Gandhinagar Institute of Technology

Academic Regulation & Curriculum

for

M.Tech

in

CAD/CAM

***w.e.f.* 2026-27**

Preamble

The Mechanical Engineering Department, Gandhinagar Institute of Technology, Gandhinagar University, is committed to fostering academic excellence, applied research, professional ethics, and industry-oriented learning across the disciplines of Mechanical Engineering, Robotics & Automation, and Energy Engineering. The programmes offered by this department are designed in alignment with AICTE guidelines, NEP 2020, Outcome-Based Education (OBE), and Choice-Based Credit System (CBCS) principles, with the goal of preparing skilled, adaptable, and innovation-driven engineers and technologists for India's rapidly evolving industrial and technological landscape.

Under the NEP 2020 framework, the department embraces a flexible, multidisciplinary, and learner-centric approach to engineering education. The Choice-Based Credit System (CBCS) enables students to exercise academic autonomy by selecting elective courses aligned with their interests, career goals, and emerging industry needs. The Outcome-Based Education (OBE) philosophy ensures that every course, every laboratory exercise, and every project activity is purposefully designed to achieve defined Programme Outcomes (POs), Programme Educational Objectives (PEOs), and Course Outcomes (COs), making the learning process transparent, measurable, and continuously improvable.

The department offers Ten programmes spanning undergraduate and postgraduate levels: D.Tech in Mechanical Engineering, D.Tech in Robotics & Automation, B.Tech in Mechanical Engineering, B.Tech in Robotics & Automation, B.Tech in Energy Engineering, B.Tech in Robotics and Artificial Intelligence, M.Tech in CAD/CAM, M.Tech in Thermal Engineering, and M.Tech in Energy Engineering, M.Tech in Robotics and Artificial Intelligence. Together, these programmes form a cohesive academic ecosystem that addresses the full spectrum of mechanical sciences — from classical thermodynamics and manufacturing to advanced robotics, intelligent automation, and sustainable energy systems.

The curriculum integrates core engineering domains including Machine Design, Fluid Mechanics, Thermodynamics, Manufacturing Processes, Mechatronics, Control Systems, Robotics, CAD/CAM, Finite Element Analysis, Renewable Energy, and Artificial Intelligence applications in engineering. Special emphasis is placed on Industry 4.0 technologies, smart manufacturing, embedded systems, energy transition, and computational design tools that are shaping the future of engineering practice in India and globally.

Through a balanced pedagogy of classroom instruction, laboratory experimentation, industry internships, live projects, design challenges, and research activities, the department aims to develop engineers who are not only technically proficient but also capable of critical thinking, independent problem-solving, and responsible innovation. The postgraduate programmes in CAD/CAM, Thermal Engineering, and Energy Engineering are designed to deepen specialization, advance research capability, and prepare graduates for leadership roles in industry and academia.

The department continuously reviews and updates its curriculum through feedback from industry partners, academic peers, alumni, and students, ensuring that its graduates remain relevant, competitive, and equipped to contribute meaningfully to India's manufacturing sector, energy future, and the global engineering community.

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1. Institutional Vision & Mission

1.1 Vision:

To create a flexible and learner-focused engineering ecosystem that builds strong technical skills, practical knowledge, and innovative thinking, preparing graduates to adapt, perform, and lead in a rapidly evolving technological and societal environment.

1.2 Mission:

To provide a holistic learning environment that develops technical skilled, innovative, and socially responsible engineers capable of addressing industrial, technological, and societal needs.

2. Departmental Vision Mission

2.1 Vision:

Impart outcome-based education to engrave mechanical engineers having a successful future with productive capabilities and progressive/innovative approach to meet the social and economical needs of society.

2.2 Mission:

To sensitize mechanical engineering students for a conquering profession/future with the subjective information of diverse technical components through vital mechanical engineering abilities with the superb mindset and fruitful teamwork with the aid of making them able to think out of the box using the state of the art laboratory facilities and resources.

3. Program Educational Objectives

PEO 1:
To develop graduates with advanced knowledge and technical expertise in Computer-Aided Design (CAD), Computer-Aided Manufacturing (CAM), and product development, enabling them to analyze, design, optimize, and manage modern manufacturing systems and engineering products for industrial and societal applications.

PEO 2:
To equip graduates with research, innovation, and problem-solving skills for addressing complex engineering challenges related to product design, manufacturing processes, automation, robotics, computer-integrated manufacturing, additive manufacturing, and smart manufacturing technologies.

PEO 3:
To prepare graduates for successful careers in industry, research organizations, academia, consultancy, and entrepreneurship through the effective application of advanced CAD/CAM tools, simulation techniques, digital manufacturing technologies, and professional engineering practices.

PEO 4:
To foster professional ethics, environmental responsibility, leadership qualities, teamwork, and effective communication skills for contributing to sustainable manufacturing, resource optimization, and societal welfare.

PEO 5:
To encourage lifelong learning, continuous professional development, and adaptation to emerging technologies and interdisciplinary advancements in digital design, intelligent manufacturing, Industry 4.0, and advanced production systems.

4. Program Details

4.1 Program Structure & Duration

- Duration & Intake : 2 Years & 9 Seats
- Semesters: 4
- Mode: Full Time
- Credit Structure: As per NEP/University norms
- Medium of Instruction: English

4.2 Eligibility Criteria for Admission

Candidates who have passed B.E. / B.Tech in Mechanical / Production / Industrial / Automobile / Manufacturing / Mechatronics Engineering or an equivalent discipline from a recognised university, with a minimum of 50% aggregate marks (45% for reserved category candidates as per applicable norms), shall be eligible for admission to the programme. Candidates holding a valid GATE score in a relevant discipline shall be given preference as per prevailing admission rules.

4.3 Admission Procedure

Admission to the M.Tech CAD/CAM programme may be granted either through the Admission Committee for Professional Courses (ACPC), Government of Gujarat, based on the prevailing postgraduate / GATE admission norms, or through the direct admission process conducted by the University as per applicable rules and eligibility criteria.

4.4. Credit Summary

Component	Credits	Sem I	Sem II	Sem III	Sem IV
Professional Core	23	13	10	0	0
Program Electives (I–IV)	18	5	13	0	0
MLC – Research Methodology & IPR	3	3	0	0	0
Audit Courses	0	0	0	0	0
Dissertation / Internal Review / Seminar	32	0	0	16	16
Total	**76**	**21**	**23**	**16**	**16**

Definition of Credit (as per UGC):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 2 Hours Practical / Lab / Fieldwork per Week = 1 Credit

5. Curriculum Structure

Gandhinagar Institute of Technology (01)

Program Name: Masters of Technology (02) | **Branch Name (Code): CAD/CAM (08)**

Semester / Year : First Year / Semeter I | **Effective From Academic Year:2025-26**

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
					L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCR - 6.5	10080109	Professional Core	Applied Mathematics for Engineers	4	4	0	0	4	60	40	0	0	100
	10080101	Professional Core	Computer Aided Tools for Manufacturing	4	3	0	2	5	60	40	30	20	150
	10080102	Professional Core	Computer Application in Design	5	3	0	4	7	60	40	30	20	150
	10000152	Audit	Disaster Management	0	2	0	0	2	0	50	0	0	50
	10000151	MLC	Research Methodology and IPR	3	1	1	2	4	0	0	80	20	100
		Program Elective-I	Elective-I	5	4	0	2	6	60	40	30	20	150
				21	**17**	**1**	**10**	**28**					**700**
	Elective-I												
	10080111	Program Elective-I	Rapid Prototyping										
	10080112	Program Elective-I	Advanced Finite Element Analysis										
	10080113	Program Elective-I	Design of Manufacturing Systems										

Program Name: Masters of Technology (02) | **Branch Name (Code): CAD/CAM (08)**

Semester / Year : First Year / Semeter II | **Effective From Academic Year:2025-26**

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
					L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCR - 6.5	10000251	Audit	Technical Writing	0	2	0	0	2	0	50	0	0	50
	10080201	Professional Core	Mechanism Design and Analysis	3	3	0	0	3	60	40	0	0	100
	10090209	Professional Core	Research Review and Seminar	3	0	0	6	6	0	0	100	0	100
	10080202	Professional Core	CNC Technology	4	3	0	2	5	60	40	30	20	150
		Program Elective-II	Elective-II	5	4	0	2	6	60	40	30	20	150
		Program Elective-III	Elective-III	6	4	2	0	6	60	40	0	0	100
		Program Elective-IV	Elective-IV	2	2	0	0	2	60	40	0	0	100
			Total	**23**	**18**	**2**	**10**	**30**					**750**

Elective-II			Elective-III			Elective-IV		
10080211	Program Elective-II	Mechanical Behaviour of Material	10080221	Program Elective-III	Computer Control and Process Planning	10080231	Program Elective-IV	Cost Management of Engineering Projects
10080212	Program Elective-II	Design for Manufacturing and Assembly	10080222	Program Elective-III	Quality Management	10080232	Program Elective-IV	Industrial Safety
10080213	Program Elective-II	Lean and Advanced Manufacturing System	10080223	Program Elective-III	Industrial Robotics	10080233	Program Elective-IV	Composite Materials

Gandhinagar Institute of Technology (01)

Institute Name (Code): Gandhinagar Institute of Technology (01)	**G U - 4th Batch - Year - 2025 - 26**
Program Name: Masters of Technology (02)	**Branch Name (Code): CAD/CAM (08)**
Semester / Year : Second Year / Semeter III	**Effective in Academic Year - 2026 - 27 (July - Dec)**

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
					L	T	P	Total	University	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 7.0	10080301	Internal Review	Internal Review - I	2	0	0	4	4	0	0	100	0	100
	10080302	Dissertation Phase	Dissertation Phase - I	14	0	0	28	28	0	0	100	0	100
			Total	**16**	**0**	**0**	**32**	**32**					**200**

Institute Name (Code): Gandhinagar Institute of Technology (01)	**G U - 4th Batch - Year - 2025 - 26**
Program Name: Masters of Technology (02)	**Branch Name (Code): CAD/CAM (08)**
Semester / Year : Second Year / Semeter IV	**Effective in Academic Year - 2026 - 27 (July - Dec)**

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
					L	T	P	Total	University	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 7.0	10080401	Internal Review	Internal Review - II	2	0	0	4	4	0	0	100	0	100
	10080402	Dissertation Phase	Dissertation Phase - II	14	0	0	28	28	0	0	100	0	100
			Total	**16**	**0**	**0**	**32**	**32**					**200**

1st Sem	700	**3rd Sem**	200
2nd Sem	750	**4th Sem**	200

Total Credit:	**76**
Total Marks:	**1850**

6. Teaching, Learning & Evaluation

6.1 Teaching Methodology

The program shall adopt: Classroom Teaching · Case Studies · Industry Interaction · Site Visits · Workshops · CAD/CAM/CAE Software Training · Research Projects · Seminars & Literature Review · AI-based Learning Tools · Blended and Digital Learning.

6.2 Attendance Rules

- Minimum 75% attendance shall be mandatory in each course.
- Students below prescribed attendance may not be permitted to appear in examination.
- Additional attendance requirements may apply for practicals, seminars, and dissertation work.

6.3 Examination and Evaluation System

6.3.1 Evaluation Components The evaluation may consist of Continuous Internal Evaluation (CIE) and End Semester Examination (ESE). CIE may include: Mid-Semester Examination · Assignments · Presentations · Software/Lab Work · Class Test · AI Quiz & Viva Voce · Seminar · Dissertation Review.

6.4 Weightage

- Continuous Internal Evaluation: 40%
- End Semester Examination: 60%

6.5 Passing Standards

A student shall be declared to have successfully passed a course subject to fulfilling the minimum passing criteria prescribed by the University from time to time. The passing criteria for the M.Tech CAD/CAM programme shall generally include:

- Minimum 40% marks in the End Semester Examination (ESE) where applicable.
- Minimum 50% aggregate marks considering all evaluation components including continuous internal evaluation and end semester examination.

- Separate passing criteria may be applicable for theory, practical, laboratory, seminar, and dissertation components as prescribed by the University.

Students must fulfil all academic, practical, attendance, and evaluation requirements for successful completion of the course and the programme. The University reserves the right to revise the evaluation and passing criteria from time to time as per academic regulations and statutory guidelines.

6.6 Grading System

The program shall follow Gandhinagar University grading norms.

6.6.1 Grade Table

Grade	Grade Points	From Marks	To Marks
AA	10	80	100
AB	9	75	79
BB	8	70	74
BC	7	65	69
CC	6	60	64
CD	5	55	59
DD	4	50	54
FF	0	0	49

6.7 Dissertation / Project Work

The dissertation is the principal component of the M.Tech CAD/CAM programme, spanning Semesters III and IV through Internal Review and Dissertation Phases I and II. Requirements may include: Proposal Presentation · Periodic Review (Internal Review I & II) · Final Report Submission · Viva Voce Examination. The dissertation shall be evaluated by internal and external examiners. Students are encouraged to align their dissertation with current research problems, industry challenges, or publishable work in CAD/CAM and allied computational design and manufacturing domains.

7. Rules and Regulations

7.1 Rules for Promotion

A student enrolled in the M.Tech CAD/CAM programme shall be promoted to the subsequent semester in accordance with the academic regulations and promotion rules prescribed by the University from time to time, subject to fulfilment of minimum attendance requirements, academic performance criteria, and completion of prescribed credits.

7.2 Maximum Duration for Completion

The maximum duration for completion of the M.Tech CAD/CAM programme shall be four academic years from the date of admission, or as prescribed by the University and applicable regulatory authorities from time to time.

7.3 Internship / Research Engagement Guidelines

Students are encouraged to undertake research internships, industry-oriented dissertation work, or experiential learning relevant to CAD/CAM. Such engagement may be carried out in: CAD/CAM/CAE and Design Companies · Manufacturing and Production Industries · Automobile and Aerospace Industries · Robotics and Automation Industries · Product Development and Tooling Organizations · Research and Development Organizations · Government and Public Sector Engineering Units · MSMEs and Industrial Workshops.

Students may be required to submit: Internship / Research Report · Work Diary / Logbook · Completion Certificate · Presentation / Viva Voce · Project or Dissertation-linked Report, wherever applicable.

7.4 Discipline Rules

Students shall maintain discipline, professional ethics, safety standards, and proper conduct within the institution, laboratories, industrial visits, internships, examinations, technical events, and all academic activities associated with the programme.

Students are expected to: attend classes, laboratories, and seminars regularly; follow institutional rules, regulations, and safety practices; respect faculty members, staff, fellow

students, and institutional property; maintain academic honesty and integrity in assignments, projects, practical work, dissertation, and examinations; and properly use laboratory equipment, software, machines, and computing facilities.

Any form of misconduct, indiscipline, ragging, use of unfair means in examinations, plagiarism in dissertation work, damage to institutional property, harassment, or unsafe laboratory practices shall be treated seriously and may result in disciplinary action including warning, suspension, cancellation of examination, withholding of results, or expulsion from the programme as per University rules, AICTE norms, and UGC regulations.

7.5 Anti-Ragging Policy

The programme shall strictly comply with: UGC Anti-Ragging Regulations · AICTE Anti-Ragging Guidelines · Anti-Ragging Affidavit requirements · Institutional disciplinary procedures. Ragging in any form is strictly prohibited and shall invite strict disciplinary action as per applicable regulations.

7.6 Ethical Use of Technology and AI Tools

Students are encouraged to effectively utilize modern engineering software, simulation platforms, and AI-based technologies for design, analysis, research, and innovation. Students may use: CAD/CAM/CAE Software · Simulation and FEA Tools · Programming and Automation Platforms · AI-based Learning Platforms · Data Analytics and Visualization Tools · Digital Manufacturing Tools · Virtual Laboratories.

The use of AI tools and digital technologies shall be ethical, responsible, and aligned with academic integrity. Students shall not engage in plagiarism, unauthorized copying, fabrication of data, or misuse of AI-generated content in academic submissions, projects, examinations, or research/dissertation activities.

8. Student Support

8.1 Industry Collaboration

The department shall actively promote collaboration with manufacturing industries, CAD/CAM/CAE and design firms, automobile and aerospace industries, robotics and automation companies, research institutions, MSMEs, public sector undertakings, and professional engineering bodies to enhance practical exposure and industry relevance of the M.Tech CAD/CAM programme. Such collaborations may include industrial internships, plant exposure, expert lectures, live industry projects and consultancy assignments, joint research and innovation activities, skill development programs, entrepreneurship support, and placement initiatives. The institution may establish MoUs with industries and research organizations for collaborative research, technology transfer, and industry-oriented learning.

8.2 Research and Consultancy

The department shall encourage faculty and students to engage in research, innovation, consultancy, and product development related to design engineering, CAD/CAM/CAE, manufacturing, automation, materials, and emerging computational domains. Students may undertake research and innovation projects, product design and development, prototype fabrication and testing, simulation and modelling studies, and industry-oriented technical problem-solving. The institution may undertake consultancy in product design, CAD/CAM/CAE analysis, manufacturing optimization, and mechanical system development. Participation in conferences, technical competitions, publications, funded projects, patents, and incubation activities shall be encouraged.

8.3 Library and Laboratory Facilities

Adequate library, laboratory, computing, and digital learning facilities shall be made available to support teaching, practical training, research, and skill development. The department shall facilitate access to engineering textbooks and reference books, national and international journals, research publications and e-resources, standards and technical databases, digital learning platforms and virtual laboratories, and CAD/CAM/CAE software and simulation tools. Necessary computing facilities, high-performance workstations, CNC and prototyping equipment, and software licences required for project- and dissertation-based learning shall

be provided.

8.4 Student Support and Mentoring

A structured system for student support, academic mentoring, and professional guidance shall be implemented. The department shall facilitate academic counselling and mentoring, career and higher-education guidance, technical skill development, research and innovation support, entrepreneurship guidance, and professional development initiatives. Students may interact with industry experts and participate in workshops, seminars, industrial visits, technical competitions, and innovation challenges to enhance employability, leadership, communication, teamwork, and overall development.

8.5 Placement and Career Development

The department shall actively promote placement assistance and career development through industry interaction, internships, professional networking, and campus engagement. Efforts shall be made to establish linkages with CAD/CAM/CAE and design companies, manufacturing and automobile industries, robotics and automation companies, R&D organizations, government and public sector engineering units, MSMEs, and startup ecosystems. Career development activities such as aptitude training, resume and interview preparation, soft-skill development, technical certification programs, and placement-oriented workshops may be organized.

9. Program Credibility

9.1 Executive Summary

The M.Tech CAD/CAM programme is designed to develop advanced specialists with strong foundations in computer-aided design, computer-aided manufacturing, computational analysis, mechanism design, CNC technology, finite element analysis, manufacturing systems, and digital product development aligned with modern engineering and Industry 4.0 requirements. The programme emphasizes a balanced integration of advanced theoretical knowledge, software and laboratory practice, research-oriented learning, and a substantial dissertation to prepare students for professional engineering practice, research, higher studies, and academia. It integrates modern computational methods, digital manufacturing technologies, simulation platforms, and AI-assisted engineering practices to enhance technical depth and research readiness. Graduates shall be prepared for careers in design and manufacturing industries, automotive and aerospace sectors, R&D organizations, and emerging technology domains, and shall be eligible to pursue doctoral research, entrepreneurship, and professional certifications.

9.2 Scope and Career Opportunities

Graduates may find career opportunities in: CAD/CAM/CAE and Design Companies · Manufacturing Industries · Automobile and Aerospace Industries · Robotics and Automation Industries · Product Development and Tooling Organizations · Research and Development Organizations · Government and Public Sector Undertakings · MSMEs and Industrial Enterprises · Consulting and Engineering Service Companies · Smart Manufacturing Industries · Academia and Research Institutions.

9.3 Potential Job Roles

CAD/CAM Engineer · Design Engineer · Product Development Engineer · CAE / FEA Analyst · Simulation Engineer · CNC Programming Engineer · Manufacturing Engineer · Tool and Die Designer · Automation Engineer · R&D Engineer · Quality Engineer · Process Planning Engineer · Project Engineer · Technical Consultant · Assistant Professor / Researcher.

9.4 Higher Study & Professional Opportunities

Students graduating from the M.Tech CAD/CAM programme may pursue: Ph.D. in Engineering and Interdisciplinary Domains · Research and Innovation-Oriented Higher Studies · Professional Certification Programs · CAD/CAM/CAE Specialized Certifications · Robotics and Automation Certifications · Industrial Design and Manufacturing Certifications · Government and Competitive Examinations · Entrepreneurship and Startup Ventures · International Technical Certification Programs.

10. Collaborative Field Work / Experimental Work

The M.Tech CAD/CAM programme shall emphasize practical learning, research exposure, and application-oriented engineering education through laboratory practice, software-based design and analysis, industrial interaction, and experimental and dissertation work. Students may participate in: industrial visits and manufacturing plant exposure; CAD/CAM/CAE modelling, simulation, and design-based exercises; product development, fabrication, and prototype-building activities; CNC, automation, and FEA-based experimental projects; research projects, innovation challenges, technical competitions, and interdisciplinary activities; and dissertation work in collaboration with industries and research organizations. The programme shall encourage experiential learning, problem-solving ability, teamwork, innovation, and technical communication aligned with modern industrial and research requirements.

11. Market Survey

11.1 Executive Summary

India is witnessing rapid growth in manufacturing, automation, automotive, aerospace, and industrial design sectors driven by Industry 4.0 adoption, digital manufacturing, and increasing industrial investment. Gujarat, particularly Ahmedabad and Gandhinagar, has emerged as a major industrial and manufacturing hub with a strong presence of engineering industries, MSMEs, automobile sectors, and smart-manufacturing ecosystems. A market survey and industry interaction conducted with engineering industries, design firms, and manufacturing units indicated strong demand for postgraduate engineers with advanced competency in CAD/CAM/CAE, design analysis, CNC technology, and digital manufacturing. The findings clearly indicate that the M.Tech CAD/CAM programme is academically relevant, industry-oriented, and aligned with present and future technological requirements.

11.2 Market Demand & Industry Trends

Major growth areas include: Advanced and Smart Manufacturing · CAD/CAM/CAE and Product Design · Digital Twin and Simulation-Driven Engineering · Additive Manufacturing and Rapid Prototyping · Robotics and Industrial Automation · Electric Vehicles and Automotive Engineering · Aerospace and Defence Manufacturing · Industrial Engineering and Mechatronics. Industries increasingly seek engineers with advanced design and analysis skills, digital engineering competency, and research-oriented thinking.

11.3 Skill Gap Identified by Industry

Industry feedback highlighted gaps among graduates including: limited proficiency in advanced CAD/CAM/CAE and FEA software; insufficient exposure to CNC programming and digital manufacturing; limited research and analytical capability; weak problem-solving, communication, and project management skills; and insufficient real-world design and manufacturing experience. Industry emphasized the need for postgraduate engineers capable of contributing effectively to design, analysis, manufacturing, and R&D functions.

11.4 Employment Opportunities & Industry Support

Graduates shall have employment opportunities in CAD/CAM/CAE and design companies, manufacturing and automobile industries, aerospace and tooling organizations, R&D organizations, MSMEs, and public sector engineering organizations. Industries have expressed willingness to support the programme through internships and research engagement, industrial visits and expert lectures, collaborative projects and workshops, skill development initiatives, and placement support. The programme is therefore expected to contribute significantly towards developing industry-ready and research-capable postgraduate engineers.

12. Review and Revision of Regulation

The University reserves the right to interpret, modify, revise, amend, or update any provision, rule, regulation, curriculum structure, evaluation pattern, academic requirement, or operational guideline related to the M.Tech CAD/CAM programme from time to time in accordance with University regulations, statutory requirements, technological advancements, industry needs, and academic developments.

In case of any ambiguity or dispute regarding interpretation of any provision of this manual, the decision of the University or Competent Authority shall be final and binding on all stakeholders. Any amendments, additions, or revisions approved by the appropriate academic or statutory bodies of the University shall automatically become applicable to the programme.

Annexure I: Detail Syllabus

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M. TECH. 1st SEMESTER

COMPUTER ENGINEERING (SOFTWARE ENGINEERING)
MECHANICAL ENGINEERING (THERMAL ENGINEERING/CAD-CAM)

DOC NO: 4061

Subject Code: 10000151	**Subject Title:** Research Methodology and IPR
Pre-requisite: Nil	

Course Objective:

- To give an overview of the research methodology and explain the technique of defining a research problem.
- To explain the functions of the literature review in research.
- To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- To explain various research designs and their characteristics.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
1	1	2	3	0	0	80	20	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	5	17
2	Effective literature studies approaches, analysis Plagiarism, Research ethics,	4	15
3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	5	17
4	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	5	17

5	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	5	17
6	New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	5	17

Course Outcome: After completion of this course, student will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

List of References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Open e-Resource:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc19_ge21/preview
2. NPTEL: https://onlinecourses.nptel.ac.in/noc22_ge08/preview

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M.TECH 1st SEMESTER

MECHANICAL ENGINEERING (THERMAL ENGINEERING / CAD-CAM)

DOC NO: 4061

Subject Code: 10000152	Subject Title: Disaster Management (Audit Course)
Pre-requisite: Zeal to learn	

Course Objective:

- To provide basic conceptual understanding of disasters.
- To understand approaches of Disaster Management.
- To build skills to respond to disasters.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
2	0	0	0	00	50	00	00	50

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	**Introduction** Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude	4	17
2	**Repercussions Of Disasters and Hazards**: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts	5	17
3	**Disaster Prone Areas in India Study of Seismic Zones**; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post Disaster Diseases and Epidemics	5	17
4	**Disaster Preparedness and Management Preparedness**: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application	5	17

	of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness		
5	**Risk Assessment Disaster Risk**: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.	5	16
6	**Disaster Mitigation:** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Nonstructural Mitigation, Programs of Disaster Mitigation in India.	4	16

Course Outcome: After completion of this course, student will be able to

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

List of References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Open e-Resource:

1. https://nptel.ac.in/courses/105104183

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 1st SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080101	**Subject Title: Computer Aided Tools for Manufacturing (Core-2)**
Pre-requisite: - Knowledge of G-Code and M-Code, Basic Knowledge of CNC Programming, Knowledge of Manufacturing Process and Their Related Machine	

Course Objective:

- Learn Software skills for 3d Modelling
- Design and Manufacturing code design
- Learn Data management systems

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Computer Aided Manufacturing:** Integrating CAD, NC and CAM, Machine tools, Point to point and continuous path machining, NC, CNC and DNC, NC Programming, Basics, Languages, G Code, M Code, APT, Tool path generation and verification, CAD/CAM NC Programming.	9	20
2	**Computer Aided Process Planning:** Production Control, Cellular Manufacturing, Manufacturing cells, Flexible Manufacturing System (FMS), Cellular v/s Flexible Manufacturing, Computer Aided Process Planning, Development, Benefits, Model and Architecture, CAPP Approaches, Variant, Generative and Hybrid.	9	20
3	**Computer Aided Inspection:** Geometrical Dimensioning & Tolerancing (GD&T), General Tolerance, Allowance and Clearance, Type of Fit, Tolerances Practices in design, Drafting and manufacturing, Computer Aided Quality control, Contact Inspection Methods, Non-Contact Inspection Methods - Non optical.	9	20
4	**Reverse Engineering:** Introduction to Reverse Engineering, Methodologies and Techniques for Reverse Engineering– The Potential for Automation with 3-D Laser Scanners,	9	20

	Reverse Engineering–Hardware and Software, Selecting a Reverse Engineering System.		
5	**Data Management:** Reverse Engineering Data Management System, Software Application, Design experiment for RE tools, RE assembly.	9	20

Course Outcome: After completion of this course, student will be able to

- Learn to Computer Aided Manufacturing.
- Learn to Computer Aided Process Planning and Computer Aided Inspection.
- Learn to Reverse Engineering and Data Management.

List of References:

1. Numerical control and computer aided manufacturing – T. K. Kundra, P.N. Rao, and N. K. Tewari – Tata McGraw Hill Publishing company Ltd.
2. CAD, CAM and CIM – P. Radhakrishan, S. Subramaniyam, New Age International.
3. CNC programming – Dr. S. K. Sinha – Galgotia publications.
4. Reverse Engineering, An Industrial Perspective – Vinesh Raja, Kiran J. Fernandes – Springer
5. Reverse Engineering – Linda Wills, Kluwer Academic Press, 1996.

Open e-Resource: Students should refer to the following sites to enhance their learning ability.

1. https://nptel.ac.in/courses/112102102
2. Open-source software like Master CAM, Solid Works and Fusion 360 are used for NC Programming and Reverse Engineering.
3. 3- D scanner is used for scanning complex component for reverse engineering.

List of Suggested Experiments:

1. Study of Computer Aided Manufacturing.
2. Study of NC/CNC Technology.
3. Student of CNC Part Programming: Lathe and Milling Jobs
4. Exercise on Reverse Engineering for simple problem.
5. Study of Geometrical Dimensioning & Tolerancing.
6. Problems on Computer Aided Process Planning and Industrial Case Problems.
7. Study of Flexible Manufacturing Systems.
8. Study of Reverse Engineering.

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 1st SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080102	**Subject Title: Computer Application in Design (Core-3)**
Pre-requisite: - CAD modelling software, Types of commands and its importance in CAD modelling	

Course Objective:

- To disseminate information on computer graphics, which are frequently utilized in a variety of fields including engineering, science, medicine, etc. for product design.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	4	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Computer Graphics Fundamentals** Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation.	8	18
2	**Curves and Surfaces Modeling** Introduction to curves, Analytical curves - line, circle and conics, Synthetic curves - Hermite cubic spline, Bezier curve, B-Spline curve, Curve manipulations, Introduction to surfaces, Analytical surfaces - Plane surface, ruled surface, Surface of revolution and Tabulated cylinder, Synthetic surfaces - Hermite bicubic surface, Bezier surface, B-Spline surface, Surface manipulations	10	22
3	**NURBS and Solid Modeling** NURBS, Basics - curves, lines, arcs, circle and bi linear surface, Regularized Boolean set operations, Primitive instancing, Sweep representations, Boundary representations, Constructive solid Geometry, Comparison of representations, User interface for solid modeling.	9	20
4	**Visual Realism** Hidden, Line, Surface, Solid removal algorithms shading, Coloring, Introduction to parametric and variational geometry-based software's and their principles creation of prismatic and lofted parts using these packages	9	20

5	**Assembly of Parts and Product Data Exchange** Assembly modelling, Interferences of positions and orientation, Tolerances analysis, Mass property calculations, Mechanism simulation, Graphics and computing standards, Open GL Data Exchange standards – IGES, STEP etc., Communication standards	9	20

Course Outcome: After completion of this course, student will be able to

- Understand the basic concept of computer graphics application in design
- Use of basic concept & characteristics in geometric modeling
- Solve CAE problems that arise in engineering

List of References:

1. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore, 1989.
2. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003.
3. David F. Rogers, James Alan Adams "Mathematical elements for computer graphics" second edition, Tata McGraw-Hill edition.
4. Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition, 2007.
5. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc., 1992.

Open e-Resource: Students should refer to the following sites to enhance their learning ability.

1. https://nptel.ac.in/courses/112104031

List of Suggested Experiments:

1. Introduction of 2D & 3D software (AutoCAD & Solidworks)
2. To study the use of solidworks for preparing a 3D CAD Model
3. To study of geometric 2D translation & scaling transformation using solidworks software
4. To study of geometric 3D translation & scaling transformation using solidworks software
5. To study of geometric 2D rotation & reflection transformation using solidworks software
6. To study of geometric 3D rotation & reflection transformation using soidworks software
7. Exercise for Advanced 3-D Modeling.
8. Exercise for 3-D Editing Options
9. Exercise for Assembly Modeling
10. Exercise for Surface Modeling

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M.TECH 1st SEMESTER

MECHANICAL ENGINEERING (THERMAL ENGINEERING / CAD-CAM)

DOC NO: 4061

Subject Code: 10080109	Subject Title: Applied Mathematics for Engineers (Core-1)
Pre-requisite:- Basic Mathematics	

Course Objective:

- Enrich the knowledge in various advanced mathematical techniques.
- Fundamental concepts for model the engineering problems.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
4	0	0	4	60	40	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Matrix Theory:** The Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR factorization - Least squares method - Singular value decomposition.	13	25
2.	**Calculus of Variations:** Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functional dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems - Direct methods : Ritz and Kantorovich methods.	12	23
3.	**Probability and Random Variables:** Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.	13	25
4.	**Laplace Transform Techniques for Partial Differential Equations:** Laplace transform - Definitions - Properties – Transform error function - Bessel's function - Dirac delta function - Unit step functions – Convolution	14	27

	theorem – Inverse Laplace transform: Complex inversion formula – Solutions to partial differential equations: Heat equation - Wave equation.		

Course Outcome: After completion of this course, student will be able to

- Apply various methods in matrix theory to solve systems of linear equations.
- Maximizing and minimizing the functional that occur in various branches of engineering disciplines.
- Computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
- Application of Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.

List of References:

1. Andrews L.C. and Shivamoggi, B. "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
2. Bronson, R. “Matrix Operations”, Schaum’s outline series, 2nd Edition, McGraw Hill, 2011.
3. James, G., “Advanced Modern Engineering Mathematics ", 3rd Edition, Pearson Education, 2004.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund’s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
5. O'Neil, P.V., "Advanced Engineering Mathematics ", Thomson Asia Pvt. Ltd., Singapore, 2003.
6. Sankara Rao, K., “Introduction to Partial Differential Equations”, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.

Open e-Resource:

1. https://nptel.ac.in/courses/111102133

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 1st SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080111	**Subject Title: Rapid Prototyping (Program Elective-1)**
Pre-requisite:- Advance Manufacturing Processes, Additive Manufacturing	

Course Objective:

- To conceive, design and implement a product, using rapid prototyping methods and computer-aid tools. The first of two phases challenge each student team to meet a set of design requirements and constraints for a structural component.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Need - Development of AM systems, Traditional manufacturing v/s AM, AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes, Use of multiple materials -Benefits- Applications.	8	14
2	**Reverse Engineering & CAD Modelling:** Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.	11	20
3	**Additive Manufacturing Systems** Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products,	15	26

	materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.		
4	**Powder Based Additive Manufacturing Systems** Selective Laser Sintering – Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy– Process, advantages and applications, Three Dimensional Printing (with binder jet) – Principle, process, advantages, application	11	20
5	**Tooling:** Classification, Soft tooling, Production tooling, Bridge tooling, direct and indirect tooling, Fabrication processes, Applications Case studies Sheet metal forming, automotive	11	20

Course Outcome: After completion of this course, student will be able to

- Student will learn about the basic terminology of Additive Manufacturing.
- Apply the reverse engineering concepts for design development.
- Students will learn about construction, working and parameters of various RP processes.
- Students will be able to select the right materials and identify the suitable RP process.
- Understand the variety of additive manufacturing techniques
- Design and develop newer tooling models
- Analyze the cases relevant to mass customization and some of the important research challenges associated with AM and its data processing tools

List of References:

1. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.
2. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
3. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
4. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005. 14
5. Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2011

Open e-Resource: Students should refer to the following sites to enhance their learning ability

1. https://archive.nptel.ac.in/courses/112/104/112104265/
2. additivemanufacturing.com/basics/
3. https://www.optomec.com/additive-manufacturing/

4. https://nptel.ac.in/courses/112107077/38
5. https://nptel.ac.in/courses/112102103/16

List of Suggested Experiments:

1. Cad modelling preparation for Additive manufacturing
2. To know principle of 3D printing and slicing software.
3. Case studies for cost estimation of various advanced manufacturing processes.
4. Development of Rapid prototyping for any automotive, household, aerospace, gift application

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 1st SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080112	**Subject Title: Advanced Finite Element Analysis (Program Elective-1)**
Pre-requisite:- Basic Knowledge of FEA and CAD	

Course Objective:

- The objective of this course is to learn advanced topics in FEM so that this tool can be used for analysis, design, and optimization of engineering systems.
- Will focus on nonlinear structural analysis. Various nonlinearities in structural problems will be studied in the mathematical and numerical aspects.
- Students will also be exposed in computer programming and use of commercial FE programs.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Finite Element Method:** Basics, history and application, Comparison with other methods, Variational approach, Galerkin's Methods.	6	11
2	**Element and Boundary Condition:** Element shapes, interpolation function. Virtual energy principle, Rayleigh-Ritz method, stiffness matrix and properties, Boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain displacement relations	8	15
3	**1-D structural problems:** axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape function. Analysis of Trusses – Plane Truss and Space Truss elements	8	15
4	**Analysis of beams:** Hermite shape functions – stiffness matrix – Load vector – Problems.	10	18

	2-D problems: CST, LST, force terms, Stiffness matrix, load vector, boundary conditions.		
5	**Element types:**Isoperimetric element – quadrilateral element, Shape functions – Numerical Integration – sub parametric and super parametric elements. **3-D problems:** Tetrahedral element – Jacobian matrix – Stiffness matrix.	10	18
6	**Basics of Dynamic Analysis:** Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen Vector, natural frequencies – mode shapes – modal analysis. Applications of numerical procedures to determine natural frequencies and mode shapes. Finite Element Method for dynamic analysis, Introduction to torsional problems	12	23

Course Outcome: After completion of this course, student will be able to

- Learn the mathematical formulation of the finite element method and how to apply it to basic (linear) ordinary and partial differential equations.
- Learn how to implement the finite element method efficiently in order to solve a particular equation.
- Solve complicated 3D structural problems for stress analysis under impact loads.
- Formulate simple problems into finite elements and solve structural, impact and crash problems.

List of References:

1. Introduction to finite elements in Engineering by Tirupathi K. Chandrupatla and Ashok D. Belegundu.
2. Finite Element Procedures in Engineering analysis by K.J Bathe.
3. The finite element methods in Engineering – S.S. Rao - Pergamon, New York.
4. An Introduction to Finite Element Methods – J. N. Reddy – McGraw Hill.
5. A Textbook of Finite Element Analysis by P. Seshu
6. Concepts and applications of finite element analysis – Robert Cook

Open e-Resource: Students should refer to the following sites to enhance their learning ability.

1. https://nptel.ac.in/courses/112106130
2. https://www.optomec.com/additive-manufacturing/
3. https://nptel.ac.in/courses/112107077/38

List of Suggested Experiments:

1. Introduction to ANSYS – Modelling and analysis
2. Solve Problems on 1-D Spring elements
3. Solve Problems on beam elements

4. Solve Problems on Truss element
5. Solve Problems on 2-D element
6. Solve problem on Bars with Constant and variable Cross-section Area, Stepped bars etc.
7. Solve problems on Bars of Tapered Cross section Area
8. To Perform Static analysis of a corner bracket
9. To Perform Modal Analysis of a Model Airplane Wing.
10. To Perform Interference Fit and Pin Pull-Out Contact Analysis.

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 1st SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080113	**Subject Title: Design of Manufacturing Systems (Program Elective-1)**
Pre-requisite: - To know the concept of design for manufacturing. To know the computer application in design for manufacturing	

Course Objective:

- The student will understand professional and ethical responsibility.
- The student will be able to perform motion study, time study, work sampling, and performance rating.
- The student will understand manufacturing systems, its components, and the impact of engineering solutions.
- The student will have ability to design a system, component, or process to meet desired needs.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** General design principles for manufacturability, strength and mechanical factors, mechanisms, selection, evaluation method, Process capability, Feature tolerances Geometric tolerances, Assembly limits, Datum features, Tolerance stacks.	6	12
2	**Factors Influencing Form Design:** Working principle, Material, Manufacture, Design, Possible solutions, Materials choice, Influence of materials on form design, form design of welded members, forgings and castings.	13	25
3	**Component Design - Machining Consideration:** Design features to facilitate machining, drills, milling cutters, keyways, Doweling procedures, counter sunk screws, Reduction of machined area,	10	19

	simplification by separation, Design for machinability, Design for economy, Design for clamp ability, Design for accessibility.		
4	**Component Design – Casting Consideration:** Redesign of castings based on Parting line considerations, Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design, Modifying the design, group technology, Computer Applications for DFMA.	12	23
5	**Design for the Environment:** Introduction, Environmental objectives, Global issues, Regional and local issues, Lifecycle assessment method, Techniques to reduce environmental impact, Design to minimize material usage, Design for disassembly, Design for recyclability, Design for manufacture, Design for energy efficiency, Design to regulations and standards.	11	21

Course Outcome: After completion of this course, student will be able to

- Learn to Factors Influencing Form Design.
- Learn to Component Design - Machining Consideration.
- Learn to Component Design – Casting Consideration and Design for the Environment.

List of References:

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. New York, Marcel
   Dekker.
2. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.

Open e-Resource: Students should refer to the following sites to enhance their learning ability

1. https://archive.nptel.ac.in/courses/112/105/112105124/

List of Suggested Experiments:

1. Study of Geometrical, Dimensioning and Tolerance.
2. Study of Material Properties for Mechanical Engineering.
3. Student of Machining Processes.
4. Exercise on Casting Processes.
5. Study of Group Technology.
6. Problems on Group Technology.
7. Study of Drilling Processes.
8. Study of Design for Environment.

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M. TECH. 2nd SEMESTER

COMPUTER ENGINEERING (SOFTWARE ENGINEERING)

MECHANICAL ENGINEERING (THERMAL ENGINEERING/CAD-CAM)

DOC NO: 4061

Subject Code: 10000251	**Subject Title: Technical Writing (Audit Course)**
Pre-requisite: Basic Language Skills	

Course Objective:

- Technical Writing focuses on planning and preparation of word choices and sentences and focuses on vocabulary building and helps them to be an effective communicator.
- Students will be able to produce a set of documents related to writing in the workplace and will be able to improve their ability to write clearly and accurately.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	0	0	0	0	50	0	0	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring	4	10
2	Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4	10
3	Sections of a paper – Title, abstract, introduction, etc. review of the literature, writing - methods, results, discussion, conclusions and final check	6	20
4	Organization of technical report: Title, Authors, Affiliation, Abstract,	4	20
5	Three pass reading. Effective communication– Teacher/Student perspective. Listening – Hearing Vs. Listening. Notes Taking. Elevator Pitch. Technical writing.	4	20
6	Useful phrases and punctuation, in-text citation and bibliography– MLA/APA styles	4	20

Course Outcome: After completion of this course, student will be able to

- Understand how to improve your writing skills and level of readability.
- Learn about what to write in each section.

- learn various skills necessary that are necessary for doing research.
- Ensure the good quality of paper at very first-time submission.

List of References:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press ,2006
3. Raman, Meenakshi and Sangeeta Sharma, "Technical Communication: Principle and Practice", Oxford University Press.
4. Goldbort R. Writing for Science, Yale University Press, 2006

Open e-Resource:

1. https://nptel.ac.in/courses/109107172

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080201	**Subject Title: Mechanism Design & Analysis (Core-4)**
Pre-requisite:- Design and Analysis of Mechanism, Kinematic and Dynamics Design	

Course Objective:

- To Develop a deep understanding of the various mechanisms, their design and simulation and be able to effectively utilize the various mechanisms.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	0	3	60	40	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction** Fundamentals of kinematics, Classifications of mechanisms, Components of mechanisms, Mobility analysis, Formation of one D.O.F. multi loop kinematic chains, Basic kinematic structures of serial and parallel robot manipulators, Compliant mechanisms, Equivalent mechanisms	8	18
2	**Kinematic Analysis** Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages. Analytical methods for velocity and acceleration Analysis– four bar linkage jerk analysis. Spatial RSSR mechanism - Denavit - Hartenberg Parameters – Forward and inverse kinematics of robot manipulators	9	20
3	**Curvature Theory & Coupler Curve** Fixed and moving centrodes, Inflection points and inflection circle, Euler Savary equation, The cubic of stationary curvature, H&N atlas of four bar coupler curves, Symmetrical linkage coupler curve	8	18

4	**Synthesis of Four Bar Mechanisms** Type synthesis, Number synthesis**,** Dimensional synthesis, Function generation, Path generation, Motion generation, Graphical methods-Pole technique, Inversion technique-point position reduction-two, three and four position synthesis of four-bar mechanisms, Analytical methods- Freudenstein's Equation	10	22
5	**Synthesis of Coupler Curve Based Mechanisms & Cam Mechanisms** Cognate Linkages-parallel motion Linkages, Design of six bar mechanisms-single dwell-double dwell-double stroke, Geared five bar mechanism-multi-dwell, Cam Mechanisms- determination of optimum size of cams	10	22

Course Outcome: After completion of this course, student will be able to

- Understand the advanced mechanism and their application
- Design mechanism with different methods
- Simulate mechanisms

List of References:

1. Uicker, J.J., Pennock, G. R. and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, 2005.
2. Sandor G.N., and Erdman A.G., "Advanced Mechanism Design Analysis and Synthesis", Prentice Hall, 1984.
3. Robert L.Norton., "Design of Machinery", Tata McGraw Hill, 2005.
4. Kenneth J, Waldron, Gary L. Kinzel, "Kinematics, Dynamics and Design of Machinery", John Wiley-sons, 1999.
5. Amitabha Ghosh and Asok Kumar Mallik, "Theory of Mechanism and Machines", EWLP, Delhi, 1999.
6. A. G. Ambekar, "Mechanism and Machine Theory", PHI, 2007.
7. Ramamurti, V., "Mechanics of Machines", Narosa, 2005.

Open e-Resource:

1. https://nptel.ac.in/courses/112105268

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080202	**Subject Title: CNC Technology (Core-5)**
Pre-requisite:- Manufacturing, Production, CAD/CAM, Basic knowledge of engineering drawings, Basic knowledge of G-Code and M-Code, Basic Knowledge of CNC Programming,	

Course Objective:

- Describe constructional features of CNC machine tools
- Explain drives and positional transducers used in CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe tooling and work holding devices for CNC machine tools

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction and history of CNC:** Introduction to CNC technology -CNC machines & controls. History & development of CNC technology. Conventional Vs. non-conventional machine tool. Numerical control on CNC machine tools. CNC Control and types of CNC control. Calculation of technological data for CNC machining. CNC clamping system. Implementation of JH for CNC. Basic health and safety. CNC programming basics. Introduction to manual NC programming. Manual NC programming for lathe & milling machines. Application Numerical Control, Advantages, & Disadvantages, Adoptive Control System. Practical training & workshop for above sub topics on CNC Machine	11	26
2	**CNC programming:** Introduction to CNC programming, Introduction, and demonstration of line programs CNC programming for lathe & milling machine using ISO codes into the CNC simulator. CNC programming for lathe and milling machines using different machining cycles into the CNC simulator. Procedures Associated with	11	26

	part programming, cutting process parameter selection, Process planning issues and path planning, G & M Codes, Interpolations, Canned Cycles and Subprograms, Tool compensations. Exposure for programming and simulator of FANUC, HAAS Controls through post processors. Programming exercise. Machining of programmed exercise on CNC lathe & milling machines.		
3	**CNC programming-Lathe:** Plan and optimize programs for CNC turning operations. Calculate parameters like speed feed etc. and set references for the various operations. Prepare operation and operation sequence for the lathe operations like turning, grooving etc. Prepare & set CNC lathe operations and test run programmed. Execute program and inspect simple geometrical forms / standard parts.	10	24
4	**CNC programming-Milling:** Plan and optimize programs for CNC Milling operations. Calculate parameters like speed feed, depth of cut etc. and set a reference for the various operations. Various methods of work process like edge finding block center etc. Prepare & set CNC Milling operations and test run programmed. Execute program and inspect simple geometrical forms / standard part.	10	24

Course Outcome: After completion of this course, student will be able to

- Learn to different G code and M code for CNC machine.
- Learn to CNC Programming for Lathe and Milling operations.
- Basic Fundamental of construction and design of CNC Machine.

List of References:

3. Numerical control and computer aided manufacturing – T. K. Kundra, P.N. Rao, and N. K. Tewari – Tata McGraw Hill Publishing company Ltd.
4. CAD, CAM and CIM – P. Radhakrishan, S. Subramaniyam, New Age International.
5. CNC programming – Dr. S. K. Sinha – Galgotia publications.

Open e-Resource: Students should refer to the following sites to enhance their learning ability.

2. https://nptel.ac.in/courses/112105211
3. Open-source software like Master CAM, Solid Works and Fusion 360 are used for NC Programming.
4. Different kind of tools and tool tips with respect to operation.

List of Suggested Experiments:

1. Study of NC/CNC Technology.
2. Study of CNC Part Programming: Lathe Jobs
3. Study of CNC Part Programming: Milling Jobs

4. Study of FANUC controller.
5. Study of HAAS controller.
6. Problems on complex job manufacturing in CNC turning center.
7. Study of safety requirement during operation with CNC.
8. Study of industrial application of CNC technology.

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080211	**Subject Title: Mechanical Behaviour of Material (Program Elective-2)**
Pre-requisite: - Metallurgy, Mechanical behavior mechanical properties and stress strain diagrams	

Course Objective:

- To Develop a deep understanding of the various mechanisms, their design and simulation and be able to effectively utilize the various mechanisms.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Review of Material Behaviour** Elasticity in metals and polymers– Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behavior – Super plasticity –. Griffith's theory, Ductile, brittle transition in steel – High temperature fracture, creep Larson Miller parameter – Deformation and fracture mechanism maps.	9	17
2	**Material Behaviour for Different Load Conditions** Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law.- Safe life, Stress life, strain-life and fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of nonmetallic materials – Failure analysis, sources of failure, procedure of failure analysis.	10	20
3	**Selection of Materials** Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with	9	17

	relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.		
4	**Mechanical Materials** Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Mar ageing steel, Nitrogen steel – Intermetallic, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials	12	23
5	**Non Metallic Materials** Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications**.**	12	23

Course Outcome: After learning the course the students should be able to:

- To familiarize the researchers in the area of material behavior under different loading and selection of materials for the design of engineering structures
- To know the types of advanced material available for manufacturing
- To know different stress relieving process from material

List of References:

1. Ashby M.F., materials selection in Mechanical Design 2nd Edition, Butter worth 1999.
2. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (34d edition), Butterworth-Heiremann, 1997.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
4. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988
5. Metals Hand book, Vol.10, Failure Analysis and Prevention, (10th Edition), Jaico, 1999.
6. Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000

Open e-Resource:

1. https://nptel.ac.in/courses/113106101

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080212	**Subject Title: Design for Manufacturing and Assembly (Program Elective-2)**
Pre-requisite: - Manufacturing processes and selection, Types of operations, production systems	

Course Objective:

- To introduce the basic concepts and design guidelines of different manufacturing processes. It is also equally important to understand concepts of design for assembly to reduce number of parts and to optimize design without compromising function. Also, current global trends and requirements of environmental design required to be addressed.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to tolerances:** Tolerances: Limits and Fits, tolerance Chains and identification of functionally important dimensions. Dimensional chain analysis-equivalent tolerances method, equivalent standard tolerance grade method, equivalent influence method. Geometric tolerances: applications, geometric tolerancing for manufacture as per Indian Standards and ASME Y 14.5 standard; surface finish, Tolerance stackup calculations; Review of relationship between attainable tolerance grades and different machining.	9	18
2	**Form design of castings, weldments, forging and sheet metal components:** Materials choice, Influences of materials, Space factor, Size, Weight- Surface properties and production method on form design. Redesign of castings based on parting line considerations, Minimizing core requirements, redesigning cast members using Weldments - Form design aspects in Forging and sheet metal components.	11	21
3	**Design for Assembly - Machining Considerations:**	11	21

	Design features to facilitate machining, Drills, Milling cutters, Keyways, Doweling procedures, Counter sunk screws, Reduction of machined area, Simplification by separation, Simplification by amalgamation, Design for machinability, Design for economy, Design for clampability, Design for accessibility, Design for assembly. Redesign For Manufacture, Design features to facilitate machining: datum features, functional and manufacturing. Component design, machining considerations, redesign for manufacture.		
4	**DFMA Tools:** Rules and methodologies used to design components for manual, automatic and flexible assembly, traditional design and manufacture Vs concurrent engineering, DFA index, poke -yoke, lean principles, six sigma concepts, DFMA as the tool for concurrent engineering, three DFMA criteria for retaining components for redesign of a product; design for manual assembly; design for automatic assembly- Computer-aided design for assembly using software.	11	21
5	**Design for the Environment:** Introduction, Environmental objectives, Global issues, Regional and local issues, Basic DFE methods, Design guide lines, Weighted sum assessment method, Lifecycle assessment method, Techniques to reduce environmental impact, Design to minimize material usage, Design for disassembly, Design for Recyclability, Design for remanufacture, Design for energy efficiency, Design to regulations and standards.	10	19

Course Outcome: After learning the course the students should be able to: \

- Understand the quality aspects of design for manufacture and assembly
- Apply various techniques of DFM for product design and assembly
- Apply the concept of designs for casting, welding, forming and assembly.
- Identify the design factors and processes along customer desires for manufacturing

List of References:

1. Product Design for Manufacture and Assembly, G. Boothroyd, P. Dewhurst, W. A. Knight, CRC Press.
2. Assembly Automation and Product Design, G. Boothroyd, CRC Press.
3. Product Design and Development, K. T. Ulrich and S. D. Eppinger, McGraw-Hill Higher Education
4. Handbook of Product Design for Manufacturing, Bralla, James G., McGraw Hill.
5. Engineering Design - A Material Processing Approach, G E Dieter, McGraw Hill
6. Mechanical Tolerance stackup and analysis, B. R. Fischer, CRC Press.
7. Mechanical assemblies: their design, manufacture, and role in product development, D E Whitney Oxford Press.

Open e-Resource:

1. https://nptel.ac.in/courses/107103012
2. https://archive.nptel.ac.in/courses/107/103/107103012/

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080213	**Subject Title: Lean and Advanced Manufacturing System (Program Elective-2)**
Pre-requisite: - Lean Manufacturing	

Course Objective:

- To emphasize the knowledge on the quality improvement, automation, and advanced manufacturing techniques to create the highest-caliber products quickly, efficiently, inexpensively, and in synchronization with the marketing, sales, and customer service of the company

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	60	40	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Lean Manufacturing** Origin of lean production system – Customer focus – Muda (waste) – Standards – 5S system – Total Productive Maintenance – standardized work –Man power reduction – Overall efficiency - Kaizen – Common layouts - Principles of JIT - Jidoka concept – Poka-Yoke (mistake proofing) - Worker Involvement– Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Lean culture.	11	20
2	**Manufacturing in Competitive Environment** Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible fixtures - Design for assembly, disassembly and service	11	20
3	**Group Technology and FMS** Part families - classification and coding - Production flow analysis - Machine cell design - Benefits. Components of FMS - Application work stations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control - Supervisory computer.	11	20

4	**Just in Time** Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties – flexible work force - line flow strategy - preventive maintenance - Kanban system - strategic implications - implementation issues - Lean manufacture.	11	20
5	**Computer Simulation & Data base Management** System issues - Types of software - specification and selection - Trends - Application of simulation software - Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.	11	20

Course Outcome: After learning the course the students should be able to:

- To impart knowledge on the pace of changes in the manufacturing technology
- To be aware about current trends in manufacturing by softwares and simulation
- To know Lean manufacturing system in current rends

List of References:

1. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing ", Third Edition, Prentice-Hall, 2007.
2. Jha, N.K. “Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.
3. Kalpkjian, “Manufacturing Engineering and Technology ", Addison-Wesley Publishing Co., 1995.
4. Pascal Dennis, “Lean Production Simplified: A Plain-Language Guide to the World's Most
5. Powerful Production System”, (Second edition), Productivity Press, New York, 2007.
6. Taiichi Ohno, Toyota Production System Beyond Large-Scale Production, Productivity Press, 1988

Open e-Resource:

1. https://nptel.ac.in/courses/112107217

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080221	**Subject Title: Computer Control and Process Planning (Program Elective-3)**
Pre-requisite: - Quality, Total Quality Management, Reliability	

Course Objective:

- To provide the student with an understanding of the importance of process planning role in manufacturing and the application of Computer Aided Process Planning tool in the present manufacturing scenario

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	2	0	6	60	40	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction** The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology	10	20
2	**Design of Component:** Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure Geometric modelling for process planning - GT coding - The optiz system - The MICLASS system.	10	20
3	**Process Planning** Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format	10	20
4	**Computer aided Process Planning** Logical Design of a Process Planning - Implementation considerations - manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.	10	20

5	**Integrated process planning** Totally integrated process planning systems - An Overview - Modulus structure - Data Structure, operation - Report Generation, Expert process planning	10	20

Course Outcome: After learning the course the students should be able to:

- Have a sound knowledge in process planning
- Handle computer aided process planning tool
- Learn Industrial Engineering documents by help of computer

List of References:

1. Chang, T.C., " An Expert Process Planning System ", Prentice Hall, 1985.
2. Gideon Halevi and Roland D. Weill, " Principles of Process Planning ", A logical approach, Chapman & Hall, 1995.
3. Nanua Singh, " Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.
4. Rao, “Computer Aided Manufacturing ", Tata McGraw Hill Publishing Co., 2000.
5. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ", Prentice Hall, 1985.

Open e-Resource:

2. https://nptel.ac.in/courses/112104289
3. http://claymore.engineer.gusu.edu/jackh/eod/automate/capp/capp.htm
4. http://Estraj.ute.sk/journal/engl/027/027.htm

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080222	**Subject Title: Quality Management (Program Elective-3)**
Pre-requisite: - Quality, Total Quality Management, Reliability	

Course Objective:

- To provide student with the basic understanding of the approaches and techniques to assess and improve process and or product quality and reliability

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	2	0	6	60	40	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction** Need for TQM, evolution of quality, Definition of quality, TQM philosophy – Contributions of Deming Juran, Crosby And Ishikawa, TQM Models.	10	20
2	**Planning Stage:** Vision, Mission, Quality policy and objective Planning and Organization for quality, Quality policy Deployment, Quality function deployment, introduction to BPR and analysis of Quality Costs	10	20
3	**TQM Principles** Customer focus, Leadership and Top management commitment, Employee involvement – Empowerment and Team work, Supplier Quality Management, Continuous process improvement, Training, performance Measurement and customer satisfaction.	10	20
4	**TQM Tools and Techniques** PDSA, The Seven Tools of Quality, New Seven management tools, Concept of six sigma, FMEA, Bench Marking, JIT, POKA YOKE, 5S, KAIZEN, Quality circles.	10	20
5	**Quality Systems** Need for ISO 9000 Systems, clauses Documentation, Implementation, Introduction to ISO14000 and OSHAS18000, Implementation of TQM, Case Studies.	10	20

Course Outcome: After learning the course the students should be able to:

- Have good knowledge of quality implementation techniques
- Be well versed with Total Quality Management
- Have good knowledge of quality management principles

List of References:

1. Brain Rethery, ISO 9000, Productivity and Quality Publishing Pvt.Ltd., 1993.
2. D.Mills, Quality Auditing, Chapman and Hall, 1993.
3. Juran J.M and Frank M.Gryna Jr., "Quality Planning and Analysis", TMH, India, 1982.
4. Narayana V. and Sreenivasan, N.S., "Quality Management – Concepts and Tasks", New Age International 1996.
5. Oakland.J.S. "Total Quality Management", Butterworth–Hcinemann Ltd., Oxford, 1989.
6. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991

Open e-Resource:

1. https://nptel.ac.in/courses/110101010

GANDHINAGAR INSTITUTE OF TECHNOLOGY
M.TECH 2nd SEMESTER
MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080223	**Subject Title: Industrial Robotics (Program Elective-3)**
Pre-requisite: - Basic of Robotics, Sensors, Electronics	

Course Objective:

- To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	2	0	6	60	40	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction and Robotics Kinematics** Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects	10	19
2	**Robot drivers and Controllers** Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers	11	21
3	**Robot Sensors** Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.	10	19

4	**Robotics Loop Design** Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	11	21
5	**Programming of Robotics System** Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots	10	20

Course Outcome: After learning the course the students should be able to:

- The student will be able to design robots and robotic work cells and write program for controlling the robots
- The student will be able to apply artificial intelligence and expert systems in robotics
- The students will have deep knowledge of robotics system and its components

List of References:

1. Deb, S.R.” Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.
2. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill, 1987.
3. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.
4. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,” Industrial Robotics Technology, Programming and Applications”, Mc Graw-Hill, Int. 1986.
5. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
6. Timothy Jordanides et al ,”Expert Systems and Robotics “, Springer –Verlag, New York, May 1991.
7. Yoram Koren,” Robotics for Engineers’ Mc Graw-Hill, 1987

Open e-Resource:

1. https://nptel.ac.in/courses/112105249

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M.TECH 2nd SEMESTER

MECHANICAL ENGINEERING (CAD-CAM)

DOC NO: 4061

Subject Code: 10080209	**Subject Title: Research Review & Seminar**
Pre-requisite: Zeal to learn	

Course Objective:

- To Learn and present the research in public to a general audience.
- Students would receive regular feedback and advice on their research projects in specific field
- The progress of our students would be regularly monitored and they would receive formal, regular feedback.
- A high rate of participation in such a visible research-oriented activity could help build the intellectual "atmosphere" of the department.
- Increased knowledge of one another's research would facilitate intergroup interactions.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
0	0	6	3	0	0	0	100	100

Content:

This course will help the scholars for their dissertation phase by motivation and encouraging in quality research. Research review will help them to boost their skills and widen their horizon of thinking for the domain. Research review and seminar is a hands-on course designed to impart soft skills by the foundational methods and techniques for academic research in CAD/CAM engineering. Scholars will examine to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Once equipped with this knowledge, scholars would be well-placed to conduct disciplined research in field of CAD/CAM engineering. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments. The details of course includes sampling techniques, research designs and techniques of analysis which will be helpful in designing of components and performing experiments in areas of CAD/CAM engineering Students will have a semester presentation and end semester presentation. Mid semester presentation will include

identification of the problem based on the latest literature available. End semester presentation should be done along with the report and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Course Outcome:
At the end of the course, the student will be able to:

1. To develop understanding of the basic framework of research review process and able to write technical report.
2. To identify various sources of information for literature review and data collection.
3. Study and develop elicit, analyze, and document skills in the form of a requirements specification.
4. Evaluate traceability between requirements, design, and implementation artefacts for the research work.
5. Develop skills to present and defend their work in front of a technically qualified audience.

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M.TECH 2nd SEMESTER

MECHANICAL ENGINEERING (THERMAL ENGINEERING / CAD-CAM)

DOC NO: 4061

Subject Code: 10080231	**Subject Title: Cost Management of Engineering Projects (Program Elective-4)**
Pre-requisite: Zeal to learn	

Course Objective:

- Establish systems to help streamline the transactions between corporate support departments and the operating units.
- Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units.
- Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	0	0	2	60	40	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Introduction and Overview of the Strategic Cost Management Process	4	14
2	Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making	6	22
3	Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Roleof each member. Importance Project site: Data required with significance.	6	22

	Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process		
4	Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraint Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.	6	21
5	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	6	21

Course Outcome: After completion of this course, student will be able to

- To understand the cost-volume-profit analysis.
- To understand the project commissioning: mechanical and process.
- To understand quantitative techniques for cost management.

List of References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd

Open e-Resource:

1. https://nptel.ac.in/courses/105104161/

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M.TECH 2nd SEMESTER

MECHANICAL ENGINEERING (THERMAL ENGINEERING / CAD-CAM)

DOC NO: 4061

Subject Code: 10080232	**Subject Title: : Industrial Safety (Program Elective-4)**
Pre-requisite: Zeal to learn	

Course Objective:

- To provide awareness about safety helps students from any major accidents.
- To provide knowledge of maintenance, its type and application gives better work environments.
- To understand Different maintenance tools and techniques

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	0	0	2	60	40	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Industrial safety:** Accident, causes, types, results and control, mechanical andelectrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment, and methods.	06	19
2	**Fundamentals of maintenance engineering:** Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment	05	16
3	**Wear and Corrosion and their prevention:** Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, generalsketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun,	07	23

	iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods		
4	**Fault tracing:** Fault tracing-concept and importance, decision tree concept, need andapplications, sequence of fault finding activities, show as decision tree, drawdecision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes	06	19
5	**Periodic and preventive maintenance:** Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantagesof preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repaircycle concept and importance	07	23

Course Outcome: After completion of this course, student will be able to

- Understand Importance of Safety and Important related Acts.
- Apply Maintenance techniques as per requirements and able to
- compare for with different technique for better performance.
- Understand wear and corrosion, its causes and remedial actions for
- preventions.
- Demonstrate fault tracing, its methods and application.

List of References:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services
2. Maintenance Engineering, H. P. Garg, S. Chand and Company
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

Open e-Resource:

1. https://archive.nptel.ac.in/courses/110/105/110105094/
2. https://archive.nptel.ac.in/courses/112/105/112105232/

GANDHINAGAR INSTITUTE OF TECHNOLOGY

M.TECH 2nd SEMESTER

MECHANICAL ENGINEERING (THERMAL ENGINEERING / CAD-CAM)

DOC NO: 4061

Subject Code: 10080233	Subject Title: Composite Materials (Program Elective-4)
Pre-requisite: Zeal to learn	

Course Objective:

- To provide knowledge of classification and characteristics of composite materials.
- To understand manufacturing of metal matrix composites.
- To understand manufacturing of polymer matrix composites.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
2	0	0	2	60	40	0	0	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	**Introduction:** Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance	02	08
2	**Reinforcements:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions	06	21
3	**Manufacturing Of Metal Matrix Composites:** Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, eaving. Properties and applications	06	21
4	**Manufacturing of Polymer Matrix Composites:** Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction	07	25

	injection moulding. Propertiesand applications		
5	**Strength:** Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations	07	25

Course Outcome: After completion of this course, student will be able to

- Understand the laminar failure criteria-strength ratio.
- Understand the compression molding.
- Understand the concept of manufacturing of metal matrix composites.

List of References:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,
3. Hand Book of Composite Materials-ed-Lubin
4. Composite Materials – K.K.Chawla
5. Composite Materials Science and Applications – Deborah D.L. Chung
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi

Open e-Resource:

1. https://nptel.ac.in/courses/112104168

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Master of Technology

CAD-CAM

Subject Code: 10080301	**Subject Title:** Dissertation Phase-1
Pre-requisite: --	

Course Objective:

1. To enable students to independently identify, analyze, and define a research problem in their chosen engineering domain, applying relevant analytical and/or experimental methodologies.
2. To conduct a comprehensive literature review, establish research objectives, define the scope, and outline the preliminary work for the dissertation project.
3. To facilitate the development of a structured research report, documenting the findings, methodology, and analysis, while proposing solutions and future work based on the project's results.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
0	0	28	14	0	0	100	0	100

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

1. Choose a domain of project work related to their engineering specialization.
2. Discover appropriate literature and define the objectives & scope of the project work.
3. Solve the designated problem through analysis, design, and/or experimentation.
4. Create and discuss the project report.

Syllabus:

The Dissertation Phase-1 is designed to train students in independently analyzing and addressing problems in their engineering field. The project may involve analytical and/or experimental work, focusing on the latest advancements in the chosen engineering domain.

The project report should include:

- Objective of study and scope of work.
- Critical literature review related to the project.
- Preliminary work conducted in the domain, including analytical and/or experimental components.

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Master of Technology

CAD-CAM

Subject Code: 10080302	**Subject Title:** Internal Review-1
Pre-requisite: --	

Course Objective:

1. Initiate independent research through systematic literature review.
2. Identify research problems and formulate a relevant dissertation topic.
3. Align topics with emerging research trends in the respective field.
4. Conduct in-depth analysis and review of existing methods.
5. Establish a structured research foundation for further dissertation development.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
0	0	4	2	0	0	0	100	100

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

1. Understand the chosen research topic and define its relevance and associated challenges.
2. Identify and interpret quality literature from reputed journals to validate the problem statement.
3. Conduct a comparative review of existing methods and highlight research gaps or scope for improvement.
4. Evaluate previous approaches using relevant datasets and appropriate performance metrics.
5. Propose a hypothesis or research direction with suitable algorithms, methods, or modeling approaches.

Course Structure and Work Plan

- Week 1–2: Finalization of research domain and title approval in consultation with guide.
- Week 3–5: Extensive literature survey (minimum 20 papers, including 10 recent journal articles).
- Week 6–8: Identification of research gaps and statement of problem.
- Week 9–11: Comparative analysis of existing methodologies.
- Week 12–14: Initial data collection, feasibility study or conceptual framework.
- Week 15–16: Preparation of draft report and internal presentation.

Deliverables:

1. Synopsis/Concept note approved by faculty guide
2. Literature review summary with annotated bibliography
3. Problem statement and research objectives

4. Comparative analysis table or benchmarking matrix
5. Internal presentation before a departmental review panel
6. Progress report (typed and signed by guide)

Evaluation Components:

Component	Weightage (Marks)
Literature Review Quality	15
Clarity of Problem Statement	10
Identification of Research Gap	10
Comparative Analysis / Review Matrix	10
Presentation and Communication	15
Viva by Panel / Review Committee	40
Total	**100**

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Master of Technology

CAD-CAM

Subject Code: 10080401	**Subject Title:** Internal Review-2
Pre-requisite: --	

Course Objective:

1. Initiate students into independent research with a focus on data collection, evaluation, and hypothesis testing.
2. Guide students in applying methodologies, validating solutions, and evaluating performance.
3. Enable students to communicate research outcomes effectively.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
0	0	4	2	0	0	0	100	100

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

1. Apply ethical standards in data collection and analysis.
2. Test and validate hypotheses using qualitative/quantitative methods.
3. Evaluate methodologies and solutions using performance metrics.
4. Analyze experimental data and derive meaningful conclusions.
5. Present and communicate research outcomes clearly.

Course Structure and Work Plan

- Week 1–2: Complete data collection and hypothesis testing.
- Week 3–6: Validate methodology and perform comparative analysis.
- Week 7–9: Analyze experimental data and finalize conclusions.
- Week 10–12: Prepare final report and presentation.

Deliverables:

1. Final Research Report: Document methodology, analysis, results.
2. Presentation Slides: Showcase research findings and methodology.
3. Experimental Data: Include experiments, analysis, and performance evaluation.
4. Internal Presentation: Final presentation for internal review.

Evaluation Components:

Component	Weightage (Marks)
Literature Review & Problem Statement	20
Hypothesis & Methodology Validation	25
Experimental Work & Data Analysis	30

Final Report & Presentation	25
Total	**100**

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Master of Technology

CAD-CAM

Subject Code: 10080402	**Subject Title:** Dissertation Phase-2
Pre-requisite: --	

Course Objective:

1. Independently execute the identified research problem, applying advanced analytical and experimental methodologies.
2. Design a comprehensive experimental or simulation setup to validate the research hypothesis.
3. Complete a detailed analysis of the results, interpret the findings, and propose future work based on the outcomes.
4. Prepare a final dissertation report summarizing the work conducted, methodologies used, and outcomes achieved.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
0	0	28	14	0	0	100	0	100

Course Outcomes (COs):

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

1. Select and define a research problem relevant to their field of specialization.
2. Conduct a thorough literature review and establish clear research objectives and scope.
3. Apply suitable analytical, design, or experimental methods to solve the research problem.
4. Compile a comprehensive project report detailing methodology, analysis, conclusions, and recommendations.

Syllabus:

This phase of the dissertation is a continuation of Dissertation Phase-1, where students will:

- Carry forward the preliminary work from Phase-1, refining the problem statement, objectives, and scope.
- Implement advanced methodologies for research, including data collection, modeling, simulation, or experimental setup.
- Analyze data from experiments or simulations and interpret the results within the context of the research problem.
- Propose solutions based on the findings, along with future work recommendations.
- Document the entire research process in a structured dissertation report.