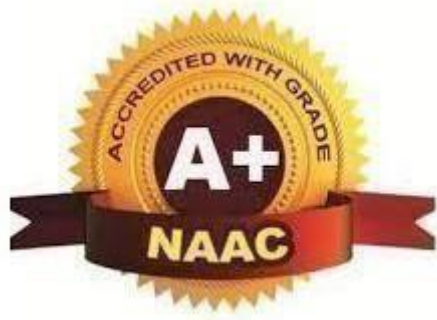




**TULSIRAMJI GAIKWAD-PATIL**  
**College of Engineering & Technology**

Mohgaon, Wardha Road, Nagpur - 441 108

**An Autonomous Institute**



**DEPARTMENT OF MECHANICAL ENGINEERING**

**M. Tech. course in Mechanical Engineering Design**

## **Teaching Scheme**

**Considering**



**From**

**Academic Year 2024-25**

## **Vision of Institute**

“To emerge as a learning center of Excellence in the National Ethos in Domains of Science, Technology and Management”

## **Mission of Institute**

- M1: To strive for rearing standard and stature of the students by practicing high Standards of professional ethics, transparency and accountability.
- M2: To provide facilities and services to meet the challenges of Industry and Society.
- M3: To facilitate socially responsive research, innovation and entrepreneurship.  
To ascertain holistic development of the students and staff members by
- M4: Inculcating knowledge and profession as work practices.

## **Vision of the Department**

“To emerge as a premier centre in the field of Mechanical Engineering Education and produce competent Engineers”.

## **Mission of the Department**

- To impart quality Technical Education through effective teaching-learning process.
- To provide a better environment to encourage innovation and entrepreneurship.
- To strengthen industry institute interaction to meet the challenges of industry and society.
- To ensure overall development of students and staff members by inculcating knowledge and professional ethics.

## **Programme Education Objectives (PEO)**

**PEO-1:** Demonstrate essential technical skills to identify analyze and solve problems and design issues in mechanical engineering.

**PEO-2:**Analyze the complex problems in the field of mechanical engineering by using modern tools.

**PEO-3:**Apply mechanical engineering concepts for the betterment of society and environment.

**PEO-4:** Develop professionals having administrative and managerial skills for mechanical engineering and allied industries.

**PEO-5:** Demonstrate the attributes of mechanical engineering in lifelong learning to Contribute towards societal needs.

## Programme Outcomes(PO)

- 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 software 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 the set one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

## Programme Specific Outcomes(PSO)

**PSO1:** Apply the knowledge to work professionally and ethically in Thermal, Design, production and Manufacturing areas of Mechanical engineering.

**PSO2:** Analyze and design mechanical components and its processes to meet the societal needs.

**PSO3:** Apply Engineering and Management principles to work professionally in the industry or as an entrepreneur.



# Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: M. Tech. course in Mechanical Engineering Design (NBA Accredited)

Scheme of Instructions: First Year M. Tech. course in Mechanical Engineering Design (As Per NEP 2020)

Semester – II



Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/week	Credits	Exam Scheme				
									CT- 1	CT- 2	TA/CA	ESE	TOTAL
1	PCC	MME21201	Finite Element Analysis	4	-	-	4	4	20	20	-	60	100
2	PCC	MME21202	Stress Analysis	4	-	-	4	4	20	20	-	60	100
3	PCC	MME21203	Stress and Finite Element Analysis Lab	-	-	4	4	2	-	-	25	25	50
4	FC	MME21204	Literature Review & Research Methodology	2	-	-	2	2	-	-	25	25	50
5	PEC	MME 21205-08	Programme Elective-III	4	-	-	4	4	20	20	-	60	100
6	PEC	MME 21209-12	Programme Elective-IV	4	-	-	4	4	20	20	-	60	100
<b>Total</b>				<b>18</b>	<b>-</b>	<b>4</b>	<b>22</b>	<b>20</b>	<b>80</b>	<b>80</b>	<b>50</b>	<b>290</b>	<b>500</b>

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Dr. Pragati Patil  
Vice-Principal  
Tulsiramji Gaikwad Patil College of  
Engineering & Technology, Nagpur

Principal  
Tulsiramji Gaikwad Patil College of  
Engineering & Technology, Nagpur

**Programme: Mechanical Engineering**  
List of **Program Electives** offered By Mechanical Department (NBA Accredited)

Semester-I		Semester-II	
Programme Elective-I	Programme Elective-II	Programme Elective-III	Programme Elective-IV
MME21105:Computer Aided Mechanical Design	MME21109: Design for manufacturing and assembly	MME21205: Tribology	MME21209:Mechanics of Composite Materials
MME21106:Reliability, Maintainability & Wear	MME21110:Robotics Drives	MME21206: Design of Hydraulic and Pneumatic System	MME21210 System Modeling and Analysis
MME21107:MEMS Design and Industrial Automation	MME21111:Mechanization In Food Processing	MME21207: Optimization Methods for Mechanical Design	MME21211:Advance Fracture Mechanics
MME21108:Ergonomics for Mechanical Design	MME21112:Additive Manufacturing	MME21208: Product Design andDevelopment	MME21212:Reverse Engineering



Course Category	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses From other discipline)	FC (Foundation Course)	Project/ Seminar/ Industrial Training	Semester Wise Credits
Semester-I	14	08	-	-	-	22
Semester-II	10	08	-	2	-	20
Semester-III	-	03	-	-	15	18
Semester-IV	-	-	-	-	20	20
<b>Cumulative Sum</b>	<b>24</b>	<b>19</b>	<b>-</b>	<b>2</b>	<b>35</b>	<b>80</b>

  
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Engineering & Technology, Nagpur

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**Program: M. Tech. in Mechanical Engineering Design**

**Semester-II      MME21201 :Finite Element Analysis**

Teaching Scheme		Examination Scheme	
<b>Theory</b>	4 Hrs/week	<b>CT-I</b>	20 Marks
<b>Tutorial</b>	Nil	<b>CT-II</b>	20 Marks
<b>Total Credits</b>	<b>4</b>	<b>ESE</b>	60 Marks
<b>Duration of ESE: 3Hrs</b>		<b>Total Marks</b>	<b>100 Marks</b>

**Course Objectives:**

1.	To understand the basic concepts of FEA.
2.	To understand the concepts and techniques of mesh less FEM for advanced analysis.
3.	To understand the Integral equations for the element Matrices.
4.	To understand FEM Methods for the solution of 3D object.
5.	To understand the Element matrices and Element Shape Functions.

**Course Contents**

<b>Unit I</b>	Introduction to Engineering Analysis tool FEA and its application in Linear static Analysis and 2D problems, Study of Finite Element modeling and simulation Techniques, Use of FEA in structural vibration and thermal Analysis.
<b>Unit II</b>	Basics of FEM – Review of finite difference method, Initial value and boundary value problems Introduction to mesh less FEM, FEA and Linking mechanical design with FEA.
<b>Unit III</b>	Two Dimensional Elements: Linear Triangular Elements, Rectangular Elements, Two Dimensional Field equations: Coordinate Systems, Integral equations for the element Matrices, Heat transfer by conduction: One dimensional fin, two dimensional fins.
<b>Unit IV</b>	FE Applications in Solid Mechanics: The axial force members, potential energy formulations. The Truss Element, Beam element, plane frame element, modeling of bolts for assembly
<b>Unit V</b>	Two dimensional Elasticity: The displacement functions, Element matrices, Element Shape Functions, FEM Modeling and Preprocessing FEM Hardware and Post processing Survey of some FE Software Systems.

**Text Books**

T.1	Reddy, Junuthula Narasimha. An introduction to the finite element method. Vol. 2, no. 2.2. New York: McGraw-Hill, 1993.
T.2	Chandrupatla, Tirupathi R., Ashok D. Belegundu, T. Ramesh, and Chaitali Ray. Introduction to finite elements in engineering. Vol. 2. Upper Saddle River, NJ: Prentice Hall, 2002.
T.3	Desai, Chandrakant S., and John Fredrick Abel. Introduction to the finite element method; a numerical method for engineering analysis. Van Nostrand Reinhold, 1971.

**Reference Books**


R.1	K.J. Bathe, Finite Element Procedures, Klaus-Jurgen Bathe 6. Singiresu s. Rao . Finite element method in engineering.
R.2	Cook,R.D,“ConceptsandapplicationinFiniteElementAnalysis”,3rdEd,TheWiley&Sons
R.3	Dixit U.S.,“Finite Element Methods for Engineers”, engage Learning

**Useful Links**

[https://www.youtube.com/watch?v=tH1ygapKG2g&list=PLSGws\\_74K018SmggufD-pbzG3thPIpF94&index=2](https://www.youtube.com/watch?v=tH1ygapKG2g&list=PLSGws_74K018SmggufD-pbzG3thPIpF94&index=2)

[https://www.youtube.com/watch?v=UOp6JEiJctA&list=PLSGws\\_74K018SmggufD-pbzG3thPIpF94](https://www.youtube.com/watch?v=UOp6JEiJctA&list=PLSGws_74K018SmggufD-pbzG3thPIpF94)

<b>Course Code</b>	<b>Course Outcomes</b>	<b>CL</b>
<b>MME21201.1</b>	<b>Apply</b> Fundamentals of FEM for the solution of 2D object.	4
<b>MME21201.2</b>	<b>Apply</b> Different FEM Methods for the Solution of Boundary Value problems.	4
<b>MME21201.3</b>	<b>Evaluate</b> Integral equations for the element Matrices.	5
<b>MME21201.4</b>	<b>Apply</b> FEM Methods for the solution of 3D object	4
<b>MME21201.5</b>	<b>Evaluate</b> the Element matrices and Element Shape Functions.	5

  
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**Program: M. Tech. in Mechanical Engineering Design**

**Semester-II MME21202 : Stress Analysis**

Teaching Scheme		Examination Scheme	
Theory	4 Hrs/week	CT-I	20 Marks
Tutorial	Nil	CT-II	20 Marks
Total Credits	4	ESE	60 Marks
Duration of ESE: 3Hrs		<b>Total Marks</b>	<b>100 Marks</b>

**Course Objectives:**

1.	To understand Stress and Strain Function for the solution of 2D object.
2.	To understand the concepts and techniques of mesh less FEM for advanced analysis.
3.	To understand the principle of St. Venants theory for finding solution of Non circular sections.
4.	To understand thermal loads and thermal stress in simple objects
5.	To understand the Element matrices and Element Shape Functions.

**Course Contents**

<b>Unit I</b>	Fundamentals of stress & strain, stress strain relationship, Elastic constant, plane stress, plane strain. Stress Analysis for two dimensional problems in Cartesian co-ordinate system, equations of Equilibrium, compatibility equation, Airy's stress function, Analysis of rectangular plates by polynomials.
<b>Unit II</b>	Two dimensional problems in polar co-ordinates, general equations in polar co-ordinates for any symmetric case, pure bending of curved beams, crane hooks, bending of beams with initial curvature, Analysis of stresses in piston rings, stresses in rotating discs, with variable and constant sections, Effect of holes on stress distribution in plates, contact stresses.
<b>Unit III</b>	Torsion: Torsion of non circular section, St. Venants theory, Membrane analogy, Torsion of thin walled tubes.
<b>Unit IV</b>	Experimental stress analysis by strain gauge & photo elasticity technique, strain rosettes, recording instruments, Thermal stresses: Thermo elasticity, thin circular discs, thermal stresses in turbine rotors, Analysis of beams under thermal load. Brittle coating techniques, polariscope, Isochromatic & isoclinic fringes, compensation techniques.
<b>Unit V</b>	Introduction to fracture Mechanics, Linear elastic fracture mechanics, Griffith's criterion, Elastic-plastic fracture mechanics.

**Text Books**


T.1	"Experimental Stress Analysis" by Sadhu Singh, Khanna Publishers
T.2	"Experimental Stress Analysis" by UC Jindal, Pearson Education India
T.3	Experimental stress analysis- Dalley & Raillery, McGraw Hill Education

**Reference Books**

R.1	Theory of Elasticity - Timoshenko & Goodier
R.2	Experimental stress analysis- Dalley & Raillery, McGraw Hill Education;

R.3	Experimental Stress Analysis- Dove & Adams
R4	Some Basic Problems of the Mathematical Theory of Elasticity- N I Mushelishvili

Course Code	Course Outcomes	CL	Class Sessions
MME21202.1	<b>Apply</b> Stress and Strain Function for the solution of 2D object.	4	9
MME21202.2	<b>Derive</b> the stress and strain equation for piston rings, and rotating discs.	3	9
MME21202.3	<b>Apply</b> principle of St. Venants theory for finding solution of Non circular sections	4	9
MME21202.4	<b>Calculate</b> thermal loads and thermal stress in simple objects.	3	9
MME21202.5	<b>Analyze</b> fundamental of fracture mechanics.	5	9

  
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**Program: M. Tech. course in Mechanical Engineering Design**

**Semester - II**

**MME21203 : Stress and Finite Element Analysis Lab**

**Teaching Scheme**

**Practical** 4 Hrs/week

**Total Credit** 2

**Examination Scheme**

**CA** 25 Marks

**ESE** 25 Marks

**Total** 50 Marks

**Duration of ESE: 02 Hrs**

**Course Outcomes (CO)**

Students will be able to

1. **Apply** Fundamentals of FEM for the solution of 2D object.

2. **Apply** Different FEM Methods for the Solution of Boundary Value problems.

3. **Evaluate** Integral equations for the element Matrices.

4. **Calculate** thermal loads and thermal stress in simple objects.

5. **Analyze** fundamental of fracture mechanics.

Sr. No.	List of Experiment	COS
1	Analyze the Static structure of bar with 1-D elements using standard FEA package.	CO1
2	Analyze the Static structure of truss with 2-D elements using standard FEA package.	CO1
3	Design Static structure with 2-D CST element using standard FEA package.	CO2
4	Design Static structure with 2-D Axis-symmetric element using standard FEA package.	CO2
5	Evaluate Static structure of a beam in transverse loading using standard FEA package.	CO3
6	Evaluate Thermal analysis to estimate nodal temperatures using standard FEA package.	CO3
7	Determine the direction of principle stress using plane Polariscope method.	CO4
8	Evaluate of stress concentration factor by photo elasticity.	CO5

**Text Books**

1 "Experimental Stress Analysis" by Sadhu Singh, Khanna Publishers

2 Reddy, Junuthula Narasimha. An introduction to the finite element method. Vol. 2, no. 2.2. New York: McGraw-Hill, 1993.

**Reference Books**

1 K.J. Bathe, Finite Element Procedures, Klaus-Jurgen Bathe 6. Singiresu s. Rao. Finite element method in engineering.


2 Cook, R.D, "Concepts and application in Finite Element Analysis", 3rd Ed, The Wiley & Sons

3 Experimental stress analysis- Dalley & Raillery, McGraw Hill Education;

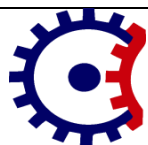
**Useful Links**

1 [https://www.youtube.com/watch?v=tH1ygapKG2g&list=PLSGws\\_74K018SmggufD-pbzG3thPIpF94&index=3](https://www.youtube.com/watch?v=tH1ygapKG2g&list=PLSGws_74K018SmggufD-pbzG3thPIpF94&index=3)

2 [https://www.youtube.com/watch?v=UOp6JEiJctA&list=PLSGws\\_74K018SmggufD-pbzG3thPIpF94](https://www.youtube.com/watch?v=UOp6JEiJctA&list=PLSGws_74K018SmggufD-pbzG3thPIpF94)

  
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**Program: M. Tech. in Mechanical Engineering Design**

**Semester-II**

**MME21204 : Literature Review & Research Methodology**

Teaching Scheme		Examination Scheme	
Theory	2Hrs/week	CT-I	25 Marks
Tutorial	Nil	CT-II	25 Marks
Total Credits	2	ESE	50 Marks
Duration of ESE: 1 Hrs		Total Marks	100 Marks

**Course Objectives:**

1.	To understand philosophy of research.
2.	To understand conceptual and methodological issues that will conduct successful research, Planning of Review work
3.	To understand process of planning and proposing, testing of hypothesis, Research Design and Sampling
4.	To understand different statistical analysis methods, Presentation Skills, Application Orientation in Research.
5.	To understand research and article writing skills, Data Analysis Reporting in Thesis

**Course Contents**

<b>Unit I</b>	<b>Research Foundation</b> Objectives of Research, Types of Research, Scientific Research, Research and Theory, Conceptual and theoretical Models, Philosophy of research, Physical, psychological health and research.
<b>Unit II</b>	<b>Review of Literature</b> Need for Reviewing Literature, What to Review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Library and documentation.
<b>Unit III</b>	<b>Planning of Research</b> The planning process, Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis, Research Design and Sampling, Measurement, Research Design/Plan.
<b>Unit IV</b>	<b>Processing of Data and Statistical Analysis of Data</b> Introduction to Statistical Software, Statistical analysis of data MINITAB, SPSS, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Questioners Preparation and Presentation Skills, Application Orientation in Research.
<b>Unit V</b>	<b>Report and Thesis writing</b> Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Data and Data Analysis Reporting in a Thesis, Use of Endnote, Language Proficiency, Citations and Plagiarism, Bibliography, API , appendix, table, Observations arrangement, Preparation of type script and lay-out of thesis, Use of LATEX Indexing of Journals, Impact factor and social Media for Researchers.

**Text Books**

T.1	Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9
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T.2	StatisticalMethodsforResearchWorkersbyFisherR.A.,CosmoPublications,New Delhi ISBN:81-307-0128-6
<b>Reference Books</b>	
R.1	Design and Analysis of Experiments by Montgomery D.C. (2001), John Wiley, ISBN: 0471260088
R.2	Methodology of Research in Social Sciences by O. R. Krishnaswamy and M. Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
R.3	SPSS online manual

<b>Useful Links</b>
<a href="https://nptel.ac.in/courses/127/106/127106227">https://nptel.ac.in/courses/127/106/127106227</a>

Course Code	Course Outcomes	CL
<b>MME21204.1</b>	<b>Learn</b> philosophy of research.	2
<b>MME21204.2</b>	<b>Describe</b> conceptual and methodological issues that will conduct successful research	3
<b>MME21204.3</b>	<b>Describe</b> process of planning and proposing, testing of hypothesis.	3
<b>MME21204.4</b>	<b>Describe</b> different statistical analysis methods.	3
<b>MME21204.5</b>	<b>Develop</b> research and article writing skills.	3

  
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**Program: M. Tech. in Mechanical Engineering Design**

**Semester-II** MME21206: Design of Hydraulic and Pneumatic System (**Programme Elective-III**)

Teaching Scheme		Examination Scheme	
<b>Theory</b>	4 Hrs/week	<b>CT-I</b>	20 Marks
<b>Tutorial</b>	Nil	<b>CT-II</b>	20 Marks
<b>Total Credits</b>	<b>4</b>	<b>ESE</b>	60 Marks
<b>Duration of ESE: 3Hrs</b>		<b>Total Marks</b>	<b>100 Marks</b>

**Course Objectives:**

1.	To understand components of hydraulic system for industrial hydraulic application
2.	To understand Control & Regulation Elements of hydraulic system.
3.	To understand Hydraulic Circuits for Industrial Application
4.	To understand Pneumatic System for Industrial Application
5.	To understand methods of installation and Maintenance hydraulic and pneumatic System.

#### Course Contents

<b>Unit I</b>	<b>Oil Hydraulic Systems:</b> Hydraulic Power Generator, selection and specification of pumps, pump characteristics. <b>Hydraulic Actuators:</b> Linear & Rotary Actuators, Selection, Specification and Characteristics.
<b>Unit II</b>	<b>Control &amp; Regulation Elements:</b> Pressure, direction and flow control valves, relief valves, and non return and safety valves actuation systems.
<b>Unit III</b>	<b>Hydraulic Circuits:</b> Reciprocating quick return, sequencing synchronizing circuits, accumulator circuits, industrial circuits, press circuits, hydraulic milling machine, grinding, planning copying, forklift earthmover circuits, design and selection of components, safety and emergency modules.
<b>Unit IV</b>	<b>Pneumatic System, and Circuits :</b> Pneumatic fundamentals ,control elements, position and pressure sensing, logic circuits, switching circuits, fringe condition modules and their integration, sequential circuits, cascade methods, mapping methods, compound circuit design, combination circuit design .
<b>Unit V</b>	<b>Installation, Maintenance and Special Circuits:</b> Pneumatic equipments, selection of components, design calculations, application, fault finding, hydro pneumatic automation, robotic circuits.


#### Text Books

T.1	HydraulicsandPneumaticsControls-ShanmugaSundaram,S.ChandPublication
T.2	IndustrialHydraulicsandPneumatics-PurushottamBalasoPawar,SankalpPublication
T.3	Hydraulics and Pneumatics - T Jagadeesha ,I K International Publishing House Pvt. Ltd

#### Reference Books

R.1	HydraulicsandPneumaticsControls-ShanmugaSundaram,S.ChandPublication
R.2	IndustrialHydraulicsandPneumatics-PurushottamBalasoPawar,SankalpPublication
R.3	Hydraulics and Pneumatics - T Jagadeesha ,I K International Publishing House Pvt. Ltd

Course Code	Course Outcomes	CL
MME21206.1	<b>Select</b> components of hydraulic system for industrial hydraulic application	3
MME21206.2	<b>Describe</b> Control & Regulation Elements of hydraulic system.	3
MME21206.3	<b>Design</b> Hydraulic Circuits for Industrial Application.	5
MME21206.4	<b>Design</b> Pneumatic System for Industrial Application	5
MME21206.5	<b>Describe</b> methods of installation and Maintenance hydraulic and pneumatic System.	3

  
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**Program: M. Tech. in Mechanical Engineering Design**

**Semester-II** MME21212:Reverse Engineering (Professional Elective-IV)

Teaching Scheme		Examination Scheme	
<b>Theory</b>	4 Hrs/week	<b>CT-I</b>	20 Marks
<b>Tutorial</b>	Nil	<b>CT-II</b>	20 Marks
<b>Total Credits</b>	<b>4</b>	<b>ESE</b>	60 Marks
<b>Duration of ESE:</b> 3Hrs		<b>Total Marks</b>	<b>100 Marks</b>

**Course Objectives:**

1. To understand phases of reverse engineering for geometric model development
2. To understand methodologies and techniques used for reverse engineering
3. To understand a reverse engineering system.
4. To understand the relationship between the reverse engineering and rapid prototyping.
5. To understand the use of reverse engineering in creating curves.

**Course Contents**

<b>Unit I</b>	Introduction: Reverse engineering fundamentals-The generic process-Three phases of reverse engineering-Phase I: Scanning, Phase II: Point processing, Phase III: Geometric model development.
<b>Unit II</b>	Methodologies and techniques of Reverse Engineering: Computer aided reverse engineering, Computer vision and reverse engineering, Structured light range imaging, Scanner pipeline
<b>Unit III</b>	Reverse engineering hardware and software: Introduction, Reverse engineering hardware, Reverse engineering software, Selection of a reverse engineering system, Case studies with implementation.
<b>Unit IV</b>	Introduction to rapid prototyping: Need & Development of RP systems, RP process chain, Impact of Rapid prototyping and Tooling on Product Development, Benefits, Digital prototyping, Virtual prototyping, Applications, Relationship between reverse engineering and rapid prototyping, Case studies with implementation.
<b>Unit V</b>	Curve and Surface Modeling: Parametric form of curves and a surface, Hermite curve and surface, Bezier curve and surface, B-spline curve and surface, introduction of NURBS.



### Text Books

T.1	K.Otto and K.Wood, Product Design: Techniques in Reverse Engineering and New Product Development, 1st edition, Prentice Hall, 2001. ISBN-13: 978-0130212719.
T.2	V.Raja and K. Fernandes, Reverse Engineering: An Industrial Perspective, Springer-Verlag, 2008. ISBN: 978-1-84628-855-5
T.3	K.A.Ingle, Reverse Engineering, McGraw-Hill, 1994. ISBN-13: 978-0070316935.

### Reference Books

R.1	L.Wills and P.Newcomb, Reverse Engineering, 1st edition, Springer-Verlag, 1996. ISBN-13: 978-1475788280
R.2	C.K.Chua, K.F.Leong and C.S.Lim, Rapid Prototyping: Principles and Applications, 4th edition, World Scientific, 2010. ISBN: 978-981-277-897-0
R.3	L.Wills and P.Newcomb, Reverse Engineering, 1st edition, Springer-Verlag, 1996. ISBN-13: 978-1475788280

### Useful Links

<https://archive.nptel.ac.in/courses/112/104/112104265/>.

Course Code	Course Outcomes	CL
MME21212.1	<b>Describe</b> phases of reverse engineering for geometric model development	4
MME21212.2	<b>Describe</b> methodologies and techniques used for reverse engineering	4
MME21212.3	<b>Select</b> a reverse engineering system.	4
MME21212.4	<b>Develop</b> an understanding on the relationship between the reverse engineering and rapid prototyping.	4
MME21212.5	<b>Analyze</b> the use of reverse engineering in creating curves.	4

  
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