IV (any one)	3	0	0	3
1	MME 391	Pre-submission Defense of Dissertation	0	0	0	4
2	MBMI 392	Dissertation (Part - I)	0	0	24	20
<b>Total</b>						<b>27</b>

**Fourth Semester**

Sl No	Subject code	Name of the Subject	Hrs/Sem			Credits
			Lecturer	Tutorial	Practical	
1	MME 491	Dissertation (Completion)	0	0	24	20
2	MME 492	Post-submission Defense of Dissertation	0	0	0	4
<b>Total</b>						<b>24</b>

**Subjects of Examination**

**First Semester**

Sl No	Subject code	Name of the Subject	No of papers	Marks
THEORY				
1	MME 101	Advanced Engineering Mathematics	1	100
2	MME 102	Engineering Management	1	100
3	MME 103	Advanced material Science	1	100
4	MME 104	Generative manufacturing Process (GMP)	1	100
5	MME 105	Design of machine Tools & Theory of Metal Cutting	1	100
6	MME106	Elective-I	1	100
Total of Theory				600
SESSIONAL				
7	MBMI 192	Advanced Manufacturing Lab-I	1	100
8	MBMI 193	Seminar I	1	100
Total of Sessional				200
<b>Total of Semester</b>				<b>800</b>

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**List of Papers**

	<b>Paper Code</b>	<b>Name of the Subject</b>
<b>Compulsory Subjects</b>	MME 101	Advanced Engineering Mathematics
	MME 102	Engineering Management
	MME 103	Advanced Material science
	MME 104	Generative Manufacturing Process
	MME 105	Design of Machine Tools & Theory of Metal Cutting

	<b>Paper Code</b>	<b>Name of the Subject</b>
<b>Elective I (Any one)</b>	MME 106A	Reliability Engineering & Failure Statistics
	MME 106B	Finite Element Method and its Applications
	MME 106C	Manufacturing Support Systems

	<b>Paper Code</b>	<b>Name of the Subject</b>
<b>Compulsory Subjects</b>	MME 201	Mechatronic Systems -Applications & Control
	MME 202	Concurrent/Simultaneous Engineering.
	MME 203	Recent Advances in Non Traditional Material Removal / Deposition Process

	<b>Paper Code</b>	<b>Name of the Subject</b>
<b>Elective II (Any one)</b>	MME 204A	Reverse Engineering, Re-Engineering & Robust Engineering.
	MME 204B	Theory of Mechanical Vibration
	MME 204C	Cryogenic Engineering

	<b>Paper Code</b>	<b>Name of the Subject</b>
<b>Elective III (Any one)</b>	MME 205A	Application of Operations Research, Heuristics, Algorithm
	MME 205B	Total Quality Management (TQM)
	MME205C	Tribology & Terotechnology

	<b>Paper Code</b>	<b>Name of the Subject</b>
<b>Elective IV (Any one)</b>	MME 301A	Robotics & Automation.
	MME 301B	NanoTechnology and Nano-Materials
	MME 301C	Bio-Mechanics And Maintenance of Biomedical Appliances

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**SYLLABI FOR THE PROPOSED COURSE**

**MME 101:** Advanced Engineering Mathematics

3-1-0 (4 credits)

**Advanced Engineering Mathematics:**

1. **Graph Theory:** Basic notions- Graph, Directed Graphs, walk, path, circuits, connected graphs, components, operation on graphs, isomorphism of graphs, trees, some important properties of trees, binary trees, spanning trees,, cutset, cut vertices, fundamental cut set, fundamental circuits 10L
2. **Vector Theory:** Vector space associated with graph, sets with one operation, sets with two operations, modular arithmetic and Galois field, vector space, subspace, Linear dependence and independence, Basis of vectors. 10L
3. **Matrix:** Rank of a Matrix, Eigenvalues and Eigenvectors of matrix, Solution of linear equations by Gauss elimination method, Matrix representation of graphs. 8L
4. **Fourier Transforms:** Discrete Fourier Transform, Fast Fourier Transform and their applications. 6L
5. **Fuzzy Theory:** Introduction to Fuzzy set theory, Fuzzy relation and Fuzzy graph with simple applications. 6L

**Text Books:**

1. Hoffman K and Kunze R – Linear Algebra, PHI
2. Golub G H and Van Loan C F – Matrix Computations, North Oxford Academic
3. Narsing Deo-Graph Theory, PHI
4. S Rajasekhara and G A vijaya Lakshmi Pai-Neural Networks, PHI
5. John Yen and Reza Langari-Fuzzy Logic: Intelligence, Control and Information, Pearson.
6. George J Klin and Bo Yuan-Fuzzy Sets and Fuzzy Logic (Theory and Applications), PHI.

**MME 102: Engineering Management**

4-0-0 (4 credits)

**PART A**

1. **Introduction** : Concept, process and significance of management; Managerial roles; An overview of functional areas of management; Development of management thought; Classical and neo-classical systems; Contingency approaches.
2. **Planning** : Concept, process and types. Decision making – concept and process; Management by objectives; Corporate planning; Environment analysis; Strategy formulation.
3. **Organizing** : Concept, nature, process and significance; Authority and responsibility relationships; Centralization and decentralization; Departmentation; Organization structure – forms and contingency factors.
4. **Directing** : Motivation – Concept & Theories – (Maslow, Alderfer, Herzberg, McClelland, Porter & Lawler, Vroom); Financial and non-financial incentives of Motivation, Leadership – Leadership Theories, Leadership styles. Communication – Type, process and barriers.

**PART B**

5. **Controlling** : Concept and process; Effective control system; Techniques of control.
6. **Values** – Importance, Sources of Value Systems, Types, Values, Loyalty and Ethical Behaviour, Values across Cultures.
7. **Business Ethics** – Nature, Characteristics and Needs, Ethical Practices in Management.

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1. Wehrich and Koontz, et al : Essentials of Management; Tata McGraw Hill
2. Stoner J and Freeman RE : Management; Prentice-Hall

**Reference Books**

1. Daft, RL : Management, Thomson
2. V.S.P Rao & Hari Krishna : Management-Text & Cases,Excel Books
3. ramaswami T; Principles of Mgmt., Himalaya Publishing
4. Chandan, JS : Management – Concepts and Strategies, Vikas Publishing
5. Robbins, SP : Management, Prentice Hall
6. S. K. Chakraborty : Values and Ethics in Organisation, OUP
7. A. N. Tripathi : Human Values, New Age International

**MME 103: Advanced Material Science**

**4-0-0 (4 credits)**

Introduction, Structure – Properties – Performance of Different Types of Materials, Atomic Bonding and coordination, Polymers, Three dimensional Bonding, Interatomic distances, 6L

Crystals, crystalline Phases, Cubic & non Cubic Structures, Polymorphism, Unit Cell Geometry, Crystal directions, Crystal planes, Imperfection of crystalline solids, Solid Solutions in Ceramic, polymers and material compounds.

8L

Phase Equilibrium: Qualitative Phase Diagram, Quantities of Phases in Equilibrium Mixtures, Invariant Reactions, Selected Phase Diagrams, Reaction Rates, Deferred Reactions, Nucleation, And Atomic Diffusion 6L

Microstructures: Single Phase Materials, Phase Distribution (Eutectoid Decomposition, Microstructures and Polymer) 2L

Powder Metallurgy: Heat treatment processes - general classifications, various heat treatment of steels, properties and applications of alloy steels, tool steels, stainless steels and cast iron, different heat treatment furnaces. 6L

Hot and cold working of metals, recovery, recrystallisation and grain growth. Fracture, fatigue and creep phenomenon in metallic materials. 4L

Non-ferrous materials - Copper and Aluminium based alloys. 2L

Mechanical, Magnetic, Electrical and Electronic properties of metals, alloys, ceramics, semiconductors and composites. 6L

**Text Books:**

1. . Material Science and Engineering by V.Raghavan, Prentice Hall.
2. Introduction to Engineering Materials by B.K.Agarwal, TMH.

**Reference Books:**

3. Mechanical Metallurgy by G.E.Dieter, McGrawhill.
4. Physical Metallurgy Principles by R.E.Reedhill, East-West Publishers.
5. Principles of Materials Science by W.F.Smith, 3rd ed., McGrawhill.
6. Steel and its Heat Treatment by K.E.Theling, Butterworth.
7. Material Science by J. C. Anderson, K. D. Leaver, R. D. Rawlings and J. M. Alexander, Chapman Hall, 4th Ed., 1992.

**MME 104: Generative Manufacturing Process**

3-0-0 (3 credits)

Part I: Comparative study on Additive & Subtractive Manufacturing Process, Introduction of Old Manufacturing Process, Three Categories of Processing like Shaping (solidification processes particulate processing, deformation and material removal), Property Enhancing (low temperature & heat treatment) and Surface Processing Operations (shot peening & Sand blasting, diffusion & ion implantation; surface coating & thin film deposition by Electroplating, Anodizing, Physical Vapour Deposition (PVD) & Chemical Vapour Deposition (CVD),

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Part II: Concept of Present GMP (Generative Manufacturing Process, Future GMP and Ultimate GMP).

**Reference Books:**

1. Text Book for GMP (Generative Manufacturing Process) by M.P. Groover

**MME 105: Design of machine Tools & Theory of Metal Cutting**

3-0-0 (3 credits)

Part I: Design of Machine Tools:

Strength & Rigidity of Machine Tools Structures, Analysis of Bearings, Slides & Guides, Machine Tools Vibration, Control Systems of Advanced (non traditional) Machine Tools. 14L

Part II: Theory of Metal Cutting:

Deformation of Metals, Mechanism of Chip formation, Interrelationships of Tool Angles including concept of 'Master Line' Mechanism of Metal Cutting, Mechanics of Metal Cutting, Tool Failures, Newer Tool Materials, Surface Integrity, Economics of Machining, Fundamental aspects of Cutting Tool Design 16L

**Textbooks :**

1. Principles of Machine Tools by A. Bhattacharya and G. Sen, Central Book Agency, Kolkata.
2. Machine Tool, Vol - I, II, III, IV by Acharkan, Mir Publishers.
3. M/C Tool & Metal Cutting is Dr. Amitabha Bhattacharyya's Book & Dr. A.B. Chattopadhyay's

**Reference Books :**

1. Fundamentals of Metal Cutting Machine Tools by G. Boothroyd, TMH.
2. Production Technology, HMT Publication, TMH.
3. Metal Cutting Theory & Practice by A. Bhattacharya, Central Book Publisher, Calcutta
4. Manufacturing Science by A. Ghosh and A.K. Mallik, Wiley Eastern.
5. Manufacturing Process by Maslov, Mir Publishers.
6. Principal of Machine Tool by G. Sen & A. B. Chattopadhyay, New Central Book Agency

**MME 106A: Reliability Engineering & Failure Statistics**

3-0-0 (3 credits)

Reliability: Definition and basic concepts; Failure data, failure modes, and reliability in terms of hazard rate and failure density function. 6L

Hazard models and bath tub curve; applicability of Weibull distribution. Reliability calculations for series, parallel and parallel-series 4L

Systems; Reliability calculations for maintained and stand-by systems. 2L

Maintenance - its role and scope in total organizational context. Objectives and characteristics of maintenance; basic guidelines for design of Organization structure for maintenance; Centralized vs. decentralized maintenance; Types of maintenance - corrective, planned, preventive And predictive maintenance; Factors affecting maintenance; opportunistic maintenance; Measurement of maintenance work; rating and Allowances. Maintenance cost budgets. 12L

Maintenance planning and scheduling; MIS in maintenance; Measurement of maintenance, Effectiveness and maintenance audit. 6L

**Reference Books:**

1. Mechanical Reliability Engineering by ADS Carter, Macmilan
2. Reliability Evaluation of Engineering Systems by Roy Billington and R.N. Allen, Pitman
3. Introduction to Reliability Engineering by Dhilan & Singh
4. Reliabilities for the Technologies by L.A. Doty, Industrial Press Inc.
5. Management of Industrial Maintenance by . Kelly & Harris- Newnes- Butterworths Management Library, London

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**MME 106B: Finite Element Method and its Applications**

3-0-0 (3 credits)

Introduction: basic concept of the finite element method, comparison with finite difference method; Variation methods: calculus of Variation, the Rayleigh-Ritz and Galerkin methods; Finite Element analysis of 1-D problems: formulation by different approaches (direct, Potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its post processing. 12L

Applications in heat Transfer, fluid mechanics and solid mechanics. 4L

Bending of beams, analysis of truss and frame. Finite element analysis of 2-D problems: finite Element modeling of single variable problems, triangular and rectangular elements 6L

Numerical considerations: numerical integration, error analysis, mesh refinement. Plane stress and plane strain problems 4L

Bending of plates; Eigen value and time dependent problems; Discussion about preprocessors, post processors and finite element packages. 4L

**Reference Books :**

1. An Introduction to the Finite Element Method by J.N.Reddy, McGrawHill, NewYork.
2. Concepts and Applications of Finite Element Analysis by R.D.Cook, D.S.Malkus and M.E.Plesha, 3rd ed., John Wiley, New York.
3. The Finite Element Method by O.C.Zienkiewicz and R.L.Taylor, 3rd ed. McGraw-Hill.
4. The Finite Element Method by T.J.T Hughes, PrenticeHall, Englewood Cliffs, NJ.

**MME 106C: Manufacturing Support Systems**

3-0-0 (3 credits)

Product Design , CAD, CAM, CIM, Quality Function Deployment (QFD),

Process Planning & Concurrent/Simultaneous Engineering.

Production Planning & Control Systems (PPC, JIT, MRP)

**Text books :**

1. Automation, Production Systems and CIM” by M.P. Groover, Prentice Hall of India.
- 2 CAD / CAM by P. N.Rao, TMH

**MME 205C: Tribology and Terotechnology**

3-0-0 (3 credits)

Friction, wear & Lubrication as a system

Terotechnology aspects affecting Tribo Characteristics

Tribo-analysis at different hostile & hazardous environment

Theories of Friction, Wear & Lubrication

Control of Tribo-aspects using different interfacial separatorss

Text books : A Text Book of Tribology & Terotechnology by Dr. D.K.Biswas & Dr. U. Bandyopadhyay, Tech International,2010

- Reference Books: 1. Introduction to Tribology of Bearings by B.C.Majumder, AHW**  
**2.Tribology by J.Halling, Bowden & Tabor**

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**MME191: Advanced manufacturing Lab-I**

0-0-4 (2 credits)

1. Measurement of Forces and Temperature at the tool-work interface point during Turning and Grinding operation.
2. Effect of Tool Geometry on Surface and Sub-surface quality of the Product.
3. Introduction & Study of CNC machine tools and Machining Centres with some ideas of FMS.
4. CNC modelling & Programming (involving CNC Lathe, CNC Drilling Machine & CNC Milling Machines)
5. Designing a Digital Encoder for position control of a Milling Cutter and then write a Programme in PASCAL for 3-axis control of Milling Machines. (Consult Electronics & IT Dept to generate digital signals to D/A converter that is connected to the Drives (dc-motor)).
6. Designing and developing a Transducer & Sensor applying Mechatronics Concept for Tribotesting of Slides – A Project work for PG Students (or it may be taken as a Seminar Project)- It is related to Tribology & Terotechnology.
7. Study and Analysis of Microstructure during Grinding Process
8. Effect of Non Conventional Lubrication in Space-simulated Environment. (Consult with Chemistry, Physics and Material Science).
9. To determine Chip reduction coefficient during turning in metal cutting process.
10. To measure cutting forces by using tool force dynamometer.

**MME 201: Mechatronic Systems-Application & Control**

4-0-0 (4 credits)

Introduction to Multidisciplinary Subject, Electric Circuits & Components, Semiconductor Electronics, System Response, OPAM, Digital Circuits, Micro Controllers & Microprocessors, Data Acquisition, Sensors and Actuators, Mechatronic Design Strategy

Text books :

Introduction to Mechatronics & Measurement Systems by Alciatore & Histan, TMH Education..

**Reference Books:**

“Mechatronics” – by Mahalik, TMH Education Pvt. Ltd.

**MME 202: Concurrent/ Simultaneous Engineering**

4-0-0 (4 credits)

Computer Aided Process Planning (CAPP), Concurrent Engineering. & Design for Manufacturing (Product Development,

Design Engineering. & Manufacturing Engineering, as a TEAM to develop a new marketable product with in a very short time), Facilities Planning & Design (Plant Layout),

Advanced Manufacturing Planning, Contribution of Rapid Prototyping, Rapid Tooling & Reverse Engineering.) in the development of Concurrent Engineering, Rapid Response Manufacturing for advanced & Cost Effective Products,

**Reference Books:**



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1. Automation, Production Systems and Computer Integrated Manufacturing by Groover, Prentice Hall.
2. CAD/CAM by M. P. Groover and E. W. Zimmers, Prentice Hall of India.
3. Manufacturing Technology, Radhakrishnan, Scitech

**MME 203: Recent trends in non Traditional material removal/ Deposition Process** 4-0-0 (4 credits)

Mechanical (AJM, WJM, AWJM, USM, AFM, MAF)  
Thermoelectric (EDM, PAM, IBM, EBM, LBM)  
Electrochemical & Chemical (BM, ECM, Ch M)  
Hybrid Processes (ECG, ECAM, ECSM, EDAG)  
Deep Edge Lithography & Micro machining

**Textbooks:**

1. Non-Conventional Machining by P.K.Mishra, Narosa Publishers.
2. Manufacturing Engineering & Technology, K. Jain, Pearson Education]

**MME 204A: Reverse Engineering, Re-Engineering & Robust Engineering** 3-0-0 (3 credits)

Reverse Engineering, Re-Engineering & Robust Engineering and comparison with Forward Engineering.

TAGUCHI's CONCEPT OF QUALITY, Signal to Noise Ratio (S/N ratio) in Robust Design, Safety, Green Engineering, Reducing the toxicity of raw materials used in production, Reducing energy consumption during the manufacturing process, Recycling materials and scrap, Reducing the amount of packaging in final product

“LEED” (Leadership in Energy & Environment Design)

**Text Books:**

1. Automation, Production Systems and CIM” by M.P. Groover, Prentice Hall of India.
2. Reverse Engineering. By Raja, Vinesh., Fernandes..
3. Reversing- Secrets of Reverse Engineering by Elad Eilam

**MME 204B: Theory of Mechanical vibration** 3-0-0 (3 credits)

Elements of vibration, Energy method, Rayleigh's method, equilibrium method, Undamped free vibrations, Newton's method, Energy method, Rayleigh's method, Torsional vibrations, Transverse vibrations of beams, Free damped vibration, viscous damping, Coulomb damping, Structural damping, Critical damping constant and damping ratio, Forced Vibration, Forced vibrations with Coulomb damping, Forced vibration with Hysteris or structural damping, Forced vibrations with Coulomb and viscous damping, Total response, characteristic curves, variation of frequency ratio, two degrees of freedom system, several degree of freedom system, transient vibration, non-linear vibrations.

**Text Books:**

1. Mechanical Vibration-by J.Thompson
2. Mechanical Vibration by Sato Shaum Series.
- 3 Mechanical Vibration- V.P. Singh, Dhanpat Rai

**MME 204C: Cryogenic Engineering** 3-0-0 (3 credits)

Development Techniques of Cryo-Tribo –Vacuum Chamber

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For Mechanical Treatment of Materials at Hazardous Environment, Material Behaviour at High Pressure and cryogenic temperature,  
Design & Fabrication of tribotesting chamber at hostile environment for Spatial requirements.

**Textbooks:**

1. Cryogenic Engineering by Russel B Scott
2. Cryogenic Engineering by Joseph H Bell
3. Cryogenic Engineering by Thomas H Flynn..
4. Cryogenic Heat Transfer by Randall F. Barron
5. Cryogenic systems by Randall F. Barron.
6. Fundamental of Process Engineering by V. Kovan

**MME 205A:** Application of Operations Research, Heuristics, Algorithm 3-0-0 (3 credits)  
Linear Programming, Algebra of LP, Simplex Procedure, Distribution Methods – Stepping Stone Method, Modified Distribution Methods, Vogel’s Approximation Method (VAM), Degeneracy – its problem and Duality,  
Non-Linear Programming, Integer Programming,  
Application of Heuristics. Application of Algorithms:  
Tabu Search, Genetic Algorithm, Simulated Annealing, Ant Colony Optimisation, Artificial Immune System etc.  
Fuzzy Logic, Neural Network.

**TEXT BOOKS:**

1. Productions and Operations Management by A.Muhlemann, J.Oakland and K.Lockyer, Macmillan.
2. Operations Research - An Introduction by H.A.Taha, Prentice Hall of India./Pearson Education
3. Operations Research by J.K.Sharma, Macmillan.
4. Operations Research, Vijayakumar, Scitech

**REFERENCE BOOKS:**

1. Production Systems: Planning, Analysis and Control by J.L.Riggs, 3rd ed., Wiley.

**MME 205B: Total Quality Management** 3-0-0 (3 credits)  
Basic concepts, definitions and history of quality control. Quality function and concept of quality cycle. Quality policy and objectives.  
Economics of quality and measurement of the cost of quality. Quality considerations in design.  
Process control: Machine and process capability analysis. Use of control charts and process engineering techniques for implementing the  
Quality plan.  
Acceptance Sampling: single, double and multiple sampling, lot quality protection, features and types of acceptance sampling tables,  
Acceptance sampling of variables and statistical tolerance analysis. Quality education, principles of participation and participative  
approaches to quality commitment.  
Emerging concepts of quality management: Taguchi's concept of off-line quality control and Ishikawa's cause and effect diagram.

**References:**

1. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
2. Quality Control and Applications by Housen & Ghose
3. Industrial Engineering Management by O.P. Khanna

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**MME 291:** Advanced Manufacturing Lab-II

0-0-3 (2 credits)

1. Experiments on Non Traditional Machining:

- EDM
  - USM
  - LBM
  - Chemical Machining
2. Studies on Arc Behaviour of GTAW & GMAW Processes
  3. On Quality Assurance & Reliability Testing.
  4. On Laser related study or Biomedical /Biomechanics Aspects.
  5. On Nano Material Testing and its application in Manufacturing
  6. On Robotics i.e. Robot Teaching using VAL Programming / any experiment on Robotics
  7. On Laser Application (like LMP) or Microdrives (for surgery)

**MME 301 A:** Robotics and Automation

3-0-0 (4 credits)

Robot Anatomy & its related attributes, Common Robot Configuration, Robot Control Systems, End effectors, Sensors & Intelligent Robots, Robot Application in Industries, Robot Programming, Engineering. Analysis of Industrial Robots, Accuracy & Repeatability, System Architecture & AGV, Artificial Intelligence & Expert Systems, Factory/ Process Automation, Factories of Future.

Text Book : •“Robotic Technology & Flexible Automation” by S.R. Deb, Tata Mcgraw-hill

Reference : •“Automation, Production Systems and CIM” by M.P. Groover, Prentice Hall of India.

**MME 301B: Nanotechnology and Nanomaterials**

3-0-0 (3 credits)

Unit – I

Introduction, Properties of materials & nanomaterials, role of dimensions in nanomaterials. Quantum Confinement, Size Quantization, three Dimensional System (Bulk), Two Dimensional System (Nanostructured Plane), One Dimensional System (Quantum Wire), Zero Dimensional System (Quantum Dots), Varieties of Quantum Dots. 6L

**Unit – II**

Fabrication of Nanomaterials by Physical Methods: -Inert gas condensation, Arc discharge, RFplasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition method and Electro deposition.

Chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and co-precipitation; Metal nanocrystals by reduction, Sol-gel synthesis; Microemulsions or reverse micelles, myle formation; Solvothermal synthesis; Thermolysis routes, Microwave heating synthesis; Sonochemical synthesis; Electrochemical synthesis; ,Photochemical synthesis, Synthesis in supercritical fluids

8L

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**Unit – III**

Nanocomposites: An Introduction: Types of Nanocomposite (i.e. metal oxide, ceramic, glass and polymer based); Core-Shell structured nanocomposites Superhard Nanocomposite: Synthesis, applications and milestones. 4L

**Unit–IV**

Nanopolymers: Preparation and characterization of diblock Copolymer based nanocomposites, Nanoparticles polymer ensembles; Assembly of polymer-Nanoparticles composite material; Fabrication of polymer-mediated organized Nanoparticles assemblies; Applications of Nanopolymers in Catalysis. 6L

**Unit–V**

Metal Nanoparticles: Size control of metal Nanoparticles and their characterization; Study of their properties: Optical, electronic, magnetic; Surface plasmon band and its application; Role in catalysis, Alloy Nanoparticles, Stabilization in Sol, Glass, and other media, Change of bandgap, Blueshift, Colour change in sol, glass, and composites, Plasmon Resonance. 6L

**References:**

1. Encyclopedia of Nanotechnology- Hari Singh Nalwa
8. 2. Fabrication of fine pitch gratings by holography, electron beam lithography and nano-imprint lithography
9. (Proceedings Paper) Author(s): Darren Goodchild; Alexei Bogdanov; Simon Wingar; Bill Benyon; Nak Kim;
10. Frank Shepherd
11. 3. Microfabrication and Nanomanufacturing- Mark James Jackson
12. 4. A Three Beam Approach to TEM Preparation Using In-situ Low Voltage Argon Ion Final Milling in a FIBSEM
13. Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005), 11: 830-
14. 831 Cambridge University Press.
15. 5. Processing & properties of structural naonmaterials - Leon L. Shaw (editor)
16. 6. Springer Handbook of Nanotechnology - Bharat Bhusan

**MME 301 C: Biomechanics and Maintenance of Biomedical Appliances**

3-0-0 (4 credits)

**1. Introduction:** Overview of human system, Vulnerable body parts, properties of Anatomical materials – hard tissue & Soft tissues 4L

**2. Basics of Design Process :** Adoptive and Adaptive design, safety, Standardisation, manufacturability, customization, interchangeability 6L

**3. Material selection:** Properties, Biocompatibility, Corrosion – Metal and alloys, Ceramics, Polymers and Composite Materials. 4L

**4. Implants Design:** Dental and Oral implants, Orthopaedic implants. Joint Replacement: Shoulder, Hip, Elbow, Knee, Ankle, Bone repair and joint implants-long bone repair and joint replacements, dental implants- effects of material selection, effects of surface properties, surface chemistry. 10L

**5. Maintenance of Equipment:** BP Apparatus, Suction Machine, Pulse Oximeter, Audiometer and Microscope. 6L

**MME 301D: Project management**

3-0-0 (3 credits)

Project Definition: Venture analysis, Project management Features;

Project organization design; Operation planning and resource allocation; Plant location analysis models; Project scheduling; Gantt charts;

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Analysis of project networks - PERT and CPM. Scheduling under Resources constraint, Cash scheduling to multi-projects situation Project Monitoring and control aspects; Decision making theories in Management under certainty, risk, uncertainty and competitive situations; Applications of the methodologies and formulations in such project decision making problem solutions; Project capital, cost estimation; Breakeven Analysis, Cost Benefit Analysis; Profitability Analysis, Commercial and notional profitability. Project Engineering, procurement, storage and construction functions and other related management problems; Project wind up and Technological obsolescence; Computer aided Project Management.

References :

1. Operations Research – An Introduction by Taha
2. Principles of Operations Research with Applications to Managerial Decision by Wagner

**TEXT BOOK:**

- “Biomedical Engineering Handbook”** Volume1(2<sup>nd</sup> Edition),J.D.Bronzino(CRC Press /IEEE Press, 2000).
1. **“Biomedical Engineering Handbook”** Volume 2 (2<sup>nd</sup> Edition), J.D.Bronzino (CRC Press / IEEE Press, 2000)
  2. . R. S. Khandpur, Biomedical Instrumentation Technology and Applications, McGraw-Hill Professional, 2004 (UNIT I, II)
  3. Raja Rao, C; Guha, S.K, Principles of Medical Electronics and Biomedical Instrumentation, Orient Longman Publishers (2000) (UNIT III, IV & V)

**Reference Books**

1. R.Anandanatarajan, “Biomedical Instrumentation”, PHI Learning, 2009.
2. John G. Webster, Medical Instrumentation: Application and Design, 3rd edition, John Wiley & Sons, New York, 1998.