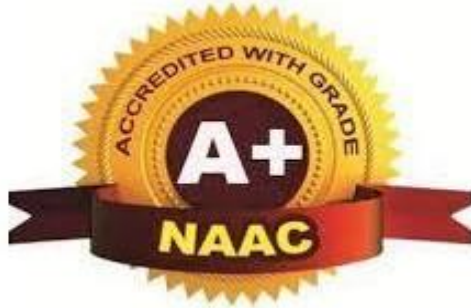# TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institution

DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech.in Mechanical Engineering Design

Teaching Scheme

AcademicYear 2023-24

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

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

- To provide facilities and services to meet the challenges of Industry and Society.

- To facilitate socially responsive research, innovation and entrepreneurship.

- To ascertain holistic development of the students and staff members by 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.

Program 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.

Program Outcomes (PO)

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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, cultural, societal, and environmental considerations.

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.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

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. Knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Mechanical professional engineering practice

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.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large such as able to comprehend and with write effective reports and design documentation, make effective presentations and give and receive clear instructions.

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 in multidisciplinary environments.

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)

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 Instructions and Syllabus

Scheme of Instructions for Second Year M. Tech. course in Mechanical Engineering Design

Semester–III (w.e.f.:AY2023-24)

Sr. No.	Course Category	CourseCode	CourseTitle	L	T	P	Contact Hrs/week	Credits	ExamScheme				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	PROJ	MMED 2301	Dissertation Phase-I	-	-	20	20	10	-	-	100	100	200
2	PEC	MMED 2302	MOOC course (8-12Hr)	-	-	-	-	3	-	-	-	-	-
3	OEC	M$$XX01-06	Open Elective-I	3	-	-	3	3	15	15	10	60	100
			Total	3	-	20	23	16	15	15	110	160	300

*$$-CS, SE, IP, MB, MED

Note: 1.MMED 2302 will be decided by respective Guide in Consultation with Program Coordinator. Course is mandatory for student and his dissertation phase I will be considered incomplete without this Mandatory MOOC Course.

2. In Case, the course offered online are not completely relevant with the topic of dissertation then any course suggested by NASSCO Mon recent technologies can be opted by candidate.

3. Programme coordinator will provide list of 03 MOOC courses of minimum 08 weeks duration (as per availability). Students are expected to complete any one out of three courses in order to get the required credits.

L-Lecture   T-Tutorial   P-Practical

CT1- ClassTest1 TA/CA-Teacher Assessment/Continuous Assessment

CT2- ClassTest2 ESE-End Semester Examination (For Laboratory End Semester performance)

PROGRESSIVE CREDITS=36+16=52

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Scheme of Instructions and Syllabus

Scheme of Instructions for Second Year M.Tech. Course in Mechanical Engineering Design

Semester–IV(w.e.f.: AY2023-24)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/week	Credits	Exam Scheme				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1.	PROJ	MMED 2401	Dissertation Phase-II	-	-	32	32	16	-	-	100	200	300
			Total	**-**	**-**	**32**	**32**	**16**	**-**	**-**	**100**	**200**	**300**

TA/CA-Teacher Assessment/Continuous Assessment

ESE-End Semester Examination (For Laboratory: End Semester Performance) TOTAL CREDITS=52+16=**68**

BoS Chairman
Head
Department of Mechanical Engineering
Tulsiramji Gaikwad Patil College of
Engineering & Technology, NAGPUR.

Director/Dean Academics
Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

Vice Principal
Tulsiramji Gaikwad-Patil
College Of Engineering &
Technology, Nagpur

Principal
Principal
Tulsiramji Gaikwad Patil College Of
Engineering and Technology, Nagpur

Scheme of Instructions and Syllabus
Scheme of Instructions for M.Tech. Course in Mechanical Engineering Design
List of Professional Elective Courses

Semester-I		Semester-II	
Professional Elective-I	**Professional Elective-II**	**Professional Elective-III**	**Professional Elective-IV**
MMED 1107: Computer Aided Mechanical Design	**MMED 1111**Advance Fracture Mechanics	**MMED 1206**: Tribology	**MMED 1210**: Mechanics of Composite Materials
MMED 1108: Reliability, Maintainability & Wear	**MMED 1112**: Robotics Drives	**MMED 1207**:Design of Hydraulic And Pneumatic System	**MMED 1211**:System Modeling and Analysis
MMED 1109:MEMS Design and Industrial Automation	**MMED 1113**: Mechanization In Food Processing	**MMED 1208**:Optimization Methods for Mechanical Design	**MMED 1212**::Industrial Safety
MMED 1110:Ergonomics for Mechanical Design	**MMED 1114**: Additive Manufacturing	**MMED 1209:** Product Design and Development	**MMED 1213**: Reverse Engineering

List of Audit Courses and Open Electives

Semester–I	Semester–II	Semester-III
Audit Course-I	**Audit Course-II**	**Open Electives**
MAU1101:Pedagogy Studies	MAU1201:Constitution of India	MCSXX01:Operation Research
MAU1102:Disaster Management	MAU1202:Research Paper Writing	MSEXX02:Cost Management of Engineering Projects
MAU1103:Sanskrit for Technical Knowledge	MAU1203:Stress Management by Yoga	MSEXX03:Energy Audit & Management
MAU1104:Value Education	MAU1204:Personality Development through Life Enlightenment Skills	MCSXX04::3D Printing Technology
		MMBXX06:Business Analytics

Course Category	PCC (Professional Core courses)	PEC (Professional Elective course)	OEC (Open Elective courses from other discipline)	Project /Seminar /Industrial Training	Semester Wise Credits
Semester-I	12	06	-	-	18
Semester-II	12	06	-	-	18
Semester-III	-	03	03	10	16
Semester-IV	-	-	-	16	16
Cumulative Sum	24	15	03	26	68

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Program: M.Tech In Mechanical Engineering Design

Semester-III | MCSXX01: Open Elective-I Operation Research

Teaching Scheme				Examination Scheme	
Theory	3 Hrs/Week			**CT-I**	15 Marks
Tutorial				**CT-II**	15 Marks
Total Credits	**3**			**CA**	10 Marks
Duration of ESE: 3Hrs				**ESE**	60 Marks
Pre-Requisites: Mathematics – I, Mathematics – II, Engineering Applied Physics, Linear Algebra.				**Total Marks**	**100 Marks**

Course Objectives:

1	To study the various OR tools,
2	Study to apply appropriate model to the given situation
3	Formulate the problem
4	Solve and analyze the problem

Course Contents

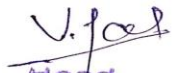| Unit I	Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR.Linear programming: Introduction, Linear programming formulation, solutions of LPP by graphical methods and simplex method. formulation of Dual of LPP. ,
Unit II	Formulation of transportation model, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods, Unbalanced transportation problem, Variants in Transportation Problems. Formulation of the Assignment problem, unbalanced assignment problem, typical assignment & travelling salesman problem
Unit III	Replacement Models- Concept of equivalence, Interest Rate, Present worth, economic evaluations of Alternatives, Group replacement models. Inventory Control Models- Introduction and inventory management concepts, Economic Order Quantity model (EOQ), Economic Production Quantity model (EPQ), model for purchase allowing for shortages, ABC analysis.
Unit IV	Drawing of Network, CPM & PERT, probability of completion of project, Cost Analysis of Project, and Concept of Crashing. Allocation & updating of Network
Unit V	Sequencing Model – Introduction, Sequencing Model: n job two machines problem, n job 3 machines problem, 2 jobs m machine problem. Simulations –Concept, applications in waiting line situations, inventory and network. Queuing models – Poisson arrivals and Exponential service times – Single channel models (MM1)and Multi channel models. (No derivation expected)

Text Books	
T.1	Engg. Optimization theory & practice by S.S.Rao, New Age Pub
T.2	Optimization Concepts & application in Engg. by A.D. Belegundu, Pearson.

Reference Books	
R.1	Introduction to optimum design by J. S. Arora, McGraw Hill Pub

R.2	Optimization Theory & Practice by M.C.Joshi, Narosa Pub.		
R.3	Practical Methods of Optimization by R. Flether, Wiley.		

CourseCode	Course Outcomes	BT level	Class Sessions
MCSXX01.1	**Recognize** the importance and value of Operations Research and mathematical modeling in solving practical problems in industry	3	9
MCSXX01.2	**Convert** given situation to mathematical form and determine optimal settings.	3	9
MCSXX01.3	**Determine** the value of the given Replacement Models.	3	9
MCSXX01.4	**Draw** project networks for quantitative analysis of projects.	2	9
MCSXX01.5	**Determine** the value of the given game model, Sequencing Model and Inventory Model.	2	9

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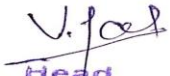
Semester-III | MCSXX04: Open Elective-I 3D Printing Technology

Teaching Scheme				Examination Scheme	
Theory	3 Hrs/Week			**CT-I**	15 Marks
Tutorial				**CT-II**	15 Marks
Total Credits	**3**			**CA**	10 Marks
Duration of ESE: 3Hrs				**ESE**	60 Marks
Pre-Requisites: Additive Manufacturing, Rapid Prototyping, Manufacturing Technology				**Total Marks**	**100 Marks**

Course Objectives:

1	The objective of this course is to impart students to the fundamentals of various 3D Printing Techniques for application to various industrial needs
2	Student will be able to convert part file into STL format.
3	Student will be able to select advance material for 3D printing
4	Student will be able to understand the method of manufacturing of liquid based, powder based and solid based techniques.

Course Contents

Unit I	**Unit-I: Introduction to Additive Manufacturing and 3D Printing Technology** Development of Additive Manufacturing, Major trends shaping the evaluation of 3D printing, Technology Improvement, Process, Classification of Additive Manufacturing Systems, Advantages and Limitations, Additive V/S Conventional Manufacturing Processes.
Unit II	**Unit-II: Materials in Additive Manufacturing** Choosing Materials for Manufacturing, Multiple Materials, Metal AM Processes & Materials, Composite Materials, Biomaterials, Hierarchical Materials , Ceramics & Bio-ceramics, 4D Printing & Bio-Active Materials
Unit III	**Unit-III: Additive Manufacturing Equipment** Process Equipment- Design and process parameters, Governing Bonding Mechanism, Common Faults and Troubleshooting, Process design
Unit IV	**Unit-IV: Post Processing** Support Material Removal**,** Surface Texture Improvements**,** Accuracy Improvements**,** Aesthetic Improvements**,** Property Enhancements Using Non-thermal Techniques**,** Property Enhancements Using Thermal Techniques
Unit V	**Unit-V: Applications and Examples** ication - Material Relationship, Applications in Design, Applications in Engineering, Analysis and Planning, Applications in Manufacturing and Tooling, Applications in Aerospace Industry, Applications in Automotive Industry, Applications in Jeweler Industry, Applications in Arts and Architecture.

Text Books	
T.1	Additive Manufacturing and 3D Printing Technology: Principles and Applications, Dr. G.K. Awari, Dr.D.P.Kothari, Prof. Vishwjeet Ambade, Dr. C. S. Thorat, CRC Press, Taylor & Francis Group
T.2	Additive Manufacturing Technologies 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing , Ian Gibson • David Rosen • Brent Stucker, Springer New York Heidelberg Dordrecht London

T.3	Additive Manufacturing Innovations, Advances, and Applications , t.S. Srivatsan • t.S. Sudarshan, CRC Press, Taylor & Francis Group

Reference Books

R.1	Understanding Additive Manufacturing Rapid Prototyping · Rapid Tooling · Rapid Manufacturing , Andreas Gebhardt, Hanser Publishers, Munich Hanser Publications, Cincinnati
R.2	Additive Manufacturing of Metals: The Technology, Materials, Design and Production , Li Yang • Keng Hsu • Brian Baughman Donald Godfrey • Francisco Medina Mamballykalathil Menon Soeren Wiener, Springer Series in Advanced Manufacturing

Useful Links

1	https://onlinecourses.nptel.ac.in/noc21_me115/preview
2	https://onlinecourses.nptel.ac.in/noc20_me50/preview

CourseCode	Course Outcomes	BT level	Class Sessions
MCSXX04.1	**Identify** the Different 3D printing Technology and machines used in Additive manufacturing.	2	9
MCSXX04.2	**Categorize** and Select suitable Material for printing.	2	9
MCSXX04.3	**Categorize** and select the different equipments in Additive manufacturing	2	9
MCSXX04.4	**Illustrate** the concept of Post processing	3	9
MCSXX04.5	**Illustrate** applications of Additive manufacturing	3	9

Head
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Engineering & Technology, NAGPUR.

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