Gandhinagar Institute of Technology

Academic Regulation & Curriculum

for

B.Tech

in

Mechanical Engineering

***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 six programmes spanning undergraduate and postgraduate levels: B.Tech in Mechanical Engineering, B.Tech in Robotics & Automation, B.Tech in Energy Engineering, M.Tech in CAD/CAM, M.Tech in Thermal Engineering, and M.Tech in Energy Engineering. 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

PEO1

To equip the mechanical engineering students with essential knowledge of Basic Engineering Science and Technical Skills.

PEO2

To implant a robust foundation in the field of engineering to resolve, investigate and redesign engineering solutions.

PEO3

To be aware of students about communal, ecological, and energy-related problems and motivate students to solve problems with engineering skills.

PEO4

To nurture students for Industries, Research and Development, and Social Needs.

4. Program Details

4.1 Program Structure & Duration

- Duration & Intake : 4 Years & 120 Seats
- Semesters: 8
- Mode: Full Time
- Credit Structure: As per NEP/University norms
- Medium of Instruction: English

4.2 Eligibility Criteria for Admission

Candidates who have passed the Higher Secondary Examination (10+2) or equivalent examination from a recognised board with Physics, Chemistry, and Mathematics (Group A) as compulsory subjects, and obtained a minimum of 50% aggregate marks (45% for reserved category candidates as per applicable norms), shall be eligible for admission to the programme.

4.3 Admission Procedure

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

4.4. Credit Summary

Disciplines	Percentage	Credits	1st Yr	2nd Yr	3rd Yr	4th Yr	Total
Core Engineering	51%	88	8	31	35	14	**88**
Humanities	5%	9	4	3	2	0	**9**
Basic Science	9%	16	12	4	0	0	**16**
Engineering Science (Minor)	11%	19	16	0	3	0	**19**
Multidisciplinary (open elective)	5%	8	4	4	0	0	**8**
IKS	5%	8	2	2	2	2	**8**
Projects / Tranning / Seminar	14%	24	0	0	0	24	**24**
		172	**46**	**44**	**42**	**40**	**172**

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: Bachelor of Technology (01) | **Branch Name (Code): ME (001)** | **G U Batch : 4th Year - 2025-26**

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

NCrF LEVEL	Subject Code	Course Type		Subject Name	Blended With	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
							L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 4.5	10000101	Basic Science		Engineering Mathematics-I	IEEE	5	3	2	0	5	70	30	0	0	100
	10010104	Core Engineering		Engineering Drawing Practice	IEEE	4	3	0	2	5	70	30	30	20	150
	10010106	Core Engineering		Fundamentals of Mechanical Engg.	IEEE	4	3	0	2	5	70	30	30	20	150
	10010105	Engineering Science (Minor)		Engineering Foundation	IEEE	4	3	0	2	5	70	30	30	20	150
	SEC014	Multidisciplainary (Open Elective)	Skill Enhancement Course (SEC-I)	Introduction of Cyber Security	NEP	2	2	0	0	2	25	25	0	0	50
	VAC014	Engineering Science (Minor)	Value Addition Course (VAC-I)	Integrated Personality Development Course	NEP	2	2	0	0	2	25	25	0	0	50
	AEC002	Humanities	Ability Enhancement Course (AEC-I)	Communication and Presentation for Technical Professionals	NEP	2	2	0	0	2	25	25	0	0	50
						23	**18**	**2**	**6**	**26**					**700**

Program Name: Bachelor of Technology (01) | **Branch Name (Code): ME (001)** | **G U Batch : 4th Year - 2025-26**

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

NCrF LEVEL	Subject Code	Course Type		Subject Name	Blended With	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
							L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 4.5	10000201	Basic Science		Engineering Mathematics-II	IEEE	5	3	2	0	5	70	30	0	0	100
	10030101	Engineering Science (Minor)		Basics of Electrical & Electronics Engineering	IEEE	4	3	0	2	5	70	30	30	20	150
	10020102	Engineering Science (Minor)		Fundamental of Civil Engineering	IEEE	4	3	0	2	5	70	30	30	20	150
	10000003	Basic Science		Engineering Physics	IEEE	4	3	0	2	5	70	30	30	20	150
	AEC015	Humanities	Ability Enhancement Course (AEC-II)	Personality Development for Effective Leadership	NEP	2	2	0	0	2	25	25	0	0	50
	VAC021	Engineering Science (Minor)	Value Addition Course (VAC-II)	Stress and Time Management	NEP	2	2	0	0	2	25	25	0	0	50
	SEC019	Multidisciplainary (Open Elective)	Skill Enhancement Course (SEC-II)	Social Media and Management	NEP	2	2	0	0	2	25	25	0	0	50
	IKS0201	IKS		Indian Ancient History and Cultural Heritage	IKS	2	1	0	2	3	0	25	25	0	50
						25	**19**	**2**	**8**	**29**					**750**

Gandhinagar Institute of Technology (01)

Institute Name (Code): Gandhinagar Institute of Technology (01)														
Program Name (Code): Bachelor of Technology (01)									**Branch Name (Code): ME (001)**				**G U Batch : 3rd Year - 2024-25**	
Semester / Year : Second Year / Semeter III									**Effective in 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		
NCF - 5.0	10010301	Professional Core	Material Science and Metallurgy	4	3	0	2	5	70	30	30	20	150	
	10010302	Professional Core	Engineering Thermodynamics	4	3	1	0	4	70	30	0	0	100	
	10010303	Professional Core	Manufacturing Processes	4	3	0	2	5	70	30	30	20	150	
	10020305	Professional Core	Mechanics of Solids	4	3	0	2	5	70	30	30	20	150	
	VAC023	Humanities	Value Addition Course (VAC-III) Universal Human Values	2	2	0	0	2	25	25	0	0	50	
	10000303	Basic Science	Statistics and Partial Differential Equations	4	3	1	0	4	70	30	0	0	100	
			Total	**22**	**17**	**2**	**6**	**25**					**700**	

Institute Name (Code): Gandhinagar Institute of Technology (01)														
Course Name (Code): Bachelor of Technology (01)									**Branch Name (Code): ME (001)**				**G U Batch : 3rd Year - 2024-25**	
Semester / Year : Second Year / Semeter IV									**Effective in 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		
NCF - 5.0	10010401	Professional Core	Fluid Mechanics	4	3	0	2	5	70	30	30	20	150	
	10010402	Professional Core	Kinematics & Theory of Machines	4	3	0	2	5	70	30	30	20	150	
	10010403	Professional Core	Fundamental of Machine Design	4	3	1	0	4	70	30	0	0	100	
	10010405	Professional Core	Manufacturing Technology	4	3	0	2	5	70	30	30	20	150	
	SEC026	Multidisciplainary (Open Elective)	Skill Enhancement Course (SEC-III) Cyber Security	2	1	0	2	3	25	25	0	0	50	
	IKS-0401	IKS	IKS - Vedic Mathematics	2	2	0	0	2	0	50	0	0	50	
			Total	**20**	**15**	**1**	**8**	**24**					**650**	

Gandhinagar Institute of Technology (01)

Course Name (Code): Bachelor of Technology (01)	Branch Name (Code): ME (001)	G U Batch : 2nd Year - 2023-24
Semester / Year : Third Year / Semeter 5	Effective in Academic Year:2026-27	

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 - 5.5	10010501	Professional Core	Mechanical Measurement and Metrology	4	3	0	2	5	70	30	30	20	150
	10010502	Professional Core	Heat Transfer	4	3	0	2	5	70	30	30	20	150
	10010503	Professional Core	Design of Machine Elements	5	4	0	2	6	70	30	30	20	150
	10010504	Professional Core	Operation Research	3	2	1	0	3	70	30	0	0	100
	10010505	Professional Core	Industrial Automation	2	2	0	0	2	70	30	0	0	100
		Open Elective	Open Elective-I	3	2	0	2	4	70	30	30	20	150
	10010506	Humanities and Social Science	Basic Principles of Management	2	2	0	0	2	50	0	0	0	50
				23	**18**	**1**	**8**	**27**					**850**
	Open Elective - I												
	10010511	**Open Elective - I**	Introduction to Robotics			10010513		**Open Elective - I**	Artificial Intelligence in Mechanical Systems				
	10010512	**Open Elective - I**	Introduction to Adative Manufacturing			10010514		**Open Elective - I**	Product Design and Inovation				

Gandhinagar Institute of Technology (01)

Course Name (Code): Bachelor of Technology (01)	Branch Name (Code): ME (001)	G U Batch : 2nd Year - 2023-24
Semester / Year : Third Year / Semeter 6	Effective in Academic Year:2026-27	

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 - 5.5	10010601	Professional Core	Applied Thermodynamics	5	4	0	2	6	70	30	30	20	150
	10010602	Professional Core	Advanced Manufacturing Processes	4	3	0	2	5	70	30	30	20	150
	10010603	Professional Core	Dynamics of Machinery	5	4	0	2	6	70	30	30	20	150
	IKS0601	IKS	Minor Project on IKS	2	0	0	4	4	0	0	0	50	50
		Program Elective	Program Elective-I	4	3	0	2	5	70	30	30	20	150
		Program Elective	Program Elective-II	4	3	1	0	4	70	30	0	0	100
				24	**17**	**1**	**12**	**30**					**750**
	Elective - I					**Elective - II**							
	10010611	**Program Elective-I**	Internal Combustion Engine			10010621		**Program Elective-II**	Energy Conservation & Management				
	10010612	**Program Elective-I**	Automation in Manufacturing			10010622		**Program Elective-II**	Industry 4.0 - Internet of Things				
	10010613	**Program Elective-I**	Rapid Prototyping			10010623		**Program Elective-II**	Industrial Engineering				
	10010614	**Program Elective-I**	Industrial Tribology			10010624		**Program Elective-II**	Maintenance Engineering and Management				
	10010615	**Program Elective-I**	Finite Element Analysis			10010625		**Program Elective-II**	Computational Fluid Dynamics				

Gandhinagar Institute of Technology (01)

Course Name (Code): Bachelor of Technology (01)	Branch Name (Code): ME (001)	G U Batch : 1st Year - 2022-23
Semester / Year : Forth Year / Semeter 7	Effective in 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	10010701	Professional Core	Power Plant Engineering	4	4	0	0	4	70	30	0	0	100
	10010702	Professional Core	Advanced Machine Design	4	4	0	0	4	70	30	0	0	100
	10010703	Project Work	Minor Project	6	0	0	12	12	0	0	80	20	100
		Program Elective	Program Elective-III	4	3	0	2	5	70	30	30	20	150
		Program Elective	Program Elective-IV	3	3	0	0	3	70	30	0	0	100
	10010704	Project Work	Summer Internship	1	0	0	2	2	0	0	0	50	50
				22	**14**	**0**	**16**	**30**					**600**

Elective - III			Elective - IV		
10010711	**Program Elective-I**	Computer Integrated Manufacturing	10010721	**Program Elective-II**	Renewable Energy Engineering
10010712	**Program Elective-I**	Refrigeration and Air Conditioning	10010722	**Program Elective-II**	Entrepreneurship
10010713	**Program Elective-I**	Design For Manufacturing and Assembly	10010723	**Program Elective-II**	Industrial Safety
10010714	**Program Elective-I**	Tool Design and Manufacturing	10010724	**Program Elective-II**	Intellectual Property Rights
10010715	**Program Elective-I**	Gas Dynamics and Jet Propulsion	10010725	**Program Elective-II**	Engineering Project Management

Gandhinagar Institute of Technology (01)

Course Name (Code): Bachelor of Technology (01)	Branch Name (Code): ME (001)	G U Batch : 1st Year - 2022-23
Semester / Year : Forth Year / Semeter 8	Effective in 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	10010801	Project Work	Internship/Major Project	11	0	0	22	22	0	0	100	100	200
	10010802	Technical Seminar	Technical Seminar	1	0	0	2	2	0	0	0	50	50
				12	**0**	**0**	**24**	**24**					**250**

6. Teaching, Learning & Evaluation

6.1 Teaching Methodology

The program shall adopt:

- Classroom Teaching
- Case Studies
- Industry Interaction
- Site Visits
- Workshops
- GIS/Software Training
- Field Surveys
- Research Projects
- Internships
- 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, internships, and field 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)
Continuous Internal Evaluation (CIE) may include:

- Mid-Semester Examination
- Assignments
- Presentations
- Field work
- Class Test

- AI Quiz & Viva Voce
- Dissertation
- Project work

6.4 Weightage

- Continuous Internal Evaluation: 33%
- Mid Semester Exam: 20%
- End Semester Examination: 47%

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 B.Tech Mechanical Engineering 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, workshop, project, seminar, and internship 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	73	79
BB	8	66	72
BC	7	60	65
CC	6	55	59
CD	5	50	54
DD	4	45	49
FF	0	0	44

6.7 Dissertation / Project Work

Students shall undertake Research Project OR Industry-Based Dissertation. Requirements may include:

- Proposal Presentation
- Periodic Review
- Final Report Submission
- Viva Voce Examination

The dissertation shall be evaluated by internal and external examiners.

7. Rules and Regulations

7.1 Rules for Promotion

A student enrolled in the B.Tech Mechanical Engineering 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 B.Tech Mechanical Engineering programme shall be eight academic years from the date of admission or as prescribed by the University and applicable regulatory authorities from time to time.

7.3 Internship Guidelines

Students shall undergo mandatory internship, industrial training, or industry-oriented experiential learning as prescribed in the curriculum structure of the programme. The internship/training may be carried out in:

- Manufacturing Industries
- Automobile Industries
- Robotics and Automation Industries
- Thermal and Power Plants
- CAD/CAM/CAE Industries
- Production and Industrial Engineering Organizations
- Design and Product Development Companies
- Energy and Renewable Energy Industries
- Research and Development Organizations
- Government and Public Sector Engineering Units
- MSMEs and Industrial Workshops

Students shall be required to submit the following documents and evaluation components after completion of internship/training:

- Internship / Industrial Training Report
- Work Diary / Logbook
- Training Completion Certificate
- Presentation / Viva Voce
- Project or Assignment Report, wherever applicable

7.4 Discipline Rules

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

Students are expected to:

- Attend classes, laboratories, and workshops 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, and examinations
- Properly use laboratory equipment, machines, tools, and workshop facilities

Any form of misconduct, indiscipline, ragging, use of unfair means in examinations, damage to institutional property, harassment, unsafe laboratory practices, or behaviour affecting the academic environment 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.

Students shall also comply with all professional, ethical, environmental, and safety standards prescribed by the institution from time to time.

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, digital tools, simulation platforms, and AI-based technologies for learning, design, analysis, research, and innovation purposes.

Students may use:

- CAD/CAM/CAE Software
- Simulation and Analysis Tools
- Programming and Automation Platforms
- AI-based Learning Platforms
- Data Analytics and Visualization Tools
- Digital Manufacturing and Design Tools
- Robotics and Embedded System Platforms
- Virtual Laboratories and Engineering Software

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 activities.

8. Student Support

8.1 Industry Collaboration

The department shall actively promote collaboration with manufacturing industries, automobile industries, robotics and automation companies, energy and power sector industries, production and design organizations, research institutions, MSMEs, public sector undertakings, and professional engineering bodies to enhance practical exposure and industry relevance of the B.Tech Mechanical Engineering programme.

Such collaborations may include:

- Industrial internships and training programs
- Industrial visits and plant exposure
- Expert lectures and technical workshops
- Live industry projects and consultancy assignments
- Joint research and innovation activities
- Skill development and certification programs
- Entrepreneurship and startup support activities
- Placement and career development initiatives

The institution may also establish Memoranda of Understanding (MoUs) with industries, research organizations, and professional bodies for academic enrichment, technology transfer, laboratory development, collaborative research, and industry-oriented learning aimed at improving employability, innovation capability, and professional competency among students.

8.2 Research and Consultancy

The department shall encourage faculty members and students to actively engage in research, innovation, consultancy, product development, and applied engineering studies related to manufacturing, thermal engineering, design engineering, robotics, automation, energy systems, materials, industrial engineering, sustainable technologies, and emerging engineering domains.

Students may undertake:

- Research and innovation projects
- Product design and development activities
- Prototype fabrication and testing
- Simulation and modelling studies
- Automation and robotics projects
- Energy efficiency and sustainability studies
- Industry-oriented technical problem-solving assignments

The institution may also undertake consultancy assignments for industries, government organizations, MSMEs, and other agencies in areas such as product design, CAD/CAM/CAE analysis, manufacturing optimization, automation systems, energy auditing, thermal system analysis, industrial process improvement, and mechanical system development.

Participation in conferences, technical competitions, workshops, publications, funded projects, patents, incubation activities, and collaborative research initiatives shall be encouraged to promote academic excellence, innovation, entrepreneurship, and industry-oriented learning.

8.3 Library and Laboratory Facilities

Adequate library, laboratory, workshop, and digital learning facilities shall be made available to support effective teaching, practical training, research, innovation, and skill development under the B.Tech Mechanical Engineering programme.

The department shall facilitate access to:

- Engineering textbooks and reference books
- National and international journals
- Research publications and e-resources
- Standards, manuals, and technical databases
- Digital learning platforms and virtual laboratories
- CAD/CAM/CAE software and simulation tools

Necessary laboratories, workshops, computing facilities, internet access, manufacturing tools, machines, measuring instruments, automation systems, robotics platforms, and fabrication

facilities required for practical and project-based learning shall also be provided to enhance technical competency, research capability, and industry readiness among students.

8.4 Student Support and Mentoring

A structured system for student support, academic mentoring, and professional guidance shall be implemented for students enrolled in the B.Tech Mechanical Engineering programme.

The department shall facilitate:

- Academic counselling and mentoring
- Career guidance and higher education support
- Technical skill development activities
- Research and innovation support
- Entrepreneurship and startup guidance
- Personal and professional development initiatives

Students may also be provided opportunities for interaction with industry experts, participation in workshops, seminars, industrial visits, technical competitions, training programs, innovation challenges, and extracurricular activities aimed at enhancing employability, leadership qualities, communication skills, teamwork, and overall personality development.

Necessary support mechanisms for addressing academic and personal concerns shall also be made available as per institutional policies.

8.5 Placement and Career Development

The department shall actively promote placement assistance and career development activities through industry interaction, internships, professional networking, industrial collaborations, and campus engagement initiatives.

Efforts shall be made to establish linkages with:

- Manufacturing Industries
- Automobile Industries
- Robotics and Automation Companies
- Energy and Power Sector Industries

- Design and Product Development Companies
- Research and Development Organizations
- Government and Public Sector Engineering Units
- MSMEs and Startup Ecosystems

Career development activities such as aptitude training, resume preparation, interview preparation, soft skill development, technical certification programs, entrepreneurship guidance, expert sessions, and placement-oriented workshops may also be organized to enhance professional competency and employability of students.

9. Program Credibility

9.1 Executive Summary

The B.Tech Mechanical Engineering programme is designed to develop industry-ready mechanical engineers with strong foundations in design engineering, manufacturing technology, thermal engineering, automation, robotics, materials engineering, energy systems, and emerging industrial technologies aligned with modern engineering and Industry 4.0 requirements.

The programme emphasizes a balanced integration of theoretical knowledge, practical skills, engineering design, industrial exposure, innovation, and research-oriented learning to prepare students for professional engineering practice, higher studies, entrepreneurship, and multidisciplinary technological domains.

The curriculum is delivered by qualified faculty members with expertise in various domains of Mechanical Engineering including design, manufacturing, thermal systems, robotics, automation, CAD/CAM/CAE, industrial engineering, and energy engineering. The teaching-learning process is supported through laboratories, workshops, simulation tools, industrial training, project-based learning, and industry interaction activities to ensure strong practical and application-oriented learning.

The programme integrates modern engineering tools, computational methods, digital manufacturing technologies, automation systems, simulation platforms, and AI-assisted engineering practices to enhance technical competency and industry readiness among students.

Students are encouraged to participate in research activities, product development, innovation projects, technical competitions, internships, startup initiatives, and interdisciplinary engineering activities to develop problem-solving abilities, creativity, leadership qualities, and professional competency.

The programme also promotes continuous interaction with industries, research organizations, MSMEs, professional bodies, and technology partners through internships, expert lectures, industrial visits, collaborative projects, workshops, certification programs, and consultancy activities.

Graduates of the programme shall be academically and professionally prepared for careers in manufacturing, automotive, aerospace, robotics, automation, thermal and energy sectors, industrial engineering, product development, research organizations, public sector industries, and emerging technology domains while also being eligible to pursue higher studies, research, entrepreneurship, and professional certifications in related fields.

The programme is designed in alignment with modern engineering practices, outcome-based education principles, industry requirements, sustainability considerations, innovation ecosystems, and evolving technological advancements in Mechanical Engineering and allied disciplines.

9.2 Scope and Career Opportunities

Graduates of the programme may find career opportunities in:

- Manufacturing Industries
- Automobile Industries
- Aerospace and Aviation Industries
- Robotics and Automation Industries
- Thermal and Power Plants
- Energy and Renewable Energy Industries
- CAD/CAM/CAE and Design Companies
- Production and Industrial Engineering Organizations
- Research and Development Organizations
- Government and Public Sector Undertakings
- MSMEs and Industrial Enterprises
- Consulting and Engineering Service Companies
- Mechatronics and Smart Manufacturing Industries
- Construction and Heavy Engineering Industries

9.3 Potential Job Roles

Graduates of the programme may work in roles such as:

- Mechanical Design Engineer
- Production Engineer
- Manufacturing Engineer

- CAD/CAM Engineer
- Automation Engineer
- Robotics Engineer
- Thermal Engineer
- Quality Control Engineer
- Maintenance Engineer
- Industrial Engineer
- Project Engineer
- Research and Development Engineer
- Energy Engineer
- HVAC Engineer
- Mechatronics Engineer
- Product Development Engineer
- Plant Engineer
- Technical Consultant

9.4 Higher Study & Professional Opportunities

Students graduating from the B.Tech Mechanical Engineering programme may pursue:

- M.Tech. in related specializations
- MBA and Management Studies
- 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
- Energy and Sustainability Certifications
- Government and Competitive Examinations
- Entrepreneurship and Startup Ventures
- International Technical Certification Programs

10. Collaborative Field Work / Experimental Work

The B.Tech Mechanical Engineering programme shall emphasize practical learning, industry exposure, and application-oriented engineering education through collaborative field work, laboratory practice, workshops, industrial training, and experimental learning activities.

Students may participate in:

- Industrial visits, field training, and manufacturing plant exposure
- CAD/CAM/CAE modelling, simulation, and design-based exercises
- Product development, fabrication, and prototype-building activities
- Robotics, automation, thermal, and energy-related experimental projects
- Research projects, innovation challenges, technical competitions, and interdisciplinary engineering activities
- Internship programs, industry-oriented mini projects, and major project work in collaboration with industries and research organizations

The programme shall encourage experiential learning, problem-solving ability, teamwork, innovation, technical communication, and practical engineering competency aligned with modern industrial and technological requirements.

11. Market Survey

11.1 Executive Summary

India is witnessing rapid growth in manufacturing, automation, robotics, automotive, energy, aerospace, and industrial sectors due to technological advancement, Industry 4.0 adoption, infrastructure development, and increasing industrial investment. Gujarat, particularly Ahmedabad and Gandhinagar, has emerged as a major industrial and manufacturing hub with strong presence in engineering industries, MSMEs, automobile sectors, renewable energy, process industries, and smart manufacturing ecosystems.

A market survey and industry interaction conducted with engineering industries, manufacturing units, automation companies, and technical professionals indicated strong demand for skilled mechanical engineers with practical knowledge, technical competency, design capability, manufacturing skills, and exposure to modern engineering technologies.

The survey also identified the growing need for engineers trained in CAD/CAM/CAE, automation, robotics, thermal systems, manufacturing processes, product development, and industrial problem-solving. Industries emphasized the importance of practical exposure, internships, project-based learning, and industry-oriented training for improving employability and professional readiness among graduates.

The findings clearly indicate that the B.Tech Mechanical Engineering programme is academically relevant, industry-oriented, and aligned with present and future technological and industrial requirements.

11.2 Market Demand & Industry Trends

The Mechanical Engineering sector continues to play a significant role in industrial growth, manufacturing development, infrastructure expansion, and technological innovation. Major growth areas include:

- Advanced Manufacturing and Smart Manufacturing
- Robotics and Industrial Automation
- Electric Vehicles and Automotive Engineering
- Renewable Energy and Sustainable Technologies

- Aerospace and Defence Manufacturing
- CAD/CAM/CAE and Product Design
- Industrial Engineering and Mechatronics
- Energy and Thermal Engineering Systems

Industries are increasingly seeking engineers with multidisciplinary skills, practical exposure, digital engineering competency, and innovation-oriented thinking aligned with modern industrial practices.

11.3 Skill Gap Identified by Industry

Industry feedback and market analysis highlighted several gaps commonly observed among engineering graduates, including:

- Limited practical and hands-on engineering exposure
- Insufficient industrial training and application-oriented learning
- Lack of proficiency in CAD/CAM/CAE and modern engineering software
- Limited exposure to automation, robotics, and emerging technologies
- Weak problem-solving, communication, and project management skills
- Insufficient industry interaction and real-world engineering experience

The industry strongly emphasized the need for technically competent graduates capable of contributing effectively to manufacturing, design, automation, energy, and industrial engineering sectors.

11.4 Employment Opportunities & Industry Support

Graduates of the programme shall have employment opportunities in manufacturing industries, automobile industries, robotics and automation companies, energy sectors, design and product development firms, research organizations, MSMEs, and public sector engineering organizations.

Industries have also expressed willingness to support the programme through:

- Internships and industrial training
- Industrial visits and expert lectures
- Collaborative projects and workshops

- Skill development initiatives
- Placement and career support activities

The programme is therefore expected to significantly contribute towards developing industry-ready engineers equipped with modern technical knowledge, practical competency, innovation capability, and professional skills.

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 B.Tech Mechanical Engineering 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

B.TECH. 1st SEMESTER

ALL BRANCHES

DOC NO: 4061

Subject Code: 10000101	**Subject Title: Engineering Mathematics-I**
Pre-requisite: Nil	

Course Objective:

- To acquaint aspiring engineers with calculus, multivariate analysis and linear algebra techniques.
- To provide students with intermediate to advance level standard ideas and tools that will help them approach more challenging concepts and applications that they will find relevant in their fields.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	02	-	05	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Differential Calculus:** Convergent sequence, Bounded sequence, Monotonic sequence, Infinite series, Geometric series, Telescoping series, Convergent, Divergent and Oscillatory Series, Cauchy's Fundamental test for Divergent, p-series, Comparison test, D'Alembert's Ratio test, Raabe's test, Gauss's test, Cauchy's Integral test, Cauchy's root test, Logarithmic test, De Morgan's and Bertrand's test, Cauchy's Condensation test, Alternating series, Leibniz's rule, Power series in x, Absolute and conditional convergence tests, Taylor's & Maclaurin's expansions of single variable, Indeterminate forms, Improper Integrals	12	25
2	**Partial Differentiations:** Limit and Continuity, Partial derivative, Implicit and Explicit functions, Euler's theorem, Geometrical interpretation of partial derivatives **Application of Partial Differentiations**: Tangent plane and Normal line, Maxima and Minima of functions of two variables, Lagrange's multiplier method, Jacobians	10	25
3	**Vector Calculus:** Vector and Scalar Fields, Gradient, curl and divergence, directional derivatives, Conservative fields, Line Integral, Work Done, Circulation and Flux, Green's Theorem	8	20

4	**Multiple Integral:** Double integral, change of order of integration, Application of Double Integral: Transformation of variables by Jacobian only for double integration, Change into polar co-ordinates in double integrals only, Triple integral, Applications of Integral: Change to spherical coordinates, Volume of a solid	8	20
5	**Curve Tracing:** Concavity, Curve Sketching, Relation between Polar Coordinates and Cartesian Coordinates, Graphs in Polar Coordinates	4	10

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

- Use Improper integral as a tool for differential and Integral calculus and understand the basic concepts of Indeterminate forms. Apply the various convergence tests to sequences, series and learning tools for power series in advanced engineering mathematics.
- Understand basic knowledge of partial derivatives and to compute extreme values of functions of several variables via partial derivatives, Tangent planes and Normal lines.
- Learn the basic concepts in vector calculus including gradient, directional derivatives, curl, work done, flux and Green's theorem.
- Gain the knowledge about solving double and triple integration to analyze engineering problems.
- Understand the geometrical terminology of cartesian and polar curves.

List of References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Edition.
2. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage
3. James Stewart, Calculus: Early Transcendentals with Course Mate, 7e, Cengage, 2012.
4. T. M. Apostol, Calculus, Volumes 1 & 2,, Wiley Eastern.
5. Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014
6. H.K.Dass, Advanced Engineering Mathematics, S. Chand.

Open e-Resource:

1. https://nptel.ac.in/courses/111108098
2. https://nptel.ac.in/courses/111104125
3. https://nptel.ac.in/courses/111105121

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.TECH 1ST SEMESTER

MECHANICAL ENGINEERING / CIVIL ENGINEERING / ROBOTICS & AUTOMATION ENGINEERING

DOC NO: 4061

Subject Code: 10010104	**Subject Title: Engineering Drawing Practice**
Pre-requisite: Zeal to learn	

Course Objective:

- Demonstrate various graphical projections
- Improve analytical skills to understand design blueprints
- Improve skills to prepare designs blueprints for mechanical parts

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Engineering Curves:** Classification and application of Engineering Curves, Construction of Conics, Cycloidal Curves, Involutes and Spirals along with normal and tangent to each curve.	10	20
2	**Orthographic Projections:** Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view.	6 (Lab teaching)	15
3	**Isometric Projections and Isometric View or Drawing:** Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing of simple objects.	4 (Lab teaching)	10

4	**Projections of Points and Lines:** Introduction to principal planes of projections, Projections of the points located in same quadrant and different quadrants, Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes.	8	15
5	**Projections of Planes:** Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane.	6	15
6	**Projections of Solids, Section of Solids and Development of Surfaces:** Classification of solids. Projections of solids (Cylinder, Cone, Pyramid and Prism) along with frustum with its inclination to one reference plane and with two reference planes, Section of such solids and the true shape of the section, Development of surfaces.	10	20
7	**Computer Aided Drawing:** Introduction to AutoCAD, Basic commands for 2D drawing like: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc.	2 (Lab teaching)	5

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

- Know and understand the conventions and the methods of engineering drawing.
- Construct basic and intermediate geometry and comprehend the theory of projection.
- Improve their visualization skills so that they can apply these skills in developing new products.
- Improve their technical communication skill in the form of communicative drawings.
- Use computer software for engineering drawing.

List of References:

1. A Text Book of Engineering Graphics by P.J.Shah S.Chand & Company Ltd., New Delhi
2. Elementary Engineering Drawing by N.D.Bhatt Charotar Publishing House, Anand
3. A text book of Engineering Drawing by R.K.Dhawan, S.Chand & Company Ltd., New Delhi
4. A text book of Engineering Drawing by P.S.Gill, S.K.Kataria & sons, Delhi
5. Engineering Drawing by B. Agrawal and C M Agrawal, Tata McGraw Hill, New Delhi
6. Engineering Graphics by Arunoday Kumar, Tech knowledge Publications, Pune

Open e-Resource:

1. https://nptel.ac.in/courses/112103019
2. https://nptel.ac.in/courses/112104172
3. https://archive.nptel.ac.in/courses/112/105/112105294/

List of Suggested Experiments:

Students must prepare sketch book and drawing sheets on the following topics. Minimum three problems must be given for sheet number 1 to 7.

1. Engineering curves
2. Projection of line
3. Projection of plane
4. Projection of solid, section of solid and development of surfaces
5. Orthographic projection
6. Isometric projection
7. At least one orthographic drawing (three views) using above mentioned AutoCAD commands.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering (Offered in All programs)
Semester 1/2

Doc 4061

Subject Code: 10010105	**Subject Title: Engineering Foundation**
Pre-requisite:- Zeal to learn the subject	

Course Objective: p

- Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements.
- Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems
- Improve analytical skills to understand design blueprints
- Learn basic properties of materials and concepts of advanced manufacturing process
- Discover the root cause of a problem or event and fully understand how to fix, compensate or learn from any underlying issues within the root cause
- Provide the engineer a means of ensuring consistent design, quality and operating characteristics with adequate reliability and safety

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Measurements:** Introduction to Measurement, Definition, objectives and concept of Metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars, standardization.	08	20

	Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements		
2.	**Engineering Workshop:** Introduction, Safety slogans and rules in Mechanical workshop, Tools and Equipment used for safety in Mechanical workshop. Types of layouts, Rules and regulations for Workshop layouts and Preparation of actual layout. Introduction, Classification and characteristics of Engineering Materials, Tools and Equipment. *Demonstration of the operation performed on sheet metal for bending operation. Preparation of job in Drilling operation and demonstration on vertical drilling machine. Tools and Equipment for plumbing shop. Preparation of job in Plumbing for joining and threading operation. *Introduction to Arduino, components and working, Electronic circuit drawing, Electronic circuit on breadboard, Demonstration of Arduino for different configuration.	10	24
3.	**Engineering Design:** Introduction to Engineering Drawing and its significance, Drawing instruments and accessories, BIS – SP 46, Types of Lines and their Application, Lettering, Dimensioning Systems, Construction of Regular Polygons, Use of Plane Scales, Diagonal Scales and Representative Fraction.	10	24
4.	**Engineering Materials:** Types, properties and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer **Modeling, Simulation and Conceptual Prototyping:** Concept of Modelling and Simulation, Goal of Modelling & simulation, Application of simulations, advantages and disadvantages of simulation, Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems, FDM, SLS, SLA.	06	14
5.	**Root Cause Analysis:** Introduction, Complete Root Cause Analysis, QM & T Approach to Root Cause Analysis, Practical guide to carry out and RCA, RCA Tools & Techniques, Lookup Table for Completing an RCA, Examples, Hints & Tips, 12 Pitfalls of RCA	04	9
6.	**Standards:** Introduction, Basic Definitions, Requirements, Guidelines, History of Standards, Modern Examples, Conformity Assessment	04	9

*** - Topic will be covered during laboratory session**

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

1. Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.
2. Students will learn about taking safety and precautionary measures of self and machines during operations.
3. Interpret engineering drawings using fundamental technical mathematics.
4. Interpret appropriate advanced material processing techniques for different requirement and application
5. Identify the breakdowns in processes and systems that contributed to event and how to prevent future events

List of References:

1. Elements of Workshop Technology: Vol- I and Vol - II", K Hajra Choudhury, A K. Hajra, Media Promoters Pvt Ltd
2. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar.
3. A Text Book of Engineering Graphics by P.J.Shah S.Chand & Company Ltd., New Delhi
4. Modern Machining Processes, P. C. Pandey, H. S. Shan, Tata McGraw Hill
5. Root Cause Analysis - Improving Performance for Bottom-line Results, Robert J Latino, Kenneth C Latino, Taylor & Francis Group, CRC Press

Open e-Resource:

1. https://onlinecourses.swayam2.ac.in/aic22_ts42/preview
2. https://onlinecourses.nptel.ac.in/noc24_me123/preview

List of Suggested Experiments:

1. Introduction to Engineering workshop: working layout and safety.
2. Demonstration of the sheet metal bending operation and observe safety measures.
3. Demonstration of the drilling operation on vertical drilling machines and observe safety measures.
4. Demonstrate and understand the plumbing operation and tools in detail.
5. Demonstrate Arduino programming for different configurations.
6. Basic understanding of measurements and metrology: concepts, application, advantage and future aspects
7. Performance on linear and angular measurements and check different characteristics of measurements
8. Drawing Practice Sheet (which includes dimensioning methods, different types of line, construction of different polygon, divide the line and angle in parts, use of stencil)
9. Problems on Plane Scale.
10. Problems on Diagonal Scale.

11. Demonstration of prototype in FDM 3D Printing

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.TECH 1st SEMESTER

Civil Engineering / Mechanical Engineering/Robotics & Automation

DOC NO: 4061

Subject Code: 10010106	**Subject Title: Fundamental of Mechanical Engineering**
Pre-requisite: Zeal to learn	

Course Objective:

- To understand various fundamental thermodynamic laws
- To understand the concept of steam generation using various boilers
- To gain knowledge of Internal combustion engine
- To select drive and transmission element as per working condition
- To compare various Renewable energy sources with conventional energy sources

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Laws of Thermodynamics**- Concept of temperature, Zeroth law, principles of thermometry and temperature scale. First law of thermodynamics, second law of thermodynamics concept of internal energy, heat engines and thermal efficiency, types of system	6	9
2	**Introduction to IC Engines and Refrigeration and Air-conditioning**: **IC Engine:** Basic Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; Introduction to electric, and hybrid electric vehicles. **Refrigeration and Air-conditioning**: Its meaning and application, unit of refrigeration; Coefficient of performance, VCR cycle, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump, construction and working of window air conditioner	13	24
3	**Couplings, Clutches and Brakes**: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)	7	12

4	**Non-Conventional Energy and their resources:** Renewable and Non-renewable Energy Resources, Advantages and Disadvantages of Renewable Resources, Renewable Energy Forms and Conversion, Solar Energy, Wind Energy, Tidal Energy, Ocean Thermal Energy; Geothermal Energy, Nuclear Energy, Hydro Energy.	6	9
5	**Mechanical Power Transmission:** **Belt Drives:** Principle, working and Application of flat and V-belt drives.; Flat belt drives (Open and crossed), Simple numerical problems on flat belt drives involving velocity ratios (with effect of belt thickness and slip). **Gear Drives:** Classification of gear drives, Gear Trains and their application: simple and compound Gear Trains, Simple numerical problems on Gear trains involving velocity ratio **Fundamentals of Mechanical Linkages:** Definitions of Machines and Mechanisms. Applications of linear motion, oscillatory motion, and rotary motion **Introduction to Robotics:** Robot anatomy, Joints & links, common Robot configurations. Applications of Robotics	10	19
6	**Steam Boiler**: Steam formation, Classification of boiler, Cochran, Lancashire and Babcock and Wilcox boiler, Functioning of different mountings and accessories	Lab Hour	-

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

- To explain fundamental mechanical properties and thermodynamics laws.
- To identify and select various power transmission drives and mechanical linkages for required application.
- Discuss various power transmission elements with their applications
- To understand the basis for boilers and IC engine
- To explain need of energy conversion and various sources of Renewable energy

List of References:

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Elements of Mechanical Engineering by P S Desai and S B Soni, Atul Prakashan
3. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
4. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
5. Elements of Mechanical Engineering by Sadhu Singh, S. Chand Publication
6. Introduction to Engineering Materials by B.K. Agrawal, McGraw Hill Publication, New Delhi

Open e-Resource:

1. https://nptel.ac.in/downloads/112108148
2. https://nptel.ac.in/downloads/112105129
3. https://nptel.ac.in/courses/116102012

List of Suggested Experiments:

1. To understand construction and working of various types of boilers.
2. To understand construction and working of mountings and accessories of boiler.
3. To study of working of two stroke and four stroke Petrol & Diesel Engine.
4. To determine the Swept volume & Clearance volume of Two stroke & Four stroke Petrol & Diesel Engine.
5. To study Vapour Compression Refrigeration System.
6. To study various types of gears and pulleys
7. To study various types of brakes.
8. To study various types of coupling.
9. To study of various types of clutches.
10. To understand different arrangement and application of various power transmission drives.

GANDHINAGAR UNIVERSITY
Ability Enhancement Course
Semester 1

Subject Code: AEC002	**Subject Title: Communication and Presentation for Technical Professionals (IEEE)**
Pre-requisite: Basic knowledge of English grammar with the ability to read, write, and summarize simple technical content effectively.	

Course Objective:

To develop effective communication and presentation skills in technical contexts, enabling students to convey ideas clearly, professionally, using modern tools and following IEEE style guidelines.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	-	-	2	25	25	-	-	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Foundations of technical communication** Importance of communication in engineering and technical context, Communication models, The **7 Cs of effective communication**, Ethics in technical communication.	04	15%
2	**Audience & clarity for engineers** Plain English vs. jargon; technical vs. non-technical audiences, Tone & style adaptation: peers, managers, clients, public, Active vs. passive voice	04	15%
3	**Workplace writing technical writing & reports** Problem/solution structure, lab/write-ups; objectivity and trustworthy sources. Professional email etiquette, Writing memos, requests & queries, Importance of style guides (IEEE, APA, Chicago).	08	30%

4	**Oral presentation fundamentals** Purpose, audience intent, slide design; speaker notes; timing; Q&A **Team presentations & meetings** Roles, hand-offs, interactive demos; running/participating in meetings; negotiating and "reading the room."	10	30%
5	**Posters and abstracts** Poster design & delivery	02	10%

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

1. Demonstrate effective oral and written communication skills in technical and professional contexts.
2. Apply IEEE guidelines for professional writing, reports, and documentation.
3. Prepare and deliver structured technical presentations using appropriate tools and techniques.
4. Collaborate effectively in teams through clear communication and presentation strategies.

List of Reference Books:

1. Title: Technical Communication: Principles and Practice, Author: Meenakshi Raman & Sangeeta Sharma, Publisher: Oxford University Press.
2. Title: Developing Communication Skills, Author: Krishna Mohan & Meera Banerji, Publisher: Macmillan.
3. Title: Technical Communication, Author: John M. Lannon, Publisher: Pearson Education.
4. IEEE Editorial Style Manual – IEEE Standards and Guidelines for Technical Writing & Publications.
5. Title: The Art of Public Speaking, Author: Stephen E. Lucas, Publisher: McGraw Hill.

Open e-Resource: NPTEL

1. https://onlinecourses.nptel.ac.in/noc25_ge42

GANDHINAGAR UNIVERSITY

Skill Enhancement Course

Semester 1

Subject Code: SEC014	**Subject Title: Introduction of Cyber Security**
Prerequisite: Active mindset, Basic knowledge of computers and the Internet, (Windows/Linux), Fundamental concepts of networking	

Course Objective:

- Introduce students to the fundamental concepts, principles, and scope of cyber security.
- Develop understanding of threats, vulnerabilities, and attacks in the digital environment.
- Familiarize students with cryptography, authentication, and basic defense mechanisms.
- Provide hands-on exposure to cyber security tools and techniques for securing systems and networks.
- Create awareness about cyber laws, ethics, and professional responsibilities in information security.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
1	0	2	2	00	00	25	25	50

Subject Contents			
Sr. No.	**Topics**	**Teaching Hrs.**	**Weightage (%)**
1	Fundamentals of Cyber Security: Introduction to Cyber Security, Types of Security: Network Security, Information Security, Application Security, Security Threats & Attacks: Malware, Phishing, DoS/DDoS, Insider threats, Cyber Security in the modern world (IoT, Cloud, Mobile security)	4	
2	Cryptography and Security Mechanisms: Basics of Cryptography: Plain text, Cipher text, Encryption,	2	

	Decryption, Hashing and Digital Signatures.		
3	Cyber Security Practices and Ethics: Security Policies, Standards, and Guidelines (ISO), Cyber Security Tools: Antivirus, Firewalls, IDS/IPS, VPN, Ethical Hacking and Penetration Testing Basics, Cyber Laws and Regulations (IT Act, GDPR, Data Protection principles), Cyber Ethics and Professional Responsibility	4	

Course Outcomes:

CO1: Understand the fundamentals of cyber security, its principles, and emerging threats.
CO2: Explain the concepts of cryptography and security mechanisms.
CO3: Analyze various types of cyber-attacks and apply suitable defense mechanisms.
CO4: Use basic cyber security tools and techniques to secure information and networks.
CO5: Develop awareness of ethical, legal, and social issues in cyber security.

List of Reference Books:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, Security in Computing, Pearson.
3. Behrouz A. Forouzan, Cryptography and Network Security, McGraw Hill.
4. Mark Stamp, Information Security: Principles and Practice, Wiley.
5. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.

Gandhinagar Institute of Technology
CSE/CE/IT/AI/CS/ME/CL/EE/EC/R&A/EN
Semester 1

Subject Code: VAC014	**Subject Title: Integrated Personality Development Course**
Pre-requisite:	

Course Objective:

1. enable students to develop a constructive mindset toward challenges and failures by learning from the experiences of eminent personalities like Walt Disney, Abraham Lincoln, and Amitabh Bachchan.
2. To instill core human values and ethics as essential qualities for success across personal, academic, and professional domains, helping students become responsible citizens and dependable individuals.
3. To inspire students through real-life case studies of Indian legends such as Sachin Tendulkar and Ratan Tata, and encourage them to emulate such traits in everyday situations.
4. To nurture a sense of national identity and cultural pride by exploring India's ancient wisdom, heritage, and contributions to global civilization.
5. To empower students with practical life skills including self-discipline, digital responsibility, leadership, networking, and selfless service, for their holistic growth and future readiness.

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	0	50	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Facing Failures:** This lecture enables students to revisit the way in which they approach challenges. Through the study of successful figures such as Disney, Lincoln and Bachchan, students will learn to face difficulties through a positive perspective, Failure is a student's daily source of fear, negativity, and depression. Students will be given the constructive skills to understand failure as formative learning experiences. **The Need for Values:** Students will learn about the need for values as part of their holistic development to become successful in their many roles - as ambitious students, reliable employees, caring family members, and considerate citizens	10	30

2	**Learning from Legends:** Students will learn from the inspirational lives of India's two legends, Sachin Tendulkar and Ratan Tata. They will implement these lessons through relatable case studies **My India My Pride:** India's ancient Rishis, scholars, and intellectuals have made tremendous contributions to the world, they developed an advanced, sophisticated culture and civilization which began thousands of years ago. Students will learn the importance of studying India's glorious past so that they could develop a strong passion and pride for our nation	10	30
3	**Remaking Yourself:** Students learn how self-improvement enables them to secure a bright future for themselves. They will learn 6 powerful thoughtprocesses that can develop their physical, intellectual, emotional, and spiritual quotients, Power of Habit, Handling Social Media **Soft Skills:** Networking & Leadership, Students are taught the means of building a professional network and developing a leadership attitude, Project Management **Selfless Service:** Seva, Students will learn that performing seva is beneficial to one's health, wellbeing, and happiness. It also benefits and inspires others.	10	40

Course Outcome:

1. To provide students with a holistic value-based education that will enable them to be successful in their academic, professional, and social lives.
2. To give the students the tools to develop effective habits, promote personal growth, and improve their wellbeing, stability, and productivity.
3. To allow students to establish a stronger connection with their family through critical thinking and devolvement of qualities such as unity, forgiveness, empathy, and effective communication.
4. To enhance awareness of India's glory and global values, and to create considerate citizens who strive for the betterment of their family, college, workforce, and nation.
5. To provide students with soft skills that complement their hard skills, making them more marketable when entering the workforce.

List of Textbooks:

1. Steve Jobs: The Exclusive Biography Paperback by Walter Isaacson,
2. The Wit and Wisdom of Ratan Tata by Ratan Tata
3. Seven Habits of Highly Effective Teens by Sean Covey, Simon & Schuster

List of Reference Books:

1. Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions by Dan Ariely, Harper Perennial
2. Playing It My Way: My Autobiography by Sachin Tendulkar, Hodder & Stoughton

Open e-Resource:

1. https://www.thebetterindia.com/102551/small-way-serveahmedabad-seva-cafe/
2. https://www.theatlantic.com/health/archive/2015/12/altruism-for-a-better-body/422280/

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B. Tech 1st /2nd SEMESTER

CSE/IT/EE/EC/CS/AI/ICT

DOC NO: 4061

Subject Code: 10000004	**Subject Title: ENGINEERING PHYSICS**
Pre-requisite: Nil	

Course Objective:

- To understand concepts of applications of semiconductor Physics, nanomaterials and non-linear optics in respective engineering branches and measurement techniques to solve problems.
- To educate students for engineering occupations in which Physics concepts may be applied to technological development. Students will be able to find work in engineering after completing this study at the interface of engineering and Physics upon graduation, while also laying a solid basis for graduate school and engineering research.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Nanoscience and nanotechnology:** Introduction to Quantum Physics: Particle in a three dimensional box, Introduction – Nanoscale; Nanomaterials: Methods for synthesis of nanomaterials, Properties of nanomaterials, Characterization techniques – X ray Diffraction (XRD) - Single Crystal, Powder and Laue techniques, Low energy Electron Diffraction (LEED), Scanning Electron Microscopy, Tunnelling Electron Microscopy, Nanostructures; Carbon nanotubes, Characteristics and applications, Nanotechnology and environment.	8	19

2	**Classification of Electronic Materials:** Free electron theory, crystal structure and reciprocal lattice, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Brillouin zone, electron in a crystal- Bloch's electron, Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.	8	19
3	**Physics of Semiconductors:** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction diode, Metal-semiconductor junction (Ohmic and Schottky), Photovoltaic effect, Exciton, Applications with numericals, Lasers and its properties, Spontaneous and stimulated emission, Einstein coefficients, Gas laser (He-Ne Laser), Semiconductor Laser, Applications of Laser.	8	19
4	**(A)Analysis of Errors:** Uncertainties in Measurements: Sources and estimation of errors, accuracy and precision, systematic error, random error, Significant figure and round off, Uncertainties, Parent and Sample Distributions, Mean and Standard Deviation of Distributions, Average error, r.m.s error, probable error and error propagation, **(B) Non-linear Optics:** Introduction to regression analysis and its uses, Basic Principle of Holography, Construction and reconstruction of hologram, Applications of Holography, Introduction to optical fiber, Numerical Aperture of optical fiber, Types of optical fiber, applications of optical fiber **(C)Measurement Techniques:** Four-point probe and Van Der Pauw measurements for carrier density, Resistivity and hall mobility, Hall effect, Hot-point probe measurement, capacitance-voltage measurements, DLTS.	12	29
5	**Physics of Superconductors:** Introduction of Superconductivity, Properties of superconductor, Effect of magnetic field, Meissner effect, Pressure effect, Impurity effect, Isotopic mass effect, Mechanism of Superconductivity: BCS Theory, Penetration depth: Magnetic field, Josephson's junction and its application, Application of superconductors	6	14

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

- Acquire understanding of fundamental physics concepts and link them to engineering science at the conclusion of the course.
- Use physics ideas to solve difficulties in engineering.
- Apply basic Physics concepts to solve new and difficult technological issues.

- The student will gain knowledge of basic theoretical and mathematical concept of nanomaterials and electronic materials.
- Demonstrate understanding of basic principles, properties and applications associated with semiconducting materials.
- Learn how to calculate and find the errors and also characterize diverse semiconducting, electrical, and optoelectrical materials and devices using various measurement techniques and non-linear optics.
- Demonstrate knowledge of superconductivity's fundamental theory, characteristics, and applications.

List of References:

1. T. Pradeep, Nano: The Essentials, New Central book Agency.
2. S. N. Goswami, Elements of Plasma Physics, Tata McGraw Hill publication.
3. B. L. Theraja, Physics for Engineers, S Chand Publication
4. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.
5. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.
6. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
7. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
8. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
9. Engineering Physics by Dattu R Joshi, McGraw hill Publications.
10. Resnick, Halliday and Krane, Physics part I and II, 5th Edition John Wiley (2002)
11. Physics for scientists and engineers with modern physics by Jewett & Serwey, Cengage publications.

Open e-Resource:

1. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL. (URL Link: https://nptel.ac.in/courses/115102026)
2. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL. (URL Link: https://nptel.ac.in/courses/113104012)
3. Online course: “Fiber Optics” by Prof. Vipul Rastogi on NPTEL. (URL link: https://nptel.ac.in/courses/115107095)
4. Online course: “Introduction to Physics of Nanoparticles and Nanostructures” by Prof. G. Mukhopadhyay on NPTEL. (URL Link: https://nptel.ac.in/courses/115101007)
5. Online course: “Introduction to Non-linear optics and its applications” by Prof. Samudra Roy on NPTEL (URL Link: https://nptel.ac.in/courses/115105105)
6. Online course “Superconductivity” by Prof. P. P. Singh and Prof. A. V. Mahajan (URL Link: https://nptel.ac.in/courses/115101012)
7. Online course “A brief course on Superconductivity” by Dr. Saurabh Basu on NPTEL. (URL Link: https://nptel.ac.in/courses/115103108)
8. The Feynman Lectures series on Physics Vol 2, Pearson Education India

List of Suggested Experiments:

1. To find the numerical aperture of an optical fiber.
2. To determine the band gap in a semiconductor using a junction diode.
3. To determine the wavelength of laser using diffraction grating.
4. To find the efficiency of a solar cell.
5. To Study the characteristics of a Zener diode and a LED.

6. To study the “Hall effect” by measuring the voltage and magnetic field, keeping current constant.
7. Determination of radii of curvature of lens using the Newton’s ring formula.
8. Analysis of errors using Least square fitting.

GANDHINAGAR UNIVERSITY

GANDHINAGAR UNIVERSITY
GANDHINAGAR INSTITUTE OF TECHNOLOGY

10000201: Engineering Mathematics-II
B. TECH. 2nd SEMESTER (All Branches)

DOC NO: 4061

Subject Code: 10000201	**Subject Title: Engineering Mathematics-II**
Pre-requisite: Basic knowledge of differentiation, integration, algebra	

Course Objective: The objective of this course is to familiarize the prospective engineers with techniques in integration, ordinary differential equations and matrices. It aims to equip the students to deal with advanced level of mathematics and applications that are required in their disciplines.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	2	0	5	70	30	0	50	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**First order ordinary differential equations:** Order and Degree, Solutions of Ordinary differential equations, Geometrical Interpretations, Exact, Non-exact, Linear and Bernoulli's equations, Euler's equations	6	10%
2	**Higher order Ordinary differential equations:** Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation, Series Solutions of ordinary differential equations	10	25%
3	**Laplace Transformation:** Definition of Laplace Transform, Existence of Laplace transform, Properties of Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform and their properties, Convolution theorem, Applications of Laplace transforms in solving ordinary differential equations and system of differential equations	8	20%
4	**Fourier Series and Fourier Integral:** Dirichlet's Condition, Fourier series of Odd and Even functions, Half range sine series and cosine series, Fourier Integral, Fourier Cosine and Sine Integrals **Gamma and Beta functions:** Definitions of Gamma and Beta functions and their properties	8	20%
5	**Matrix Algebra:** Definition of Matrix, types of matrices and their properties, Determination of rank, The inverse of a matrix by Gauss Jordan method, Solution of a system of linear equations by Gauss elimination and Gauss Jordan Methods, Eigen values and Eigen vectors of matrices, Cayley-Hamilton's Theorem and its applications, Diagonalization	10	25%

Course Outcome:

At the end of the course the students will be able to

1. Learn the techniques to solve ordinary differential equations for Mathematical modelling of real-world problems.
2. Apply effective mathematical methods for the solutions of higher order ordinary differential equations.
3. Apply the techniques of Laplace transforms and inverse Laplace transforms to solve the Ordinary differential equations of real-world problems
4. Utilize Fourier series to study the behavior of periodic functions and to gain the knowledge of Fourier Integral and to acquire understanding on how to tackle integration problems using Gamma and Beta functions.
5. Understand the algebra of matrices in order to solve applies and theoretical issues using algebraic operations

List of References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Edition.
2. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage
3. H.K.Dass, Advanced Engineering Mathematics, S. Chand.
4. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley 1995
5. Fuzhen Zhang, Matrix Theory- Basic Results and Techniques, Springer, 1999
6. Shanti Narayan, P.K. Mittal, A Textbook of Matrices, S Chand & Company, 2010

Open e-Resource: Digital Platforms

- National Programme on Technology Enhanced Learning (NPTEL)
- SWAYAM
- National Digital Library of India (NDLI)
- Massachusetts Institute of Technology (MIT) Open Learning

GANDHINAGAR INSTITUTE OF TECHNOLOGY
Bachelor of Technology - Civil Engineering
Semester- 1st/2nd Semester

Subject Code: 10020102	**Subject Title: Fundamental of Civil Engineering**
Pre-requisite: Nil	

Course Objective:

- To understand quantitative assessment in every field of the construction industry, understand Use the techniques, skills, and modern engineering tools necessary for the civil engineering practices, understand and apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying, solve measurement problems in an optimal way.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Branches of Civil Engineering, Scope of Civil Engineering, Role of Civil Engineer in Society. Impact of infrastructural development on economy of country.	4	10
2	**Surveying, Leveling and Mapping:** Introduction: Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, Plans and maps, Scales, Units of measurement. **Linear Measurement:** Methods, Instruments used in chain surveying, Selection of stations, Chaining, Ranging, Offsetting, Errors in chaining and correction, Conventional symbols.	20	40

	Angular Measurement: Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing and correction of bearings for local attraction. **Leveling:** Aims and applications, Definition of various terms, Instruments for leveling, Methods of leveling, recording observations in level-book, computing reduced levels by HI and rise & fall method, Definition of contour, Characteristics of contours of different terrains and application of contour maps, Introduction to Plannimeter, introduction to Global positioning system (GPS), remote sensing (RS) and Geographical information system (GIS)		
3	**Building Materials:** Introduction to construction materials like Stone, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete, bitumen.	4	10
4	**Building Construction:** Classification of buildings, Types of loads acting on buildings, building components and their functions and nominal dimensions.	8	20
5	**Water Resources:** Hydrologic cycle, water use and its conservation, Introduction to dams, weirs, barrages and check dams.	4	10
6	**Advancements in Civil Engineering:** Mass Transportation systems-BRTS, Metro, Rainwater harvesting systems, Watershed Management, Energy efficient building, Development of River fronts, Heritage structures & its conservations, Features of Earthquake resistant structures.	4	10

Course Outcome:

Sr. No.	CO statement
CO-1	Conceptualize simple land survey to prepare maps with existing details.
CO-2	Identify angular measurement on field and understand various methods of surveying
CO-3	Recognize construction materials.
CO-4	Describe detail knowledge of building construction.
CO-5	Explain the hydrological cycle and water conservation
CO-6	Describe advancement in the field of civil engineering.

List of Textbooks:

1. Title: Basic Civil Engineering; Author: Dr.R.B.Khasiya ; Publisher. Mahajan Publishing House.
2. Title: BASIC CIVIL ENGINEERING Author: Dr R P Reathaliya (Author); Publisher. Atul Prakashan
3. Title: Surveying Vol. I Author: Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain16th Edition Publisher: Laxmi Publication Delhi
4. Title: Elements of Civil Engineering Author: Dr. R.K. Jain and Dr. P.P. Lodha Publisher: McGraw Hill Education, India Pvt. Ltd.

5. Title: Surveying Theory and Practice (7th Edition) Author: James M Anderson and Edward M Mikhail Publisher: McGraw Hill Education, India Pvt. Ltd.

List of Reference Books:

1. Title: Elements of Civil Engineering Author: Dr. R.K. Jain and Dr. P.P. Lodha Publisher: McGraw Hill Education, India Pvt. Ltd.
2. Title: Basic Civil Engineering, Author: S.S. Bhavikatti, Publisher: New age Publisher
3. Title: Surveying Vol. I Author: Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain16th Edition Publisher: Laxmi Publication Delhi
4. Title: Surveying Theory and Practice (7th Edition) Author: James M Anderson and Edward M Mikhail Publisher: McGraw Hill Education, India Pvt. Ltd.
5. Title: Surveying and Leveling Author: R. Subramanian Publisher: Oxford University
6. Title: Surveying and Leveling Author: N. N. Basak Publisher: Tata McGraw Hill Education, Pvt. Ltd. New Delhi
7. Title: Surveying Vol. I Author: S. K. Duggal Publisher: Tata McGraw Hill Publication New Delhi
8. Title: Building drawing Author: M.G. Shah, C.M. Kale and S.Y. Patki Publisher: Tata McGraw Hill
9. Title: Civil Engg. Drawing Author: S. C. Rangwala Publisher: Charotar Pub. House Anand
10. Title: Building Construction Author: Dr. B. C. Punmia, Ashok kumar Jain, Arun kumar Jain Publisher: Laxmi Pub. Delhi.
11. Title: Building Construction and Construction Material Author: G.S. Birdie and T.D. Ahuja Publisher: Dhanpat Rai Publishing Company

Open e-Resource:

1. http://nptel.ac.in/courses/105107122/
2. http://nptel.ac.in/courses/105107157/
3. http://nptel.ac.in/courses/105101087/
4. http://nptel.ac.in/courses/105104100/

List of Suggested Experiments:

1. Introduction to surveying equipment and Unit Conversion.
2. Chart preparation of various building material.
3. Linear measurement using Chain Surveying.
4. Angular Measurement using compass surveying.
5. Measurement of Fore bearing and back bearing using compass.
6. Traverse Survey Using Compass.
7. Measurement of interior angle using compass and local attraction effect.
8. Determination of R.L. of Points using dumpy level.
9. Determination of Aggregate Impact value.
10. Determination of Aggregate Crushing Value.
11. Compressive Strength test on Concrete cube.

GANDHINAGAR UNIVERSITY

(Established and Incorporated Under Gujarat Private Universities Act 2009, Amendment: Guj. Act No. 7 of 2022)

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.TECH 1st / 2nd SEMESTER

Computer Engineering /Information Technology /Electronics & Communication Engineering / Electrical Engineering / Civil Engineering / Mechanical Engineering

DOC NO: 4061

Subject Code: 10030101	**Subject Title:** Basics of Electrical & Electronics Engineering
Pre-requisite: Nil	

Course Objective:

- To Impart the basic knowledge of electrical quantities and to understand the impact of technology in a global and social context.
- To provide knowledge of analog and digital electronics.
- To Introduce the basic knowledge of transformer and electrical machines and electrical safety.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	8	20%
2	**AC Circuit:** Representation of sinusoidal waveforms, sinusoidal function- Terminology, Form Factor and Peak Factor, Phase and Phase Difference, Phasor representation of alternating quantities, Phasor addition and subtraction Behavior of purely resistive, inductive and capacitive circuits, Phase relation RL circuit, series RC circuits, series RLC circuit between voltage and current Active, Reactive and Apparent Power, Power Factor and Parallel and series-parallel AC circuits, Resonance in series and parallel circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.	10	23%

3	**Transformers and Electrical machines** Construction and working principle of single phase and three phase transformers Equation, voltage and current Ideal and practical transformer, autotransformer. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, single phase induction motor	6	14%
4	**Analog Electronics and Applications:** Semiconductor Diode & its characteristics, Half-Wave, Full-Wave & Bridge Rectifier, Zener Diode, Light-Emitting Diode (LED), Photo diode, Solar cell and Seven Segment Display. Bipolar Junction Transistor, Amplifier, Oscillator and Operational Amplifier.	8	20%
5	**Digital Electronics:** Number System, Basic Logic Gates, Building AND, OR & NOT Gate using Diodes and Transistors, Digital logic families, RTL, DTL, TTL.	4	9%
6	**Electrical Installations:** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6	14%

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

- Analyze electrical circuits with different elements and describe qualitative comparison between AC and DC systems.
- Understand the construction, working and basic characteristics of transformer and Induction machine
- Learn about the working of Bread-Board, Multimeter, Power Supply, Function Generator, CRO/DSO, GCB/PCB.
- Apply Diodes, Transistors and Logic Gates in different circuits.
- Recognize the importance of protective devices and electrical safety measures.

List of References:

1. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
2. Basic Electrical Engineering - Nagsarkar and Sukhija, Oxford University Press
3. B. L. Theraja, “Electrical Technology – Part I and II”, S. Chand and Co. 2012
4. V.N. Mittal, ‘Basic Electrical Engineering’, Tata Mcgraw-Hill,2nd edition 2006.
5. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
6. A. Chakrabarti, S. Nath, C. Chanda, ‘Basic Electrical Engineering’, Tata McGrawHill Education India Pvt. Ltd, 2013.
7. Robert Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education, 10th Edition, 2009.
8. Albert Malvino and David Bates, “Electronics Principles” Tata McGraw-Hill, 7th Edition, 2006.
9. Digital Logic and Computer Design By M Morris Mano, Prentice Hall Publication, Fourth Edition.

Open e-Resource:

1. http://vlab.amrita.edu/index.php
2. https://www.facstaff.bucknell.edu/mastascu/eLessonsHTML/EEIndex.html
3. http://www.learnabout-electronics.org
4. http://www.electronics-tutorials.ws
5. https://www.coursera.org/course/eefunlab
6. https://www.coursera.org/course/introtoelectronics
7. http://www.electronicsandyou.com
8. https://onlinecourses.nptel.ac.in/noc21_ee55/preview
9. PSpices and NGSpice (Open Source Software)

List of Suggested Experiments:

1. To verify ohm's law in an electric circuit.
2. To verify KCL and KVL in an electric circuit.
3. To verify the Network theorems
4. To determine power in a single phase circuit using wattmeter.
5. Determination of B-H curve of magnetic material.
6. Analysis series RLC circuit.
7. Demonstration of domestic installations like MCB, ELCB, MCCB
8. To determine power in a three phase circuit using two wattmeter.
9. Demonstration of cut-section models and charts of various machines.
10. Understanding of various electrical bills and calculation for energy consumption.
11. To study and perform the VI characteristics of P-N junction diode
12. To study and perform the VI characteristics of Zener diode.
13. To study and perform about the Half Wave and Full Wave Rectifier.
14. To study and perform the Input and Output characteristics of a Transistor.
15. To study and configure an op-amp as an inverting and non-inverting amplifier.
16. To study and verify digital logic gates.
17. To configure diodes and transistors as logic gates and verify the truth table.

Gandhinagar Institute of Management

B.Tech
Semester II **DOC NO: 4061**

Subject Code: AEC015	**Subject Title: Personality Development for Effective Leadership**
Pre-requisite: NA	

Course Objective:

1. To help students in enhancing their self-awareness, interpersonal skills, and overall personal grooming.
2. To foster personal growth and development by focusing on self-awareness, communication skills, emotional intelligence, and goal setting.
3. To explore various aspects of personality enhancement and leadership qualities for improving their confidence, firmness, and relationships with others.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	-	-	2	25	25	-	-	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Understanding Personality Development** • Definition and Importance of Personality • Determinants of Personality: Heredity and Environment • Theories of Personality (Big Five Model, MBTI, etc.) **Self-Awareness and Self-Analysis** • SWOT Analysis for Personality Growth • Building Self-Confidence and Positive Thinking • Overcoming Self-Limiting Beliefs	7	25%
2	**Leadership and Its Significance** • Definition and Characteristics of an Effective Leader • Leadership vs. Management • Different Leadership Styles (Autocratic, Democratic, Transformational, etc.) **Effective Communication Skills**	7	25%

	• Verbal and Non-Verbal Communication • Barriers to Communication and Overcoming Them • Public Speaking and Presentation Skills		
3	**Emotional Intelligence (EI) and Leadership** • Components of Emotional Intelligence (Self-Awareness, Self-Regulation, Motivation, Empathy, Social Skills) • Role of EI in Decision-Making and Conflict Resolution • Developing Empathy and Active Listening Skills **Building Leadership Skills** • Goal Setting and Strategic Thinking • Motivation and Team Building • Time Management and Delegation	7	25%
4	**Decision-Making and Problem-Solving** • Decision-Making Models (Rational Model, Intuitive Model, etc.) • Overcoming Decision-Making Biases • Critical Thinking and Analytical Skills **Ethics and Values in Leadership** • Ethical Decision-Making in Leadership • Corporate Social Responsibility and Leadership Ethics • Leading with Integrity	7	25%

Course Outcome:

- To comprehend the role of confidence and self-esteem in personal development.
- To create a comprehensive action plan for personality enhancement and leadership development.
- To cultivate personality and leadership qualities in diverse and inclusive environments.

List of Textbooks:

1. D. P. Subharwal – Personality Development Handbook
2. Rajiv Mishra – Personality Development: Transform Yourself
3. Dr. Shailesh Tondon & Dr. Asish Kaushal – Personality Development & Grooming
4. Del Carnegie – The Leader in You
5. Andrew Bryant – Self Leadership
6. Peter G. Northouse – Leadership: Theory and Practice
7. Radcliffe – Leadership: Plain and Simple

List of Reference Books:

NA

Open e-Resource:

1. English GUETA Website
2. English GUETA App
3. English GUETA YouTube Channel

List of Suggested Experiments: NA

Gandhinagar University
UG/PG
Semester-II

Subject Code: IKS0201	Subject Title: Indian Ancient History and Cultural Heritage

Course Objective:

- Foster an appreciation for the composite nature of Indian history, culture and heritage.
- Instill a sense of love and belonging among learners, contributing to nation-building efforts.
- Provide an overview of various components of cultural heritage, including fairs, festivals, dances, art, architecture, and historical landmarks, which are crucial for a deeper understanding of history.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
01	0	2	02	0	25/ Project	25/ Project		50

Subject Contents			
Sr. No	**Topics**	**Total Hours**	**Credit**
1	**Indian Ancient History:** Introduction of Ancient India. Harappan Civilization. Rigvedic & Later Vedic Period. India in the 6th Century B.C. Persian and Greek invasions and its impact. Mauryan and Gupta Periods. Post – Mauryan. Brief History of the Sanskrit literature: The Vedas, The Brahmanas and Upanishads & Sutras, Epics: Ramayana and Mahabharata & Puranas.	15	1
2	**Indian Cultural Heritage:** Ethnic Indian Cultural Construct – Fairs & Festivals and their historical background. Indian dances as Cultural Heritage. Indian Architecture: Temples, Stupas, Caves, Chaityas. Medieval Architecture and Colonial Architecture. Social culture in India- Vedic culture. Ancient period- varna and jati, family and marriage in India, position of women in ancient India, Contemporary period; caste system and communalism.	15	1

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

- Demonstrate knowledge of the key events, periods, and figures that have shaped Indian history from ancient to modern times, including their impact on the socio-political and economic landscape.
- Analyze the rich cultural heritage of India, including art, architecture, literature, and philosophy, while recognizing the contributions of various communities to India's pluralistic society.

List of Text Books:

1. An advanced history of India – causes and decline of Guptas by B.C. Majumdar and others, 1967, Macmillan.
2. Ancient India by R.C. Majumdar, 1977, Motilal Banarasi Das.
3. History of Ancient India by Rama sankar Tripati, 1942, Motilal Banarasi Das.
4. History and culture of India to 1000 A.D. by H.V. Srinivasa Murthy, 1980, S. Chand and Co.
5. History of South India by K.A. Nilakanta Sastry 1976, Oxford University Press.
6. History of Ancient India by Krishnaswamy Aiyangar, 1980, Seema Publishers.
7. Ancient India by V.D. Mahajan, 1985, S.Chand and Company.
8. Advance History of India by K.A. Nilakantasastry and C.S.Srinivasachari, 1980, Allied Publishers.
9. Ancient Indian History and Civilization by Silendranath Sen, 1988, Wiley Eastern.
10. Lothal and Indus Civilizations by S.R.Rao, 1972, Asia Publishers, Madras

GANDHINAGAR UNIVERSITY
Skill Enhancement Course
Semester 2

Subject Code: SEC019	**Subject Title: Social Media Management**
Pre-requisite: Active mindset, Basic Computer understanding & Practical Thinking.	

Course Objective:

- Students will learn by doing assignments focusing on social media, post writing and publishing, management and measurement tools, a social media audit, editorial calendar and crises management.
- Students will master the skills necessary to become successful social media managers.

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	-	50	-	-	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Unit 1: Introduction to Social Media** Introduction to Social Media, Importance of Social Media, History and Evolution of Social Media, Managing Information, Aggregators. Facebook, Twitter, Instagram, LinkedIn, YouTube, Blogs.	06	30%
2	**Unit 2: Using Social Media Strategy** Plan for Social Media Management, Touchpoint, Analysis Scheduling, Creating Content, Managing Content Programmers, Planning Worksheet, Social Media Campaign.	06	30%
3	**Unit 3: Evaluating Social Media** Evaluation of Social Media Platforms, Content Management Systems (CMS), Tolls to Manage and Measure Performance of Social Media Content and Campaign, Handling Critical Issues in Social Media Management and Legal Aspects of Social Media.	06	30%

4	**Unit 4: Social Media Awareness**	02	10%

List of Reference Books:

1. Guy Kawasaki & Peg Fitzpatrick, “The art of social media: power tips for power users”
2. Social media marketing all in one for dummies, Jan Zimmerman & Deborah N
3. Social media explained by Mark W. Schaefer

GANDHINAGAR UNIVERSITY

Semester-2

Subject Code: VAC021	**Subject Title:** Stress and Time Management
Pre-requisite: Candidate must have achieved regular degree in the 10+2 system from any recognized Board.	

Course Objective:

(1) To develop and maintain a structured daily routine that balances work, personal responsibilities, and self-care activities

(2) To prioritize tasks effectively by setting clear, achievable goals and deadlines, while incorporating regular breaks and mindfulness exercises to enhance focus, prevent burnout, and foster a positive mental state.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
02	-	-	02	25	25	-	-	50

Subject Contents			
Sr. No	**Topics**	**Total Hours**	**Weight (%)**
1	**Unit 1: Understanding Mental Health and prevention** Basic Concepts: Mental Health and Illness, Mental Health Continuum, Perspectives on Mental Health, Mental Health Issues and Challenges, The concept of Counseling and Psychotherapy, Psychological First Aid, Community Mental Health, Mental Health Capacity Building, Mental Health Literacy.	10	33%
2	**Unit 2: Mental Health, Stress and its effect** Meaning, elements and purposes, Characteristics and causes of poor mental health, achieving mental health and role of teachers, Nature, meaning and types of stress, Factors influencing stress, Causes and remedial measures.	10	33%
3	**Stress and Adaptation - Introductory concepts** Introduction, Sources, Effects, Indicators & Types of Stress, Types of stressors, Stress Adaptation – General, Adaptation Syndrome (GAS), Local, Adaptation Syndrome (LAS), Manifestation of stress - Physical & psychological, Coping strategies/ Mechanisms, Stress Management,	10	34%

	Assist with coping and adaptation, Creating therapeutic environment, Recreational and diversion therapies		

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

- Students will be able to apply effective time management techniques, such as prioritization, goal setting, and scheduling, to optimize productivity and reduce stress
- Students will develop a deeper understanding of their mental health needs and recognize the importance of self-care
- Students will learn and implement mindfulness, relaxation, and stress management techniques to cope with daily challenges and prevent burnout.

List of Reference Books:

1. Westerhof, G. J. & Keyes, C. L. M. (2010). Mental Illness and Mental Health: The Two Continua Model Across the Lifespan. Journal of Adult Development, 17, 110119
2. Keyes, C. L. M. (2005). Mental Illness and/or Mental Illness? Investigating Axioms of the Complete State Model of Health. Journal of Consulting and Clinical Psychology, 73 (3), 539- 548
3. Snyder, C. R. & Lopez, S. J. (Eds.) (2002). Handbook of Positive Psychology. Oxford: Oxford University Press
4. Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A Dimensional Approach. Wadsworth: Cengage Learning
5. Aggarwal, J. C. (2011). Essentials of Edu. Psychology. New Delhi: Vikas Pub. House.
6. Mangal, S. K. (2015). Advanced Educational Psychology. New Delhi:
7. Mattoo, M. I. (2019). Psychological Foundations of Education. New Delhi: Discovery Publishers.

Gandhinagar Institute of Technology
Bachelor of Technology Civil Engineering/Mechanical Engineering
Semester 3

Subject Code: 10000303	**Subject Title: Statistics and Partial Differential Equations**
Pre-requisite: Differential Calculus, Fundamental Statistics	

Course Objective:

- To provide an overview of probability and statistics to engineers
- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	1	-	4	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Basic Probability:** Mathematical & Statistical definition of Probability, Conditional Probability, Baye's Theorem, Discrete Random Variables, Probability Mass Function, Continuous Random variables, Probability Density Function **Special Probability Distribution:** Binomial Distribution and its properties, Poisson Distribution and its properties, Normal Distribution and its properties	10	24
2	**Basic Statistics:** Measure of Central Tendency, measure of variance Karl Pearson's Coefficients of Skewness, Moments, Correlation and its properties, Types of Correlation, Correlation Coefficient, Rank Correlation, Regression, Regression Coefficient, Properties and Expressions of Regression Coefficient, Least Square Approximation, Fitting of Linear Curve, Quadratic Curve and Non-linear Curves	10	24
3	**Sampling Theory:** Test of Hypothesis, Level of Significance, Critical Region, One tailed and two tailed test	8	19

	Test of Significant for Large Samples: Means of the samples and test of Significant of means of two large samples, **Test of Significant of Small Samples: Chi-Square Test**: Test of Goodness of Fit and Independence of Attribute		
	First Order Partial Differential Equations: Lagrange's' Linear Partial Differential Equations of First Order, Non-Linear Partial Differential Equations of First Order, General Method of finding solutions of first order Nonlinear PDEs (Charpit's Method)	6	14
6	**Higher Order Partial Differential Equations:** Solution of Homogeneous Linear Partial Differential Equations with Constant Coefficients, Solution of Non-Homogeneous Linear Partial Differential Equations with Constant Coefficients, Classification of Second Order Partial Differential Equations, Method of Separation of Variables: One dimensional Wave Equation, One dimensional Heat Equation, Two-dimensional Laplace's Equation	8	19

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

1. Interpret the basic principles of probability theory in problem solving situations and learn about different probability distributions to tackle statistical issues.
2. Outline the statistical data using measures of central tendency and classify the methods of correlation and regression to find relationships between variables and forecast outcomes.
3. Learn how to create and evaluate hypotheses, determine the likelihood that hypotheses will be incorrect, and make conclusions using crucial values.
4. Solve field problems in engineering involving PDEs.

List of Textbooks:

1. Ravish Singh, Mukul Bhatt, Probability and Statistics, Tata McGraw Hill.
2. Ravish Singh, Mukul Bhatt, Complex Variables and Partial Differential Equations, Tata McGraw Hill.
3. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

List of Reference Books:

1. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
2. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint)
5. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002

Open e-Resource:

- https://onlinecourses.nptel.ac.in/noc23_ma83/preview
- https://onlinecourses.nptel.ac.in/noc23_ma77/preview
- https://onlinecourses.nptel.ac.in/noc23_ma51/preview
- https://onlinecourses.nptel.ac.in/noc23_ma71/preview
- https://onlinecourses.nptel.ac.in/noc23_ma81/preview

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 3

Subject Code: 10010301	**Subject Title: Material Science and Metallurgy**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

1. Students will learn basic principles of material science and its importance related to particular applications.
2. Students will learn about Mechanical properties of material and its usage for various treatment processes

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Engineering Materials:** Engineering requirements of materials, Properties of engineering materials, Metallic Materials, Ceramic Material, Polymers, Composite and Nano-materials. Criteria for selection of materials for engineering Applications.	4	7
2.	**Crystal Structure & Imperfection :** crystallography, Atomic structure and; Structure of crystalline solids; Lattices, unit cells; Crystal systems, Bravais lattices; Indexing of directions and planes, notations, Inter-planar spacings and angles, co-ordination number, packing factors stacking sequence in BCC, FCC and HCP, Polymorphism or Allotropy. Factors influencing nucleation and growth. Imperfections in crystals and their effect on properties, Solute strengthening.	5	10
3.	**Examinations of Mechanical Properties in Engineering Material**: Concepts of stress and strain, Stress-Strain diagrams, Types, properties and applications, Structure of Metals, Fracture, Macro-examination, Spark Test, Sculptures Print, Macro-etching, Microscopic examinations, Magnetic Testing, Chemical analysis of steel and iron for Carbon, Sulphur & Phosphorous. Impact, Testing & toughness behavior. Hardness of materials.	6	12
4.	**Solidification of alloys and Phase diagram**	9	20

	Solidification of metals and an alloy, Nucleation and Growth during freezing of pure metal and alloy ingot/a casting Resultant macrostructures; Effects of Structure on Mechanical Properties. Systems, phases and phase rule, structural constituents, Gibb's free energy for thermodynamic stability of phases, Gibbs phase rule, Binary phase diagram its types, solid solution – Hume Rothery Rules, Unary and Binary equilibrium phase diagrams, Different reactions like eutectic, eutectoid, peritectic and peritectoid; Non-equilibrium cooling		
5	**Allotropy of Iron, Iron-Iron Carbide equilibrium system:** Allotropy of iron; Iron-iron carbide equilibrium diagram: Phases present and their properties, different reactions of the Iron-Iron Carbide equilibrium system; constituents, microstructures and properties of plain carbon steels. Alloy groups (Wrought Irons, Steels and Cast Irons) of Iron-Iron Carbide equilibrium system and their characteristics in general. Equilibrium cooling of eutectoid, hypoeutectoid and hypereutectoid steels, their resultant microstructures and hence correlated properties and applications. IS and ISO Codification, Different specifications and designations of steels.	5	12
6	**Heat Treatment and TTT curves** Study of heat treatment processes such as annealing, normalizing, spherodizing, hardening, tempering, carburizing, nitriding, cyaniding, induction hardening, flame hardening and hardenability of steel. Application of above processes to machine components and mechanical equipments such as gears, shaft bearings, turbine blades, crank shafts, pistons etc. Time-Temperature-Transformation Diagram, Isothermal and continuous transformations	6	15
7	**Non Destructive Testing of Materials & Corrosion Development:** Fundamentals and introduction to non-destructive testing. Scope and limitations of NDT Visual examination methods. Leak and pressure testing of industrial components, Dye penetrant and magnetic particle methods of NDT, Ultrasonic Testing. Eddy current testing with their Principle of non-destructive testing, the test methods, relative merits, demerits and applications. **Corrosion of Metal And Alloys:** Mechanism of corrosion, types of corrosion, corrosion prevention techniques.	7	18

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

1. Interpreting the basic concept of Material Science and Metallurgy
2. Identify about the ferrous and non ferrous metals and alloys and their applications
3. Checking different non-destructive testing methods
4. Discriminating the causes and prevention of metallic corrosion
5. Monitor the Scope and limitations of different materials

List of References:

1. Callister's Material Science and Engineering, R. Balasubramaniam, Wiley India
2. Elements of Material Science and Engineering, Lawrence H. Van Vlack, Pearson Education.
3. The Science and Engineering of Materials Donald R. Askeland and Pradeep P. Phule, Cengage Learning.
4. Principles of Materials Science and Engineering, W F Smith, McGraw Hill
5. Materials Science and Metallurgy, K. I. Parashivamurthy, Pearson Education.
6. Physical Metallurgy, Sydney H. Avner, Tata McGraw-Hill.Practical Non-Destructive Testing, Baldev Raj, T. Jayakumar and M. Thavasimuthu, Narosa Pub. House. ASM Handbook Vol.
7. Metallography and Microstructure, Ed. George F. Vander Voort, ASM International 2004.

Open e-Resource:

1. https://archive.nptel.ac.in/courses/113/102/113102080/

List of Suggested Experiments:

1. To get acquainted with the operation, construction, use and capabilities of a metallographic microscope.
2. To study procedure of specimen preparation for microscopic examination and to carry out a specimen preparation.
3. To understand what is micro examination, importance of micro examination and to study various ferrous, non-ferrous microstructures.
4. To identify the different types of material available for design, manufacturing and processing of various components based on structure-property-performance-processing relationships.
5. To show the effect of different quenching media (Oil, Water and Brine) on the hardness of medium carbon steel.
6. To understand the concept of hardenability and its relevance to heat treatment procedure to be adopted in practice.
7. To find out the effect of varying section size on hardenability of steel and obtain hardness distribution curves of hardened steel cross-section.
8. Study of different heat treatment processes- annealing, normalizing, hardening and tempering, surface and casehardening to improve properties of steel during processes and applications.
9. To understand the procedure of testing, nature of indication, the capability and sensitivity of the liquid penetrant test and the magnetic particle test.
10. To understand the procedure of testing, nature of indication, the capability and sensitivity of the Eddy current test and the Ultrasound test.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 3

Subject Code: 10010302	**Subject Title: Engineering Thermodynamics (Core-1)**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

1.Fundamental concepts of various laws of thermodynamics.
2.To understand the theory and applications of classical thermodynamic properties, equations of state.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	1	0	4	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Module -I** Introduction: Fundamental Concepts: Macroscopic versus microscopic point of view, thermodynamic state, processes and cycles, point function and path function, quasi-static process, concepts of simple compressible substances, dimensions and units, thermodynamic equilibrium; Temperature and Zeroth law; Concept of ideal gases and their equations of state; pure substance and phase, Thermodynamic definition of work, Definition of heat, comparison of Heat and Work.	5	12
2.	**Module –II** First Law of Thermodynamics: The first law referred to cyclic and non-cyclic processes, concept of internal energy of a system, concept of PMM1, first law applied to a control volume, steady flow energy equation, application of SFEE for devices such as boiler, turbine, heat exchangers, pumps, nozzles, etc. Second Law of Thermodynamics: Limitations of the first law, statements of the second law, their equivalence, Carnot theorems and corollaries, Concept of reversibility; Internal and external irreversibility, Absolute thermodynamic temperature scale. Clausius theorem, property of entropy, inequality of Clausius	14	33
3.	**Module – III** Vapour Power Cycles: Steam formation, Types of steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of steam tables, steam calorimeters, Carnot vapor cycle, Rankine cycle, calculation of cycle	23	55

	efficiencies, variables affecting efficiency of Rankine cycle, reheat cycle, regenerative cycle, reheat-regenerative cycle, feed water heaters. Gas Power cycle: Concept of air standard cycles, Assumptions, Carnot Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, Comparison of Otto, Diesel and Dual cycles, Efficiency of air standard cycle, Mean Effective Pressure, Simple Brayton cycle		

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

1. To identify the unique vocabulary associated with thermodynamics and explain the basic concepts of thermodynamics.
2. Comprehend laws of thermodynamics and its applications.
3. To analyze different gas power and vapor power cycles.
4. Make calculations for commonly used working fluids i.e. ideal gases and steam

List of Reference Books:

1. Nag P. K. " Engineering Thermodynamics ", 6th Edition, McGraw-Hill Education, Noida, 2017
2. Yunus Cengel & Boles “Thermodynamics: An Engineering Approach (SIE)”, 8th Edition, McGraw Hill education, 2017.
3. D. S. Kumar., “Engineering Thermodynamics (Principles & Practices)", Reprint 2013 edition
4. Gordon Rogers and Yon Mayhew, "Engineering Thermodynamics", Pearson Education, India, 4th Edition, 2002.
5. Jones and Dugan., "Engineering Thermodynamics ", PHI Learning Pvt. Ltd, 1998.
6. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J, 6th Edition, “Fundamentals of Thermodynamics”, John Wiley and Sons, 2003

Open e-Resource:

1. https://nptel.ac.in/courses/112106320
2. https://nptel.ac.in/courses/112105123
3. https://nptel.ac.in/courses/112105220
4. https://nptel.ac.in/courses/112105266

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 3

Subject Code: 10010303	Subject Title: Manufacturing Processes (Professional Core)
Pre-requisite: Zeal to learn the subject	

Course Objective:

1. Provide the fundamental knowledge of all conventional manufacturing machines and processes.
2. Explore the basic concepts in machining science.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Basic Machine Tools and Metal Cutting Principles:** Machine tools classification, working and auxiliary motions in machine tools, Primary cutting motions in machines tools, Cutting tool geometry and tool signature, cutting forces and power requirement in machining	4	8
2.	**Metal Cutting Lathes:** Engine Lathes, construction all arrangement and principal units of engine lathes, type and size range of engine lathes, Operations carried on engine lathe , attachment extending the processing capacities of engine lathes, Types of lathe machines, Capstan and Turret lathes, Taper turning on lathe, Thread cutting on lathe using gear train and chasing dial, Alignment tests of lathes	10	22
3.	**Drilling Machines:** Purpose and field of application of drilling machines, Types of drilling machines, Drilling and allied operation: drilling, boring, reaming, tapping, counter sinking, counter boring, spot facing; deep hole drilling, alignment tests of drilling machine.	6	15
4.	**Boring Machine:** Purpose and filed of application, Horizontal boring machines, Precision boring machines.	3	5
5.	**Milling Machines:** Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, attachments extending the processing capabilities of general purpose milling machines, Indexing, Helical milling operation and its set up, Alignment tests of milling machine.	8	20

6.	**Planers, Shapers and Slotters:** Classification of planers, Shapers and Slotters, Attachments extending the processing capacities of planers, Shapers and Slotters, machine and tooling requirements	5	10
7.	**Sawing and Broaching Machines:** Metal sawing classification: reciprocating sawing machines, circular sawing machines, band sawing machines, Types of broaching machines, advantage and limitations of broaching.	3	5
8.	**Grinding Machines and Abrasives:** Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, center less grinders, Types of grinding wheels, wheel characteristics and wheel selection.	6	15

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

1. Understand the basic concept of machining operations.
2. Analyze conventional machining processes.
3. Study, understand and generate the sequence of machining operations to produce the end product.
4. Judge the limitations and scope of machines to perform a variety of operations.

List of Textbooks:

1. Workshop Technology Vol. II, Hajra & Choudhari.
2. Manufacturing Processes, O.P. Khanna.
3. Production Technology, R. K. Jain.

List of Reference Books:

1. Workshop Technology Vol. I, II & III, WAJ Chapman.
2. Processes and Materials of Manufacture; Lindberg Roy A.; Prentice-Hall India.
3. Principles of Manufacturing Materials and Process, J S Campbell.

Open e-Resource:

1. https://nptel.ac.in/courses/112107145/14
2. https://nptel.ac.in/courses/112103248
3. https://onlinecourses.nptel.ac.in/noc20_me41/preview

List of Suggested Experiments:

1. To study about different operations on Lathe Machine by performing exercises of round bar specimens.
2. To study about Drilling machine and Job preparation.
3. To study about the Boring Machine.
4. To study about the Grinding Machine.
5. To study about the Milling machine and Job preparation.

6. To study about Shaper machine and job preparation.
7. To study about the Planar machine.
8. To study about the Slotter machine.
9. To study about Sawing machine.
10. To study about Broaching machine.

GANDHINAGAR INSTITUTE OF TECHNOLOGY
Bachelor of Technology - Civil Engineering
Semester-III

Subject Code: 10020305	**Subject Title: Mechanics of Solids**
Pre-requisite: Basic understanding of Physics and Mathematics	

Course Objective:

1. Mechanics is the name of the field of applied science that deals with either the state of rest or the condition of motion.
2. Engineers are eager to apply the rules of mechanics to practical field issues. Engineering mechanics is the practice of using the laws of mechanics to solve practical issues.
3. The laws and principles of mechanics will be taught to the students, along with how they apply to engineering problems.
4. Mechanics of solids is very essential for an engineer in planning, designing and construction of various types of structures and machines, so that the design is safe and economical.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:** Scalar and vector quantities, Composition and resolution of vectors, System of units, Definition of space, time, particle, rigid body, force. Principle of transmissibility, Principle of superposition, Law of gravitation	2	5
2	**Fundamentals of Statics:**	10	25

	Force: Types of Forces, Characteristics of a force, System of forces. **Coplanar concurrent forces:** Resultant of coplanar concurrent force system by analytical method only- Law of parallelogram of forces, Law of triangle of forces, Law of polygon of forces, Composition and resolution of forces, Equilibrium conditions for coplanar concurrent forces, Equilibrant, Free body diagrams, Lami's theorem. **Coplanar non-concurrent forces:** Moments & couples, Characteristics of moment and couple, Equivalent couples, Force couple system, Varignon's theorem, Parallel forces, Resultant of non-concurrent forces by analytical method only, Equilibrium conditions of coplanar non-concurrent force system, Equilibrant, Free body diagrams.		
3	**Center of gravity and moment of inertia** **Center of gravity and centroid:** Centroid of lines, plane areas and volumes, Pappus – Guldinus first and second theorems. **Moment of inertia of planar cross-sections:** Parallel & perpendicular axes theorems, polar moment of inertia, radius of gyration of areas.	6	10
4	**Friction** Theory of friction, Types of friction, Static and kinetic friction, Cone of friction, Angle of repose, Coefficient of friction, Laws of friction, Friction on inclined plane, ladder friction, wedge friction, belt and rope friction.	4	10
5	**Simple stresses & strains** **Normal/axial stresses:** Tensile & compressive, Shear and complementary shear. **Strains:** Linear, shear, lateral, thermal and volumetric. Elastic Constants: Modulus of elasticity, Poisson's ratio, Modulus of rigidity and bulk modulus. **Analysis of normal stress & strains:** Homogeneous and composite bars having uniform & stepped sections axial loads and thermal loads, hoop stresses, analysis of homogeneous prismatic bars under multidirectional stresses.	8	20
6	**Statically determinate beams** **Beams:** Types of loads, Types of supports, Types of beams; Determination of support reactions. **Bending moment and shear force:** Relationship between loading, shear force & bending moment**,** bending moment and shear force diagrams for beams subjected to only three types of loads: i) concentrated loads ii) uniformly distributed loads iii) couples and their combinations; Point of contraflexure.	4	10
7	**Stresses in homogeneous beams** **Bending stress in beams:** Pure bending, Theory of pure bending, Neutral axis, Moment of resistance, Relationship between moment of resistance, Bending stress, moment of inertia, Radius of curvature and modulus of elasticity; Section modulus. **Shear stress in beams:** Horizontal shear stress, Relationship between shears force, shear stress and moment of inertia; Horizontal shear stress distribution diagrams across beam section; average shear stress.	4	10
8	**Principal stresses**	4	10

	Analytical solution for elements under axial and shear stress: Normal, tangential and resultant stress on inclined plane, angle of obliquity of resultant stress, maximum shear stress, principal planes and principal stresses, principal stresses in beams under bending and shear.		

Course Outcome:

Sr. No.	CO statement
CO-1	Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering.
CO-2	Apply principles of statics to determine reactions & internal forces in statically determinate beams.
CO-3	Determine centroid and moment of inertia of a different geometrical shape and able to understand its importance.
CO-4	Know basics of friction and its importance through simple applications.
CO-5	Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear in combination and graphically represent the distribution.

List of Textbooks:

1. Title: Engineering Mechanics Author: R S Khurmi, Publisher: S Chand & Company
2. Title: Engineering Mechanics Author: S S Bhavikatti, Publisher: New Age International Ltd.
3. Title: Engineering Mechanics Author: A.K. Tayal, Publisher: Umesh Pub.
4. Title: Strength of Materials Author: S. Ramamruthum & R. Narayan, Publisher: Dhanpat Rai.

List of Reference Books:

1. Title: Mechanics for Engineers - Statics Fourth Edition Author: F. P. Beer and E. R. Johnson, Publisher: McGraw-Hill
2. Title: Mechanics of Materials 2nd Edition Author: Timoshenko and Gere, Publisher: CBS
3. Title: Engineering Mechanics of Solids Author: E P Popov, Publisher: Prentice Hall India Learning Pvt. Ltd

Open e-Resource:

1. https://nptel.ac.in/courses/105104160

List of Suggested Experiments:

1. Equilibrium of coplanar concurrent forces
2. Equilibrium of coplanar concurrent forces
3. Equilibrium of coplanar parallel forces: Determination of reactions of simply supported beam
4. Verification of principle of moment: Bell crank lever

5. Determination of coefficient of static friction using inclined plane
6. Determination of parameters of machines: (a) Wheel and differential axles (b) Single purchase crab
7. Determination of hardness of metals: Brinell hardness test
8. Determination of impact of metals: Izod/Charpy impact test
9. Determination of compression test on (a) Metals –mild steel and cast iron (b) Timber –along and parallel to the grains.
10. Determination of tensile strength of metals

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Gandhinagar Institute of Technology

B. Tech CE/IT/CSE/AI/CS/EC/EE/CL/ME/R&A

Semester 3

Subject Code: VAC023	**Subject Title: Universal Human Values**
Pre-requisite :- Zeal to learn the subject	

Course Objective:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

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	25	25	-	-	50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:** Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	9	20
2.	**Understanding Harmony in the Human Being - Harmony in Myself!:** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure	8	17

	Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.		
3.	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	11	25
4.	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	7	15
5.	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: (a) Ability to utilize the professional competence for augmenting universal human order, (b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, (c) Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: (a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, (b) At the level of society: as mutually enriching institutions and organizations	10	23

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

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.

3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

List of References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Open e-Resource:

1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Productions

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 4

Subject Code: 10010401	**Subject Title: Fluid Mechanics (Core-1)**
Pre-requisite:- Elements of Mechanical Engineering	

Course Objective:

1. The course is designed to give fundamental knowledge of fluid, its properties and behavior under various conditions.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Fluids and Their Properties:** Introduction of fluid, fluid classifications, hypothesis of continuum, Shear stress in a moving fluid, molecular structure of the material, fluid density, viscosity, causes of viscosity in gases and liquids, surface tension, capillary effect, vapor pressure, cavitation, compressibility and the bulk modulus Pressures and Head: Pressure at a point, Pascal's law, Hydrostatic law - atmospheric, gauge and vacuum pressure- measurement of pressure. Pressure gauges, Manometers: differential and Micro Manometers.	8	20
2.	**Static Forces on Surface and Buoyancy:** Hydrostatic forces on submerged plane, horizontal, vertical, inclined, and curved surfaces Total pressure and center of pressure derivations, buoyancy,	8	20

	equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacenter relative to the center of buoyancy.		
3	**The Energy Equation and its Application**: Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, Measurement of flow: Pitot tube, Venturi meter and orifice meter. Classification of orifices, Flow over rectangular, triangular, trapezoidal and stepped notches, Broad crested weirs	10	25
4.	**Dimensional Analysis And Similarities:** Dimension reasoning, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π-theorem	6	15
5.	**Viscous Flow:** Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula **Turbulent Flow:** Expression for coefficient of friction -Darchy Weishbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes. **Compressible Flow:** Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties **Flow through pipes:** Major energy losses, Minor energy losses, Hydraulic gradient and total energy lines, Pipes in series and parallel, Equivalent pipes, Siphon, power transmission through pipe, Flow through nozzle at end of pipe, Water hammer in pipes	8	20

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

1. Understand the basic concept of fluid mechanics and use various devices for measuring fluid pressure.
2. Calculate hydrostatic force and use of the law of conservation mass to fluid flow.
3. Apply Bernoulli's equation to fluid flow problems, use different fluid flow measuring devices.
4. Correlate fundamentals of fluid mechanics with various mechanical systems.
5. Understand the basics of Viscous, Turbulent, and Compressible flow.

List of Reference Books:

1. 1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K.Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
4. Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
5. Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd
6. Fluid Mechanics by A. K. Mohanty, PHI Learning Pvt. Ltd.

Open e-Resource:

1. Fluid Mechanics virtual labs. http://eerc03-iiith.vlabs.ac.in/
2. https://nptel.ac.in/courses/105105119

List of Suggested Experiments:

1. To determine the metacentric height of a floating body.
2. Verification of Bernoulli's theorem.
3. To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturi meter)
4. To determine the Coefficient of discharge through open channel flow over a Notch. (Rectangular or V notch)
5. To determine the different types of flow Patterns by Reynolds's experiment.
6. To determine the Friction factor for the different pipes.
7. To determine the loss coefficients for different pipe fittings.
8. To determine the viscosity of fluid by viscometer (Redwood or Saybolt)

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 4

Subject Code: 10010402	**Subject Title: Kinematics and Theory of Machines**
Pre-requisite: Professional Core Course	

Course Objective:

1.Enrich the knowledge of essential elements of machine and their functionality.
2.Fundamental concepts of linkages, cams, gear, governors and gyroscope.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Assigned Faculty**
1.	**Introduction of Mechanisms and Machines :** Concepts of Kinematics and Dynamics, Mechanisms and Machines, Planar and Spatial Mechanisms, Kinematic Pairs, Kinematic Chains, Kinematic Diagrams, Kinematic Inversion, Four bar chain and Slider Crank Mechanisms and their Inversions, Degrees of Freedom,Mobility and range of movement - Kutzbach and Grubler's criterion, Grashof's criterion , straight line mechanisms	06	VRP
2.	**Analysis of mechanisms (Position, velocity, acceleration):** Graphical and analytical velocity analysis of fourbar pin jointed linkages and fourbar slider crank linkages, Instant centers of velocity, Graphical and analytical acceleration analysis of fourbar pin jointed linkages and fourbar slider crank linkages, Graphical velocity and acceleration analysis of quick return mechanisms.	08	MBK
3.	**Governors :** Introduction, Types of Governors, Centrifugal Governors, Terms Used in Governors, Watt Governor, Porter Governor, Proell Governor, Hartnell Governor, Hartung Governor, Wilson-Hartnell Governor, Pickering Governor, Sensitiveness of Governors, Stability of Governors, Isochronous Governor, Hunting, Effort and Power of a Governor, Effort and Power of a Porter Governor, Controlling Force, Controlling Force Diagram for a Porter Governor, Controlling Force Diagram for a Spring-controlled Governor, Coefficient of Insensitiveness.	08	DHP
4.	**Cam and Follower:** Types of cams, Types of followers, Follower displacement programming, Derivatives of follower Motion, Motions of follower, Layout of cam profiles.	08	VRP

5.	**Gear and Gear Trains:** Terminology, Law of Gearing, Characteristics of involute and cycloidal action, Interference and undercutting, centre distance variation, minimum number of teeth, contact ratio, spur, helical, spiral bevel and worm gears, problems. **Gear Trains:** Synthesis of Simple, compound & reverted gear trains, Analysis of epicyclic gear trains.	08	SSP
6.	**Gyroscope:** Principle of gyroscope, Definition of axes, active and reactive couples; Roll, Yaw and Pitch motions; Gyroscopic effect in a rotor, two wheelers, Four wheelers, ship and aeroplane.	06	SRP

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

1. Identify functional characteristics of various machine elements.
2. Determine position, velocity, and acceleration of linkages in mechanism at any instant
3. Analyse motion of different governors.
4. Analyse various motion transmission elements like gears, gear trains and cams.
5. Analyse effect of gyroscopic couple on vehicles, ships and aeroplanes

List of Reference Books:

1. Rattan S. S., Theory of Machines, Tata McGraw Hill Education
2. Norton R. L., Kinematics and Dynamics of Machinery, Tata McGraw Hill Education
3. Ambekar A. G., Mechanism and Machine Theory, PHI Learning Private Ltd.
4. Ghosh Amitabha & Mallik Ashok Kumar, Theory of Mechanisms and Machines, East West Press.
5. Uicker J.J., Pennock G.R., Shigley J.E., Theory of Machines and Mechanisms, Oxford University Press.
6. Khurmi R.S. & Gupta J.K., Theory of Machines, S.Chand Publication.

Open e-Resource:

1. https://nptel.ac.in/courses/112106270

List of Suggested Experiments:

1. To study the inversion of four bar mechanism.
2. To study inversion of slider and crank mechanism.
3. Analysis with graphical method for velocity and acceleration of various mechanisms.
4. Analysis of cam profile.
5. Analysis of gears & gear train.
6. To study characteristics and performance of Watt governor
7. To study characteristics and performance of Porter governor
8. To study characteristics and performance of Proell governor
9. To study characteristics and performance of Hartnell governor
10. Analysis of gyroscopic effect.

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 4

Subject Code: 10010403	**Subject Title: Fundamental of Machine Design**
Pre-requisite: Zeal to learn the subject	

Course Objective:

1. To learn the various steps involved in the Design Process.
2. To learn designing shafts and couplings for various applications.
3. To learn the design of temporary and permanent Joints.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	1	0	4	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Design Considerations:** Design procedure, Selection of preferred sizes, Aesthetic and Ergonomic considerations in Design, Manufacturing considerations in Design, Materials Selection in Machine Design, Standardization, Limits, Fits and Tolerances.	6	10
2.	**Design Against Static Load:** Stress-strain, Stresses due to bending & torsional moment, Factor of safety Theories of elastic failures, Cotter & Knuckle joints, Levers.	12	25
3.	**Shafts, Keys and Couplings:** Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and splines – Rigid and flexible couplings.	12	25
4.	**Riveted and Welded Joints:** Types of riveted joints, rivet materials, types of failure, strength and efficiency of joint, Caulking and Fullering, Longitudinal and Circumferential lap joint, eccentrically loaded riveted joint.	10	25

	Welded joints, stress relieving of welded joints, Strength of butt and fillet joint, Eccentric load in the plane of weld, welded joint subjected to bending and torsion.		
5.	**Columns and Strut:** Compressive axial loading of columns and struts, Slenderness ratio, Compressive stress and buckling of members, Effect of end conditions; Euler's Formula, Applications, validity and limitations; Rankine's Formula, Johnson's equation; Eccentric loading of long columns	8	15

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

1. Develop the fundamental concepts of mechanical design process.
2. Explain the design machine members subjected to static loads.
3. Design power transmitting elements such as shaft, keys and couplings
4. Design various types of joints and fasteners.
5. Understand the principles and theories related to the design and analysis of struts and columns in the context of machine components.

List of Reference Books:

1. Sighley J. E., Mechanical Engineering Design, Tata McGraw Hill Education.
2. Bhandari V. B., Design of Machine Elements, Tata McGraw Hill Education.
3. Sharma P. C. and Aggarwal D. K., A Textbook of Machine Design, S K Kataria & sons.
4. Norton. R. L., Design of Machinery, Tata McGraw Hill Education.
5. Juvinall R. C, Fundamentals of Machine Component Design, John Wiley & Sons.
6. Kannaiah P., Machine design by, Scitech Publication.

Open e-Resource:

1. https://archive.nptel.ac.in/courses/112/105/112105125/

List of Suggested Tutorials:

1. Problems related to preferred size.
2. Problems related to limits, fits, tolerances.
3. Problems related to theories of failures.
4. Design of cotter & knuckle joints.
5. Design of levers.
6. Design of shafts.
7. Design of keys & couplings.
8. Design of riveted joints.
9. Design of welding joints.
10. Problems related to column & strut.

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Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 4

Subject Code: 10010405	**Subject Title: Manufacturing Technology**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

1. The Manufacturing Technology content is develop to learn basic concepts of Casting, Welding, forming and advanced finishing processes
2. To learn about the effects of process parameters used in manufacturing technology

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Metal casting** Casting principle, Metal casting processes and equipment, Pattern making and process , mould design and its properties, Gating system, types of casting processes Melting furnace, Heat transfer and solidification, Shrinkage, Cleaning of casting, Casting defects and residual stresses. Die Casting	12	20
2.	**Metal Joining** Physics of welding, Classification of welding and its princple, Formation of a fusion welded joint, Welding arc, Welding powder source characteristics, Metal transfer, Heat flow, Thermal stresses, Metallurgical aspect of welding, Design considerations in welding, Solid and liquid state joining processes, Brazing and Soldering, Welding defects	14	30
3.	**Metal Forming** Introduction to bulk and sheet metal forming, Concept of strain hardening Plastic deformation and yield criteria, Types of forming processes: extrusion, rolling, wire drawing, Fundamentals of hot and cold working processes, types of cold forming processes; Shearing, Drawing, Squeezing, Blanking, Piercing, deep drawing, Coining and embossing. Effects of process and geometric parameters in forming process	16	40

4.	**Finishing Processes** Introduction, Lapping, Horning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing.	3	10

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

1. Illustrate the basics of manufacturing processes,
2. interpret the effect of process parameters on manufacturing processes,
3. Appraise casting welding and forming processes for function requirement,
4. Distinguish of various finishing processes

List of References:

1. Production technology, by R.K. Jain, Khanna publishers.
2. Production Technology by P.C. Sharma S Chand & Co Ltd.
3. Manufacturing Technology Vol-II, By P.N. Rao, Tata McGraw Hill.
4. Manufacturing Engg. And Technology By S. Kalpakajain, PHI/Pearson.
5. Welding technology, by O.P.Khanna, DhanpatRai publishers.

Open e-Resource:

1. https://nptel.ac.in/courses/112104195

List of Suggested Experiments:

1. Introduction to different Manufacturing Processes
2. Pattern making and its importance
3. Review of Different Casting Processes
4. Job work on joining of two metal plates by Arc Welding Process
5. Job work on joining of two GI sheets by Resistance Welding Process
6. Review of Gas Welding Processes
7. Job work on cup Drawing process in metal forming
8. Awareness about Plastic, Glass and Ceramic Processing techniques
9. Review of different finishing process

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Gandhinagar Institute of Technology
Bachelor of Technology
Semester 4

Subject Code: IKS0403	Subject Title: Vedic Mathematics
Pre-requisite: -	

Course Objective: The main objective of this course is to make students appreciate the amazing computational power of Vedic Sutras and help them to develop skill for doing faster and accurate calculations.

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

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	**Vinculum, Multiplication, Division & Roots** Vinculum: Conversion, Application, Addition and Subtraction, Beejank, Multiplication: Vertically and Crosswise, Base number/sub base number, Sum and difference of Products, Division: Nikhilam, Paravartya Yojayet, Flag Digit (Vertically and Crosswise), Mixed Operations, Indices: Meru Prastar, Square, Cube, Fourth and Fifth Power, Mixed Operations, Roots: Vilokanam (up to Fifth Root), Square root and Cube root, Mixed Operations	10	50 %
2	**Expansion & Factorisation:** Introduction -Meru Prastar -upto fifth Power, Mixed Operations, Factorisation (Cubic expression) -Remainder Theorem, use of Differentiation, LCM/HCF Partial Fractions, Anurupye sunyamanyat (3 elementary methods), Solution of Equations, (Quadratic equations /simultaneous equations of 2 or 3 variables)	10	25 %
3	**Complex Numbers & Calculus:** Complex Numbers: Multiplication, Division and square-root, Calculus: Differentiation, Integration, Various Number System: (Binary, Quadral, Octal and Hexadecimal Systems) – Conversion and Basic operations.	10	25 %

Course Outcome:

After Completion of this Course Students will be able to:

- Understand and apply Vedic methods for arithmetic operations, including vinculum, Beejank multiplication, and division techniques like Nikhilam and Paravartya Yojayet.
- Solve problems involving indices, roots, LCM/HCF, divisibility, recurring decimals, and numerical codes using traditional Vedic approaches.

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- Apply Vedic techniques in algebra for multiplication, division, expansion, factorisation, partial fractions, and solving equations.
- Demonstrate basic understanding of, complex numbers, calculus, and number systems using foundational Vedic and mathematical concepts.

List of Reference Books:

1. Bharatiya Krishna Teerth : Vedic Mathematics (Motilal Banarasidas New Delhi, 2001).
2. V.G. Heroor : The History mathematics and Mathematicians of India.
3. V.G. Unkalkar : Magical world of Mathematics, (Vandana Publishers Bangalore, 2008).
4. Dr. Vyawahare-Chouthaiwale- Borgaonkar: Introduction to Vedic Mathematics.

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Gandhinagar Institute of Technology
B. Tech – CE/IT/CSE/AI/CS/ME/R&A/EN/EE/CL/ECE
Semester 4

Subject Code: SEC026	**Subject Title:** Cyber Security
Pre-requisite: Internet, Network basics	

Course Objective:

(1) Understanding types of cybercrime and cyber-attacks.
(2) Learn tools for vulnerability scanning and port scanning.
(3) Configuring firewalls and using it for greater system security.
(4) Learn tools for network defense and web applications.
(5) Understanding different laws in cyber security.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
1	0	2	2	25	25			50

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction:**Definition and Origin of the Word, Cyber Crime and Information Security, Who are Cyber Criminals, Classification of cyber crimes, E-mail Spoofing, Spamming, Forgery, Hacking, Online Frauds, Software Piracy, Computer Sabotage Email Bombing, Computer Network Intrusion, Password Sniffing, Credit Card Frauds, Phishing, vishing, Identity Theft, CPU Hijackers, Darknets and Dark Markets. Cyber Attacks: Virus and Warms,Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection	7	25
2	**Systems Vulnerability Scanning**: Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, Hping Kismet	6	25

3	**Network Defense tools Firewalls and Packet Filters:** Firewall Basics, Windows Host based Firewall, Windows Firewall Control, Linux Host based Firewall, Packet Filter Vs Firewall, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, Snort: Introduction Detection Systemls-iptables	7	25
4	**Web Application Tools Scanning for web vulnerabilities tools:** Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra	7	25

Course Outcome:

1. To identify and describe the major types of cybercrime
2. Describe system and web vulnerability
3. To Configure firewalls on all platforms for all types of attack scenarios.
4. Evaluate network defense tools and web application tools.
5. Investigate a cybercrime, prepare report and apply laws for the case

List of Reference Books:

1. Cyber Security A Complete Guide - 2024 Edition by Gerardus Blokdyk - 2024
2. The New Outstanding 2024 Guide To Cybersecurity: Everything You Need To Know by Kaylee Bryant - 2024
3. Cyber Security for Next-Generation Computing Technologies Inam Ullah Khan, Mariya Ouaissa, Mariyam Ouaissa · 2024
4. See Yourself in Cyber: Security Careers Beyond Hacking Ed Adams- 2024
5. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley

Open e-Resource:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
3. https://www.coursera.org/specializations/cyber-security
4. https://www.coursera.org/specializations/cybersecurity-attack-and-defense

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code: 10010501	**Subject Title: Mechanical Measurement and Metrology**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

- Understand metrology, its advancements & measuring instruments,
- Acquire knowledge on different standards of length, calibration of End Bars, linear and angular measurements.
- Equip with knowledge of limits, fits, tolerances and gauging.
- Acquire knowledge of measurement systems and methods with emphasis on different transducers, intermediate modifying and terminating devices.
- Understand the measurement of Force, Torque, Pressure, Temperature and Strain.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Metrology, Linear and Angular Measurement:** Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Classification and selection of measuring instruments and systems. Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Classification of standards and Traceability, calibration of End bars, standardization. Slip gauges- Indian standards on slip gauge, method of selection of slip gauge, stack of slip gauge, adjustable slip gauge, wringing of slip gauge, care of slip gauge, slip gauge accessories, problems on building of slip gauges (M87, M112). Measurement of angles- sine bar, sine center, angle gauges, optical instruments for angular measurements, Auto collimator-applications for measuring straightness and squareness.	12	25%

2.	**System of Limits, Fits, Tolerance and Gauging:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919-1963), geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials. **Comparators**: Functional requirements, classification, mechanical-Johnson Mikrokator, sigma comparators, dial indicator, electrical-principles, LVDT, Pneumatic- back pressure gauges, solex comparators and optical comparators- Zeiss ultra-optimeter.	12	25%
3.	**Measurement systems and basic concepts of measurement methods**: Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response- time delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers. **Intermediate modifying and terminating devices**: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers. Terminating devices, Cathode ray oscilloscope, Oscillographs. **Advances in metrology**: Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines constructional features, applications.	12	25%
4.	**Force, Torque and Pressure Measurement:** Direct methods and indirect method, force measuring inst. Torque measuring inst., Types of dynamometers, Absorption dynamometer, Prony brake and rope brake dynamometer, and power measuring instruments. Pressure measurement, principle, use of elastic members, Bridgeman gauge, McLeod gauge, Pirani gauge.	4	12%
5.	**Measurement of strain and temperature:** Theory of strain gauges, types, electrical resistance strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature Compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells and torque sensors. Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer.	5	13%

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

1. Understand the objectives of metrology, methods of measurement, selection of measuring instruments, standards of measurement and calibration of end bars.
2. Describe slip gauges, wringing of slip gauges and building of slip gauges, angle measurement using sine bar, sine center, angle gauges, optical instruments and straightness measurement using Autocollimator.
3. Explain measurement of tooth thickness using constant chord method, addendum comparator methods and base tangent method, composite error using gear roll tester and measurement of pitch, concentricity, run out and involute profile.
4. Understand laser interferometers and Coordinate measuring machines.
5. Explain measurement systems, transducers, intermediate modifying devices and terminating devices.
6. Describe functioning of force, torque, pressure, strain and temperature measuring devices.

List of References:

1. Engineering Metrology and Measurements, Bentley, Pearson Education.
2. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill
3. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON)
4. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar.
5. Industrial Instrumentation & Control by S K Singh, McGrawHill
6. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press

Open e-Resource:

1. http://nptel.ac.in/courses/112106138

List of Suggested Experiments:

1. Basic understanding of measurements and metrology: concepts, application, advantage and future aspects
2. Performance on linear and angular measurements and check different characteristics of measurements
3. Performance on temperature measurements and check different characteristics of measurements and also do calibration
4. Performance on pressure measurements and check different characteristics of measurements and also do calibration
5. Performance on stress, strain and force measurements and check different characteristics of measurements and also do calibration
6. Performance on Speed/Velocity, acceleration measurements.
7. Performance on surface measurements.
8. Performance on measurements of gears and screw threads.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code: 10010502	Subject Title: Heat Transfer
Pre-requisite:- Zeal to learn the subject	

Course Objective:

1. The course is prepared to provide a detailed understating of various modes of heat transfer audits applications in Mechanical Engineering.
2. The course also provides the basic technical knowledge related to heat exchangers.

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	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1.	**Conduction**: Fourier's law, effect of temperature on thermal conductivity of different solids, liquids and gases, generalized equation in Cartesian, cylindrical and spherical coordinates and its reduction to specific cases, One dimensional steady state conduction, heat conduction through plane and composite walls, cylinders and spheres, electrical analogy, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient **Transient heat conduction**: lumped capacitance method for bodies of infinite thermal conductivity, time constant, one-dimensional transient heat conduction in plane wall with finite conduction and convective resistances	10	24
2.	**Convection**: Newton's law of cooling, dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection, Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer	8	20
3.	**Radiation**: Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power, emissivity, Kirchhoff's law, Planck's law, Rayleigh-Jeans' law, Wien's law, Wien's displacement law, Stefan-Boltzmann law, intensity of radiation, radiosity, irradiation, radiation shields	8	20

4.	**Heat exchanger**: Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness-NTU method for parallel and counter flow heat exchanger	9	22
5.	**Two-phase heat transfer:** Boiling of liquids, Pool boiling curve, modes of pool boiling, correlation for pool boiling, condensation of vapor, film wise and drop wise condensation, condensation on flat surfaces and horizontal tubes	7	14

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

1. To classify the heat transfer problems and to apply the principles of steady state one dimensional heat transfer, extended surface, and unsteady state conduction for commonly encountered Mechanical engineering problems.
2. To identify the type of convection problems and to apply concepts of natural and forced convection for related problems Appraise casting welding and forming processes for function requirement
3. To explain various laws of radiation heat transfer and to determine the radiation heat transfer between black and grey surfaces of simple Mechanical systems
4. To practice LMTD and effectiveness-NTU method for simple heat exchange device
5. To identify types of boiling and condensation heat transfer process and to use the same to estimate heat transfer coefficient for simple cases

List of References:

1. Heat and Mass Transfer by R K Rajput, S.Chand Publication
2. Heat and Mass Transfer: Fundamentals and Application by YunusCengel, McGraw Hill
3. Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley
4. Heat Transfer by Mills and Ganesan, Pearson Education
5. Heat Transfer by J P Holman , McGraw Hill
6. Heat and Mass Transfer by P.K. Nag, McGraw Hill

Open e-Resource:

https://nptel.ac.in/courses/112108149

List of Suggested Experiments:

1. To determine the thermal conductivity of given metal rod
2. To determine the thermal conductivity of the given composite walls.
3. To determine Stephan Boltzmann constant experimentally.
4. To determine heat transfer co-efficient by forced convection.
5. To determine heat transfer co-efficient by natural convection.
6. To determine the overall heat transfer co-efficient of shell and tube type heat exchangers.
7. To determine the emissivity of gray body.
8. To study film and drop wise condensation and to determine the film co-efficient

9. To measure convective heat transfer co-efficient and effectiveness of the fin under forced convection.
10. To measure convective heat transfer co-efficient and effectiveness of the fin under natural convection.
11. To determine heat transfer co-efficient for hair pin heat exchanger.
12. To determine heat transfer co-efficient for transient heat transfer process.
13. To determine critical radius of insulation.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code: 10010503	Subject Title: Design of Machine Elements
Pre-requisite: - Fundamental of Machine Design	

Course Objective:

Throughout this course, students will develop the ability to apply engineering principles and analytical techniques to solve practical design problems in mechanical systems, gaining hands-on experience in designing, analyzing, and evaluating mechanical components and systems for engineering applications.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Design against Fluctuating load:** Stress Concentration, Endurance limit and Fatigue failure, Factors affecting endurance limit, S-N Diagram, Design for finite and infinite life for completely reversed load, Design based on Gerber, Goodman and Soderberg criteria	12	20
2.	**Design of Springs:** Types of Spring, Wahls' factor and its use in design of spring, Effect of end connections on design of compression spring, Design of helical tensile spring and compression spring for circular wire, Buckling of compression spring, Length and number of turns calculation, Design of leaf spring.	10	16
3.	**Power screws:** Types of threads, Design of screw with different types of threads used in practice, Design of nuts, Design of C clamp, Screw jack	8	12
4.	**Power Transmissions Elements**: Transmission of power by Belt and Rope drives, Transmission efficiencies, Design of Belts Flat and V types, Design of Ropes, pulleys for belt and rope drives, Materials, Design of Chain drives and wire rope.	12	26

5.	**Design of Clutches & Brakes:** Types of clutches, Design of various mechanical clutches like single plate, multiple plate, centrifugal clutch etc., Design of various mechanical brakes like block brake, band brake, internal expanding shoe brake etc.	14	26

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

1. Evaluate the fatigue life of mechanical components.
2. Design various types of springs effectively for mechanical application.
3. Design and analyze power screws for practical mechanical applications.
4. Understand power transmission systems, calculate transmission efficiencies and design components accordingly.
5. Design and analyze mechanical clutches and brakes.

List of References:

1. Sighley J. E., Mechanical Engineering Design, Tata McGraw Hill Education.
2. Bhandari V. B., Design of Machine Elements, Tata McGraw Hill Education.
3. Sharma P. C. and Aggarwal D. K., A Textbook of Machine Design, S K Kataria & sons.
4. Norton. R. L., Design of Machinery, Tata McGraw Hill Education.
5. Juvinall R. C, Fundamentals of Machine Component Design, John Wiley & Sons.
6. Kannaiah P., Machine design by, Scitech Publication.

Open e-Resource:

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

List of Suggested Experiments:

1. Design of machine components subjected to fluctuating loads
2. Design of Spring
3. Design of Power screw
4. Design of Belt Drive
5. Design of Rope Drive
6. Design of Chain Drive
7. Design of Clutches
8. Design of Brakes

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code: 10010504	Subject Title: Operation Research
Pre-requisite: - Zeal to learn the subject	

Course Objective:

1. To apply various optimization techniques for decision making.
2. aims to introduce students to use quantitive methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.
3. Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Tutorial		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
2	1	0	3	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Operations Research:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research. **Linear Programming Problem:** Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Special Case of LP Problem, Graphical Sensitivity Analysis. Introduction of Primal and Dual Problems, Economic Interpretation. Introduction of Goal and Integer Programing. Dynamic Programming: Steps involved in dynamic programming, characteristics and explanation of dynamic programming, formulation of Deterministic and probabilistic dynamic programming.	08	25
2.	**Transportation and Assignment:** Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, Unbalanced problems and profit maximization problems. Transhipment Problems. Assignment Problems and Travelling sales man Problem.	06	25

3.	**Replacement theory:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.	04	15
4.	**Game Theory:** Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, M x2), Algebraic and graphical methods.	04	10
5.	**Project Management:** Introduction to PERT and CPM, Critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.	08	25

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

1. Develop models for optimizing the management and production systems from the verbal description of the real system
2. Make use of LPP techniques for optimization of Production mix problem in industry
3. Evaluate transportation, transshipment, assignment and travelling salesman and Queuing problem.
4. Apply quantitative techniques in machine replacement, game theory, business decision making under conditions of certainty, risk and uncertainty
5. Demonstrate Project management Problem

List of References:

1. Operations Research: An Introduction by HamdyTaha, Pearson Education Inc
2. Operations Research: Principles and Practice by Pradeep PrabhakarPai, Oxford Higher Education, Oxford University press
3. Operations Research: Principles and Practice by Ravindran Phillips and Solberg by Wiley India Edition,
4. Operations Research by P Mariappan, Pearson
5. Operations Research by A M Natarajan, P Balasubramani, A Tamilarasi, Pearson Education Inc
6. Operations Research by H N Wagner, Prentice hall.
7. Optimization in Operations Research by Ronald Rardin, Pearson Education Inc.
8. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
9. Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

Open e-Resource:

1. https://nptel.ac.in/courses/110106062
2. https://nptel.ac.in/courses/111107128

List of Suggested Tutorials:

1. Industrial Problems of Linear Programming
2. Industrial Problems on Transportation
3. Industrial Problems on Assignment

4. Industrial Problems on Game Theory
5. Industrial Problems on Replacement
6. Industrial Problems on PERT and CPM

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code: 10010505	Subject Title: Industrial Automation
Pre-requisite: - Zeal to learn the subject	

Course Objective: Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn the basics of automation, how a system works and the importance of PLC, SCADA and robots in automation. This course will provide an opportunity to learn industrial automation techniques.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Tutorial		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
2	0	0	2	70	30	--	--	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction:** Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: modbus & profibus. Role of computers in measurement and control.	04	15%
2.	**Automation components:** Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.	06	25%
3.	**Programmable logic controllers:** Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.	08	25%
4.	**Distributed Control System:** Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	08	20%

5.	**Overview of Industrial automation using robots:** Basic construction and configuration of robot, Pick and place robot, Welding robot. Internet of things for plant automation and overview of Industry 4.0	06	15%

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

1. Explain automation components and systems application.
2. Identify suitable industrial automation hardware for given application.
3. Measure industrial parameters like temperature, pressure, force, displacement, speed, flow, level, humidity and pH.
4. Integrate SCADA with PLC Systems.

List of References:

1. Industrial Instrumentation and Control By. S.K. Singh, The McGraw Hill Companies
2. Process Control Instrumentation Technology By. C.D. Johnson, PHI
3. Industrial control handbook, Parr, Newnem
4. Programmable logic controller, Dunning, Delmar

Open e-Resource:

1. https://nptel.ac.in/courses/108105063
2. https://onlinecourses.nptel.ac.in/noc21_me67/preview

GANDHINAGAR UNIVERSITY

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code: 10010506	Subject Title: Basic Principles of Management
Pre-requisite:- Zeal to learn the subject	

Course Objective:

- Enrich the knowledge of essential elements of Economics and its application.
- Understand the concepts of Management, Organizational structure & Corporate social responsibility.

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

Subject Contents			
Sr. No	Topic	Total Hours	Weigh (%)
1.	**Introduction to Management;** Definitions, Nature, Management Difference between Management & administration, skill, types and roles of managers Management Principles; Scientific principles, administrative principles, Maslow's Hierarchy of needs theory.	8	28%
2.	**Functions of Management;** Planning, Organizing, Staffing, Directing, controlling (meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization, chain of command, centralization and decentralization.	12	42%
3.	**Organizational Structures**; Organisational culture of Environment concept of culture and its importance, attributes culture, How does culture affect managers and employees.	4	15%
4.	**Corporate Social Responsibility;** Corporate Social Responsibility; meaning, importance Business Ethics; meaning, importance.	4	15%

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

1. Identify and apply appropriate management techniques for managing business.
2. Have a conceptual knowledge about the planning and decision making.
3. Apply the concept of organising for the effective functioning of a management.
4. Demonstrate the techniques for controlling and coordination.

GANDHINAGAR
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List of References:

1. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P and Decenzo David A.
2. Principles and Practices of Management by L.M.Prasad
3. Principles of Management by Tripathy and Reddy

Open e-Resource:

1. https://nptel.ac.in/courses/110107150

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

Subject Code:	**Subject Title: Introduction to Robotics**
Pre-requisite: - Zeal to learn the subject	

Course Objective:

This course aims to introduce students to the fundamentals of robotics, including sensor interfacing, signal processing, and actuator control using Arduino. Through hands-on experiments, students will learn to design, build, and program simple robotic systems. The course will also foster problem-solving skills and promote innovation in robotic applications.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
2	-	2	3	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Robots and Robotics:** Definition and overview of Robotics, History and Evolution of Robots, Robotic System, Mechanics of Robotics (Multidisciplinary Areas in Robotics), Degrees of Freedom of a Joint, Degrees of Freedom of a System, Introduction Manipulator, Classification of Robots, Workspace of Manipulators	4	15
2.	**Sensors and Actuators:** Overview of Sensors in Robotics, Classification of Sensors, Characteristics of Sensors, Overview of Actuators, Types of Actuators (Electric, Pneumatic, Hydraulic)	4	15
3.	**End Effectors and Application of Robots:** Robot End-Effectors, Classification of Grippers, Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications, Economic Analysis	4	15
4.	**Robot Kinematics:** Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation, Denavit-Hartenberg Notations	10	35

5.	**Hydraulic and Pneumatic Systems:** Fluid power control elements and standard graphical symbols, Construction and performance of fluid power generators, Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control, Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations.	6	20

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

1. Gain a comprehensive understanding of fundamental of robotics, classification, and mechanics of robotic systems and manipulators.
2. Analyse and classify different types of sensors and actuators and also their characteristics in robotic systems.
3. Acquire knowledge about different robot end-effectors and the diverse applications of robots across various industries.
4. Understand the principles of robot kinematics and frame transformations.
5. Develop an understanding of fluid power systems, including the construction and operation of hydraulic and pneumatic components, and the design of logic circuits for robotic applications.

List of References:

1. Richaerd D Klafter, Thomas Achmielewski and Mickael Negin, “Robotic Engineering – An integrated Approach” Prentice HallIndia, New Delhi, 2001.
2. Robotics by K.S. Fu, R.C. Gonzalez, C.S.G. Lee, McGraw-Hill Book Company, 1987
3. James A Rehg, “Introduction to Robotics in CIM Systems”, Prentice Hall of India, 2002.
4. Mikell P. Groover, “Automation, Production Systems, and Computer Integrated Manufacturing”, 2nd Edition, John Wiley & sons, Inc, 2007.
5. Deb S R, “Robotics Technology and Flexible Automation”, Tata McGraw Hill, New Delhi, 1994.
6. Introduction to Robotics by J.J. Craig, Addison-Wesley Publishing Company, 1986
7. Hydraulics and Pneumatics by Andrew Parr, JAICO Publishing Home, Ahmedabad

Open e-Resource:

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

List of Suggested Practical:

1. To study and demonstrate various sensors and actuators for robotics system.
2. To study robot applications in various trending fields.
3. To study and demonstrate robotic arm, its configuration and end effectors.
4. Design and assembly of hydraulic / pneumatic circuit.
5. Introduction to Robotic controller card like Arduino UNO board.
6. Interfacing drivers for Arduino Controller for Robotic application
7. To study speed control of stepper motor using microcontroller.

8. To study different methods of speed control of dc Motor.
9. To study forward kinematics of robot.
10. To design obstacle avoidance robot.

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010601	**Subject Title: Applied Thermodynamics**
Pre-requisite: - Zeal to learn the subject	

Course Objective:

- A Mechanical Engineer must have a good understanding of energy conversion in various thermal devices and must understand phenomena occurring in high-speed compressible flow.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Properties of gases and gas mixtures:** Avogadro's law, equation of state, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart, internal energy; enthalpy and specific heat of a gas mixtures	04	7
2.	**Psychrometry:** Dalton's law of partial pressure, Properties of moist air, temperature and humidity measuring instruments, psychrometric chart, psychrometric processes such as sensible heating and cooling, heating and humidification cooling and dehumidification, chemical dehumidification, adiabatic saturation.	08	14
3.	**Refrigerant and Refrigeration cycles:** Classification, nomenclature and desirable properties of refrigerant, secondary refrigerants, ODP and GWP, Compound compression with intercooler, flash gas removal and flash intercooler, Desirable characteristics of refrigerant absorbent pair for vapor absorption cycle, Simple H2O -NH3 cycle, LiBr2 – H2O cycle and its working	08	14
4.	**Fuel Air and Actual Cycles:** Assumptions for fuel–air cycles, reasons for variation of specific heats of gases, change of internal energy and enthalpy during a process with variable specific heats, isentropic expansion with variable specific heats, effect of variable specific heats on Otto, Diesel and Dual cycle, dissociation, comparison of air standard and fuel air cycles, effect of operating variables, comparison of air standard and actual cycles, effect of time loss, heat loss and exhaust loss in petrol and diesel engines,	08	14

5.	**IC engine performance and Emissions**: Measurement of indicated power, brake power, friction power, fuel consumption and emission, calculation of brake thermal efficiency, brake power and brake specific fuel consumption, variable compression ratio engines, heat balance sheet, principal engine emissions, source of engine emissions, emission measurement instruments like five gas analyzer and smoke meter, Euro and Bharat standards of emissions of I.C. Engines, Emission control methods like Air injection, Exhaust gas recirculation, Catalytic converter, Evaporative emissions control	10	18
6.	**Hydraulic Turbines:** Introduction, Classification of turbines, Impulse and reaction turbines, construction, working and performance of Pelton, Francis and Kaplan Turbines, Draft tube, Governing of hydraulic turbines, Cavitation	08	14
7.	**Reciprocating Compressors:** Construction and working, Multistage conditions for minimum work, Intercooling, Efficiency and control of air compressors **Centrifugal Compressors:** Essential parts, Static and total head properties, Velocity diagram, Degree of reaction, surging and choking, Losses in centrifugal compressor **Axial Flow Compressors:** Construction of an axial flow compressor, Aerofoil blading, Lift and drag, Performance characteristics	10	18

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

1. To apply various gas laws of real gas and their mixture, to make use of psychrometric properties to identify basic psychrometric processes
2. To experiment with vapor compression and vapor absorption systems.
3. To explain fuel-air and actual cycles for IC engines and to develop understanding of IC engines testing and their emission norms.
4. Formulate and analyze models of hydraulic components.
5. To demonstrate various air compressors and experiment with them.

List of References:

1. Engineering Thermodynamics by P.K. Nag, McGraw-Hill Education
2. Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd.
3. Internal Combustion Engines by Ganeshan, McGraw-Hill Education
4. Turbines, Compressors and Fans by S.M. Yahya., TMH Publishers
5. Fundamentals of Internal Combustion engine by H.N.Gupta, PHI Learning
6. Internal Combustion Engine Fundamentals by John B. Heywood, McGraw Hill Education Pvt Ltd.

Open e-Resource:

1. https://archive.nptel.ac.in/courses/112/103/112103307/

List of suggested Experiments:

1. To perform different psychrometric processes and analyze the same using psychrometric chart.
2. To determine COP and apparatus dew point of an air conditioning test rig.
3. To determine $(COP)_C$ and $(COP)_H$ of heat pump.
4. To determine saturation efficiency of air cooler/air washer.
5. Performance test of 4 stroke Petrol Engine.
6. Performance test of 4 stroke Diesel Engine.
7. Determination of friction power of multi cylinder petrol engine using Morse Test Method.
8. Performance test on Reciprocating compressor.
9. Performance test on Centrifugal compressor.
10. Test rig of Pelton turbine
11. Test rig of Kaplan turbine
12. Test rig of Francis turbine

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010602	**Subject Title: Advanced Manufacturing Processes**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

1. To Learn the basic concepts advanced manufacturing processes
2. To impart brief knowledge of metal removal rate during different advanced processes and product development processes.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Unconventional Machining Processes:** **Mechanical Energy Based Processes** Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM). Working Principles – equipment used – Process parameters – MRR- Applications. **Electrical Energy Based Processes** Electric Discharge Machining (EDM)- working Principle- equipment used -Process Parameters - Surface Finish and MRR - electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications. **Chemical and Electro-Chemical Energy Based Processes** Chemical machining and Electro - Chemical machining (CHM and ECM) - Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR - Applications. Principles of ECM - equipments-Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications. **Thermal Energy Based Processes** Laser Beam machining and drilling (LBM), Plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications	25	30
2.	**Rapid Prototyping** Introduction Stereo Lithography Systems	10	30

	Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems. Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application **Selective Laser Sintering Fusion Deposition Modelling** Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications. **Solid Ground Curing** Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application. **Concepts Modelers** Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems		
3.	**Glass Science** Glass and Glassy State, Glass Compositions and Properties, Raw Materials, Glass Melting, glass furnace and furnace types, Glass Forming Processes, Glass processing, Application of Glass	5	20
4.	**Composite Materials** Introduction, Classification of composites, Manufacturing methods : Spray Lay-Up, Wet/Hand Lay-up, Vacuum Bagging, Filament Winding, Pultrusion, Resin Transfer Moulding (RTM), Resin Film Infusion (RFI), Mechanical Properties -Stiffness and Strength	5	20

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

1. Illustrate the principles of advanced manufacturing processes.
2. Differentiate various metal removing processes based on surface finish.
3. Select appropriate advanced manufacturing Processes as per raw materials and surface finish.
4. Interpret appropriate advanced material processing techniques for different requirements and applications.
5. Appraise different advance material processing techniques for industry applications.

List of References:

1. Unconventional Machining process, Dr. Senthil, A R S Publishers

2. Modern Machining Processes, P. C. Pandey, H. S. Shan, Tata McGraw-Hill 3. Design for Advanced Manufacturing: Technologies and Processes, LaRoux K. Gillespie, McGraw-Hill Education
3. Advanced Machining Processes / Non Traditional and Hybrid Machining Processes, Hassan El-Hofy,McGraw-Hill
4. The Handbook of Glass Manufacture, F.Tooley, Tooley, New York : Books for Industry, [1974]
5. 3D Printing and Additive Manufacturing: Principles and Applications, Chee Kai Chua and Kah Fai Leong, World Scientific
6. Rapid Prototyping, Adithan M., Atlantic Publisher

Open e-Resource:

http://nptel.ac.in

List of Suggested Experiments:

1. Case Studies/ Brain storming for selection criteria for different manufacturing processes.
2. Case studies for cost estimation of various advanced manufacturing processes.
3. Material study in additive manufacturing process
4. Development of 3D Printed Job
5. Case study of design for advance machining processes.
6. Demonstration of 3D printer and its parts
7. Study on Rapid Prototyping
8. Project based learning for Development of 3D printer
9. Study of Composite material and methods
10. Application based case study of composite material

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010603	**Subject Title: Dynamics of Machinery**
Pre-requisite: - Kinematics & Theory of Machine, Design of Machine Elements	

Course Objective:

The course is designed to give fundamental knowledge of behavior of machines under dynamic Condition, which includes balancing of machines and analysis of mechanical vibration.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Dynamic force analysis of mechanisms:** Introduction, D'alembert's principle, equivalent offset inertia force, dynamic analysis of four link mechanism, dynamic analysis of slider crank mechanism, velocity & acceleration of piston, angular velocity & angular acceleration of connecting rod, engine force analysis, dynamically equivalent system inertia of the connecting rod, inertia force in reciprocating engines.	06	10
2.	**Turning moment diagrams and flywheel:** Turning moment diagram for various type of engines, fluctuation of energy, fluctuation of speed, flywheel, energy stored in flywheel, dimensions of flywheel rims, flywheel in punching presses	06	10
3.	**Balancing:** Introduction, static balancing, dynamic balancing, transference of force from one plane to another plane, balancing of several masses in different planes, force balancing of linkages, balancing of reciprocating mass, balancing of locomotives, Effects of partial balancing in locomotives, secondary balancing, balancing of inline engines, balancing of v-engines, balancing of radial engines, balancing machines.	14	25
4.	**Free vibrations and damped free vibrations**: Types of vibrations, elements constituting vibration, spring mass system, free undamped vibrations, equation of motion, equivalent spring stiffness, free damped vibrations, equation of motion for viscous damper, damping factor, under damped system, critically damped system, over damped	14	25

	system, logarithmic decrement, free torsional vibration of a two and three rotor system, torsionally equivalent shaft, torsional vibration of a geared system.		
5.	**Forced damped vibrations:** Analytical solution of forced damped vibration, vector representation of forced vibrations, Magnification factor, force transmissibility, forced vibration with rotating and reciprocating unbalance, forced vibration due to excitation of support, vibration frequency measurement.	12	22
6.	**Critical speeds of shafts:** Critical speed of shaft carrying single rotor and having no damping, Critical speed of shaft carrying single rotor and having damping, secondary critical speeds in horizontal shafts, critical speed of shaft having multiple rotors.	04	08

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

1. Summarize dynamic forces and equivalent systems in mechanisms.
2. Analyze turning moment and its diagrams of flywheel.
3. Minimize unbalance in mechanical systems by means of static and dynamic balancing.
4. Demonstrate longitudinal vibrations, transverse vibrations and torsional vibrations in single degree of freedom systems.
5. Determine critical speed of the shaft.

List of References:

1. Ratan S. S.,Theory of Machines, Tata McGraw Hill Education.
2. Ambekar A. G., Mechanical Vibrations and Noise Engineering, Prentice Hall of India.
3. Haideri Farazdak , Dynamics of Machinery, Nirali Prakashan.
4. Balaguru S., Dynamics of Machines, , Cengage Learning India Pvt. Ltd.
5. Norton R L, Kinematics and Dynamics of Machinery, McGraw-Hill.
6. Singh Sadhu, Theory of Machines : Kinematics and Dynamics, Pearson

Open e-Resource:

https://archive.nptel.ac.in/courses/112/107/112107212/

List of Suggested Experiments:

1. Static and dynamic balancing of rotating masses.
2. Natural frequency of simple & compound pendulum
3. Natural frequency of spring mass system
4. Natural frequency of rolling surface
5. Torsional vibration system
6. Torsional vibration of rotor system
7. Free damped vibration
8. Whirling of shaft
9. Forced damped vibration
10. Study of Dynamic Forces and Turning Moments in Mechanisms

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010611	**Subject Title: Internal Combustion Engine**
Pre-requisite:- Fundamental of Mechanical Engineering and Engineering Thermodynamics	

Course Objective:

- Provide fundamental knowledge of Internal Combustion Engine.
- Provides students the sufficient knowledge to take active part in design and development work within the automotive industry.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction:** Comparison of SI and CI Engines, Difference in thermodynamic and operating variables, comparison of performance characteristics, comparison of initial and maintenance costs application of SI and CI engine.	4	8%
2.	**Fuels and its supply system for SI and CI engine:** Important qualities of IC engine fuels, rating of fuels**,** Carburetion, mixture requirement for different loads and speeds, simple carburetor and its working, types of carburetors, MPFI, types of injection systems in CI engine, fuel pumps and injectors, types of nozzles, spray formation.	6	12%
3.	**Combustion in SI and CI Engines**: Combustion equations, calculations of air requirement in I C Engine, stoichiometric air fuel ratio, proximate and ultimate analysis, enthalpy of formation, adiabatic flame temperature. Stages of combustion in SI engines, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, combustion chambers for SI engines, Stages of combustion in CI engines, detonation in C.I. engines, factors affecting detonation, controlling detonation, combustion chamber for SI and CI engine	8	20%
4.	**Engine lubrication:** Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems **Engine Cooling:** Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling **Supercharging/Turbo-charging:** Objectives, Limitations, Methods and Types, Different arrangements of turbochargers and superchargers	7	16%

5	**Rating, Testing and Performance:** Measurements of speed, air flow, fuel consumption, indicated power brake power, frictional horse power, and smoke, testing of engines as per Indian Standard 10001, performance test for variable speed I C Engines, heat balance sheet, governing test for constant speed IC engines, effect of fuel injection parameters in CI engines and ignition advance of SI engines on performance of engine. Rating of internal combustion engine based on (I) continuous operation of engine (II) Maximum power an engine can develop (III) Power calculated from empirical formula, Trouble Shooting and Overhauling of Engines.	8	20%
6	**Emission of IC engine:** Emission from SI engine, effect of engine maintenance on exhaust emission control of SI engine, diesel emission, diesel smoke and control, diesel and control comparison of gasoline and diesel emission. Measurement and calculation for of emission constituents.	6	12%
7	**Unconventional Engines &Alternative Fuels for IC Engine:** Working principle of stratified charge engines sterling engine, Wankel engine Methanol, Ethanol, vegetable oils, biogas, biofuels, hydrogen and comparison of their properties with Diesel and petrol.	6	12%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**30**	**30**	**10**	**0**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of Experiments:

1. To demonstrate various engines and their components.
2. Demonstration of valve timing diagram
3. To demonstrate about the fuel injection system for C.I. Engine
4. To demonstrate about carburetor and its types.
5. To carry out the performance analysis of single cylinder two stroke petrol engine.
6. To carry out the performance analysis of multi cylinder four stroke petrol engine.
7. To carry out the performance analysis of multi cylinder four stroke diesel engine.
8. To carry out various Performance tests: Morse Test and William Line Plot

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

1. Describe and explain the major phenomena going on in an internal combustion engine such as gas exchange, combustion and emissions formation/reduction.
2. Explain the performance and evaluation of internal combustion engine and to discuss how this is affected.

3. Reflect on the role of internal combustion engines for transports in society as well as the emissions issue from both a sustainable and ethical perspective.
4. To aware about the alternative fuels and their properties.
5. To brief the latest development of unconventional engines.

List of References:

1. I. C. Engines by Heywood.
2. I. C. Engines by Mathur& Sharma, Dhanpatrai
3. I. C. Engines by V.Ganeshan, Tata McGraw Hill
4. I. C. Engines by Domkundwar&Domkundwar, Dhanpatrai
5. I. C. Engines by R.K.Rajput, LaxmiPrakashan

Open e-Resource: https://nptel.ac.in/course.php

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010612	Subject Title: Automation in Manufacturing
Pre-requisite: - Zeal to learn the subject	

Course Objective:

The aim of the present course is to introduce the students about the basic automation process and understanding of its devices. Students can get innovative idea of shop floor automation. This subject is useful to understand the different types of automation and production systems used in industries.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction:** Automation and types, Automated Manufacturing System, Reasons for Automating, the USA Principle, Strategies for automation and process improvement, automation migration strategies, levels of automations, Types of Automations.	4	8
2.	**Group Technology:** Part family, Part classification and coding, production flow analysis – OPITZ classification system, cellular manufacturing, quantitative analysis in cellular manufacturing. Rank Order Clustering Technique (ROC), Holier Method –I,II, Single Linkage Cluster Analysis Technique(SLCA). Application of group technology	10	22
3.	**Flexible Manufacturing Systems:** Types of flexibility, types of FMS, FMS components, FMS Components-Workstations, Material Handling and Storage Systems, Computer Control System, Human Recourses, FMS Applications and Benefits., Quantitative analysis of FMS, Sizing the FMS, System performance measure. Automated Material Handling & Storage: Functions, Types, Analysis of material handling equipment, Design of Conveyor & AGV systems. Problems. Development for total material handling system.	10	22
4	**Industrial Robotics and Mechatronics System:** Introduction, Robot Anatomy and Related Attributes, Robot Control Systems, Industrial Robot Applications, Robot Programming overview. Transducers, Selection Criteria, Signal Conditioning, Calibration.	6	14

5	**Automated Machinery:** Introductions, Automated transfer machine, automated transfer line, auto-storage and retrieval system, automated guided vehicles, automated material handling system, automated inspection system and CMM.	6	14
6	**Modular Automation Design:** Introduction to modular design, modular automations, Case study for modular design: 1. Casting shop design, 2. Press working shop design, 3. Machine shop design.	4	8
7	**Automation Economy:** Plant Economy, feasibility of automation on economical sense, effect of automation on economy, feasibility of automation in Indian market, Scope of automation in Indian industries, Break Even point analysis for automation.	5	12

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

1. Overall understanding of automated systems integration using CIM.
2. Identify scope of automation in shop floor: Casting, Machine shop and Press work.
3. Understand working of different sensors and actuator and find application for industrial automation.
4. Design small automated system.
5. Application of group technology and FMS.

List of References:

1. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover, P.H.I. Learning Private Limited.
2. Industrial Automation and Robotics by Er. A. K. Gupta and S. K. Arora, University Science Press, Laxmi Publishing Pvt. Ltd.
3. Robotics and Control by R. K. Mittal and I. J. Nagrath, McGraw Hill Education (India) Private Limited.
4. Flexible Manufacturing Cells and System -William. W. Luggen Hall, England Cliffs, Newjersy.
5. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill.

Open e-Resource:

1. https://archive.nptel.ac.in/courses/112/104/112104289/

List of Suggested Experiments:

1. To study the fundamentals of automation and its types.
2. Problems on GT and Industrial case problems on coding.
3. Study of Flexible Manufacturing System.
4. Study and report on micro controller and its application.
6. Study and report on Industrial Robotics: Sensors and Actuators.
7. Study and report on Different Automated Machinery.
8. Study and report on Modular Automation System: Casting shop, Machine shop, Press Shop.
9. Study and report on Economic analysis of Automation.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010613	Subject Title: Computer Aided Design
Pre-requisite:- Zeal to learn the subject	

Course Objective:

Computers have become inevitable in today era and find their application in various stages of product development. This course intends to introduce students to use of computers in the phases of product design viz. conceptualization, geometric modeling, graphical representation, and finite element analysis.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction:** A typical product cycle, CAD tools for the design process of product cycle, CAD / CAM system evaluation criteria, Input / Output devices; Graphics Displays: Refresh display, DVST, Raster display, pixel value and lookup table, estimation of graphical memory, LCD, LED fundamentals. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System, Screen Coordinate System. Line and Curve generation algorithm: DDA, Bresenham's algorithms. Graphics exchange standards and Database management systems.	4	9
2.	**Curves and Surfaces:** Parametric representation of lines: Locating a point on a line, parallel lines, perpendicular lines, distance of a point, Intersection of lines. Parametric representation of circle, Ellipse, parabola and hyperbola. Synthetic Curves: Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines and NURBS. Various types of surfaces along with their typical applications.	6	13
3.	**Mathematical representation of solids:** Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations. Schemes: B-rep, CSG, Sweep representation, ASM, Primitive instancing, Cell Decomposition and Octree encoding.	6	13

4.	**Geometric Transformations:** Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D; Orthographic and perspective projections. Window to View-port transformation. .	10	21
5.	**Finite Element Analysis:** Review of stress-strain relation and generalized Hooke's Law, Plane stress and Plane strain conditions; Concept of Total Potential Energy; Basic procedure for solving a problem using Finite Element Analysis. 1-D Analysis: Concept of Shape function and natural coordinates, strain - displacement matrix, derivation of stiffness matrix for structural problems, properties of stiffness matrix. 1-D structural problems with elimination and penalty approaches, 1-D thermal and fluid problems. Trusses and Beams: Formulation of stiffness matrix, simple truss problems to find displacement, reaction, and stresses in truss members. Structural analysis using Euler- Bernoulli beam element.	20	44

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

1. Demonstrate basic concept of computer aided design and its applications,
2. Understand the parametric representation of various entities of design,
3. Make use of various concepts and characteristics in geometric modeling,
4. Analyze geometric transformations,
5. Determine stress and strain in structural elements through FEA.

List of References:

1. CAD/CAM: Theory & Practice, by Ibrahim Zaied, Tata McGraw Hill.
2. Computer Graphics, by Hearn E J and Baker M P, Pearson.
3. Introduction to Finite Elements in Engineering, by Chandrupatla T A and Belegundu A D, PHI.
4. A First Course in the Finite Element Method, By Logan D, Cengage.
5. Mathematical Elements for Computer Graphics, by David F. Rogers and J. Alan Adams, Tata McGraw Hill**.**

Open e-Resource:

1. https://nptel.ac.in/courses/112102101
2. http://help.autodesk.com/view/fusion360/ENU/
3. https://academy.autodesk.com/curriculum/introduction-cad-and-cae
4. https://www.youtube.com/watch?v=XmBNKNIz0rY
5. https://www.youtube.com/watch?v=DmWHKkBnw6o

List of Suggested Experiments:

1. Prepare a programme for plotting lines and curves using algorithms learned.
2. Introductory exercise for 3-D modelling.
3. Exercise for advanced 3-D modelling.
4. Exercise for 3-D editing options.
5. Exercise for Assembly modelling.
6. Exercise for FEA of 1-D structural problems.
7. Exercise for FEA of trusses.
8. Exercise for FEA using Beam Element.
9. Exercise for FEA of 1-D thermal problems.
10. Exercise for FEA of 2-D structural problems.

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Semester 6

Subject Code: 10010621	Subject Title: Energy Conservation & Management
Pre-requisite:- Zeal to learn the subject	

Course Objective:

- To provide detailed understanding of energy conservation and management, 3Es (Energy, Economics and Environment) and their interaction
- To aware about energy audit and importance of financial management.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	1	0	4	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Energy Scenario:** Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future. **Energy Conservation Act 2001 and related policies:** Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction.	06	13
2.	**Energy Management & Audit:-** Definition, energy audit, need, types of energy audit. Energy management (audit) approach- understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering.	06	14
3.	**Financial Management:-** Investment-need, appraisal and criteria, financial analysis techniques simple payback period, return on investment, net present value, internal rate of	06	13

	return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs).		
4.	**Energy Monitoring and Targeting:-** Defining monitoring & targeting, elements of monitoring & targeting, data and information analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM), Energy Management Information Systems (EMIS).	04	9
5.	**Energy Efficiency in Thermal Utilities and systems:-** **Boilers:** Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation. **Steam System:** Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment of steam system, thermo-compressor, steam pipe insulation, condensate pumping, steam dryers. **Furnaces:** Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery. Forging furnace heat balance, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace. **Insulation and Refractories:** Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation. **Heat Exchangers:** Types, networking, pinch analysis, multiple effect evaporators, condensers, distillation column, etc. **Waste Heat Recovery:** Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential. **Cogeneration:** Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine. Heating, ventilation, air conditioning (HVAC) and **Refrigeration System:** Factors affecting Refrigeration and Air conditioning system performance and savings Opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, and performance assessment of window and split room air conditioners and star labels	19	42
6.	**Energy and environment, air pollution, climate change:** United Nations Framework Convention on Climate Change (UNFCC),sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).	04	9

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

1. To summarized the energy conservation scenario, energy and environment, air pollution, climate change, and various acts and policy for the energy conservation
2. To infer the concept of financial management, energy monitoring and targeting.
3. To apply the knowledge of energy audit for the energy management and operation of energy audit instruments.
4. To analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.
5. To evaluate the net present worth in financial management and performance assessment of various thermal utilities and systems.

List of References:

1. Energy Engineering and Management, Amlan Chakrabarti Prentice hall India 2011
2. Energy Management Principles, CB Smith, Pergamon Press, New York,
3. Bureau of energy efficiency –Handouts New Delhi
4. Energy Management Hand Book. W. C. Turner.John Wiley and sons
5. Handbook on Energy Efficiency, TERI, New Delhi, 2009
6. Energy Auditing and Conservation; Methods, Measurements, Management & Case Study, Hamies, Hemisphere Publishing, Washington, 1980.

Open e-Resource:

1. https://nptel.ac.in/courses/112105221

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010622	Subject Title: Industry 4.0 - Internet of Things
Pre-requisite: - Zeal to learn the subject	

Course Objective:

IoT will change industries and transform the way we work and live. Industrial companies are already pivoting from Products to Services leveraging IoT technologies – this digital transformation is more broadly called the Industrial IoT or Industrial Internet. The objective of this subject is make students aware about this latest technology, its application and to identify future scope for better manufacturing system.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	1	0	4	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Industry 4.0:** Introduction, core idea of Industry 4.0, origin concept of industry 4.0, Industry 4.0 production system, current state of industry 4.0, Technologies, How is India preparing for Industry 4.0	6	15%
2.	**A Conceptual Framework for Industry 4.0:** Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0. Proposed Framework for Technology Roadmap, Strategy Phase, Strategy Phase, New Product and Process Development Phase.	7	20%
3.	**Advances in Robotics in the Era of Industry 4.0:** Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly. Introduction, AR Hardware and Software Technology, Industrial Applications of AR.	7	20%
4.	**Understanding Industrial Internet of Things (IIoT):** Industrial Internet of Things and Cyber Manufacturing Systems, Application map for Industrial Cyber Physical Systems, Cyber Physical Electronics production. Modeling of Cyber Physical Engineering and manufacturing, Model based engineering of supervisory controllers for cyber physical systems, formal verification of system, components, Evaluation model for assessments of cyber physical production systems.	8	20%

5.	**Architectural Design Patterns for CMS and IIoT:** CPS-based manufacturing and Industries 4.0., Integration of Knowledge base data base and machine vision, Interoperability in Smart Automation, Enhancing Resiliency in Production Facilities through CPS. Communication and Networking of IIoT.	7	15%
6.	**Application of Industry 4.0 - Internet of Things:** Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIOT in Manufacturing Sector.	7	20%

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

1. Describe Industry 4.0 and scope for Indian Industry.
2. Demonstrate conceptual framework and road map of Industry 4.0
3. Describe Robotic technology and Augmented reality for Industry 4.0
4. Describe Industrial Internet of Things and Cyber Physical manufacturing
5. Demonstrate Cyber Physical and Cyber Manufacturing systems
6. Describe Architectural design patterns for industrial Internet of Things
7. Analyse AI and data Analytics for Industrial Internet of Things
8. Evaluation of Workforce and Human Machine Interaction and Application of Industrial Internet of Things

List of References:

1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".
5. Sabina Jeschke, Christian Brecher Houbing Song , Danda B. Rawat Editors Industrial Internet of Things Cyber Manufacturing Systems
6. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Willy Publications Olivier Hersent, David Boswarthick, Omar Elloumi,
7. The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
8. Inside the Internet of Things (IoT), Deloitte University Press
9. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series
10. Five thoughts from the Father of the Internet of Things; by Phil Wainewright - Kevin Ashton
11. How Protocol Conversion Addresses IIoT Challenges: White Paper By RedLion.
12. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014

Open e-Resource:

1. www.nptel.ac.in/

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 6

Subject Code: 10010623	**Subject Title: Industrial Engineering**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

- To prepare students to understand different aspects like: Plant location and its selection, Plant layout within the plant.
- To understand and apply different concept of production planning and control.
- Study of productivity and Work-study are important tools, after studying it student are able to apply it in the industry for productivity improvement.
- This course gives idea about how to prepare job plan, and also gives knowledge of industrial legislation.
- To aware student about Statistical quality control, entrepreneurship, and waste management.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	1	0	4	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Location Selection and Plant Layout:** Nature of Location Decision, Importance of Plant Location, Dynamic Nature of Plant Location, Choice of site for selection, Comparison of location. Principles of Plant layout and Types, factors affecting layout, methods, factors governing flow pattern, travel chart, analytical tools of plant layout, layout of manufacturing shop floor, repair shop, services sectors and process plant. Quantitative methods of Plant layout: CRAFT and CORELAP, Relationship diagrams.	08	18%
2.	**Production Planning and Control:** Types of Production systems and their Characteristics, functions, and objectives of Production Planning and Control, Sales forecasting: Techniques and Applications, Steps of Production Planning and Control: Process planning, Loading, Scheduling, Dispatching and Expediting with illustrative examples, Introduction to line of balance, assembly line balancing, and progress control.	06	13%

3.	**Productivity and Work Study:** Definition of productivity, application and advantages of productivity improvement tools, reasons for increase and decreases in productivity. Areas of application of work study in industry. Reaction of management and labour to work study. **Method Study:** Objectives and procedure for methods analysis, Recording techniques, Operations Process Chart, Flow Process Chart, Man-Machine , Multiple Activity Chart, Travel Chart, and Two Handed process chart, String Diagram, Therbligs. **Micro motion and macro-motion study**: Principles of motion economy, Normal work areas and workplace design. **Work Measurement:** Objectives, Work measurement techniques – time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, and standard time. Introduction to ergonomics.	08	18%
4.	**Job Evaluation and Wage Plan:** Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans	04	9%
5.	**Industrial Legislation:** Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, Employees provident fund scheme 1952.	04	9%
6.	**Entrepreneurship:** Concept, product identification, infrastructure facilities, preparation of project report, sources of industrial finance, Resources allocation, Government incentives to entrepreneurs.	04	9%
7.	**Inspection and Quality Control:** Inspection – functions, types, objectives and benefits, quality control principles, Concepts of quality circles, Total quality management, Quality assurance, Quality audit, Basic Concept ISO 9000, ISO 14000 and QS 9000, Six sigma: Concept, Principle, Methodology, Scope, Advantage and limitations. **Statistical Quality Control:** SQC Concept, variable and attributes, normal distribution curves and its property charts for variable and attributes and their applications and interpretation (analysis) process capability. Acceptance sampling, sampling plans, OC curves and AOQ curves.	08	18%
8.	**Waste Management:** Introduction and Meaning, Reasons for generation and accumulation of obsolete, Surplus and scrap Items, Identification and control of waste, disposal of scrap.	03	6%

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

1. Describe location decision, Site selection and Plant layout.
2. Demonstrate Production Planning and Control.
3. Analyse Productivity, Work study techniques, Job evaluation and Wage plan.
4. Illustrate Statistical Quality Control and Inspection.
5. Understand Industrial Legislation and Entrepreneurship and waste management.

List of References:

1. Work study by International Labour Organization, ILO
2. Manufacturing Organization and Management, Harold Amrine, John Ritchey, Moodie, Kmec, 6th Ed., Pearson
3. Industrial Engineering and Management, by Praveenkumar, Pearson
4. Production System, Planning, Analysis and Control – By J.L. Riggs 3rd ed. Wiley
5. Production and Operations Management – By R. Panneerselvam, PHI Private Ltd.,
6. Production and Operations management by S Anilkumar, Suresh, New Age International

Open e-Resource:

1. https://archive.nptel.ac.in/courses/112/107/112107143/#

2. https://archive.nptel.ac.in/courses/112/107/112107292/

List of Suggested Tutorials:

1. Case study demonstration on location decision and site selection
2. Tutorials on Production Planning and Control
3. Case study on plant layout problem
4. Exercise on OPC, FPC, Travel chart
5. Exercise on Method study, Motion Study and work measurement
6. Problems on wage and incentive plans
7. Exercise on statistical quality control techniques
8. Case study analysis of Entrepreneurship
9. Exercise on Waste management

GANDHINAGAR UNIVERSITY

Gandhinagar Institute of Technology

B.Tech. Mechanical Engineering

Semester 7

Subject Code : 10010701	**Subject Title : Power Plant Engineering**
Prerequisite : Engineering Thermodynamics and Heat Transfer	

Course Objective :

Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance and to address the underlying concepts, methods and application of different Thermal Power Plants.

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	70	30	0	0	100

Subject Content			
Sr No	**Topic**	**Total Hours**	**Weight (%)**
1	**Coal Based Thermal Power Plant:** Layout of modern coal power plant, site selection criteria, Rankine cycle and its improvisations, Supercritical Pressure Boilers, FBC Boilers, Steam Nozzles, Steam Turbines, Steam Condensers, Cooling Towers, Steam & Heat rate **Combined Cycle Power Plant:** Binary Cycles and Cogeneration systems. Subsystems of thermal power plants – Draught system, Fuel and ash handling, Feed water treatment.	14	30
2	**Gas Turbine Power Plant:** Classification, Open and closed cycle, Gas turbine fuels, Actual Brayton cycle, Optimum pressure ratio for maximum thermal efficiency, Work ratio, Air rate, Effect of operating variables on the thermal efficiency and work, Cooling of gas turbine blade, Combined steam and gas turbine plant.	10	22
3	**Nuclear Power Plant:** Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors, Brief	08	18

	about the Nuclear program in India, Safety measures for Nuclear Power plants.		
4	**Power from Renewable Energy:** HydroElectric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photovoltaic (SPV), Solar Thermal, GeoThermal and Fuel Cell power systems.	08	18
5	**Energy, Economic and Environmental issues of Power plants:** Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.	05	12

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

1. Explain the layout, construction and working of the components of thermal, Diesel, Gas and Combined cycle power plants.
2. Explain the layout, construction and working of the components of Nuclear power plants.
3. Explain the layout, construction and working of the components of Renewable Energy power plants.
4. Explain the applications of power plants while extending their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

List of References:

1. Power Plant Engineering, P.K. Nag, McGraw-Hill Education
2. Power Plant Technology, M.M. El-Wakil, McGraw-Hill Education
3. Thermal Engineering, R.K.Rajput, Laxmi Publication
4. Gas Turbines by V.Ganeshan, McGraw Hill Education
5. Steam Turbine Theory and Practice, William J. Kearton, CBS Publication

List of Open Source Software / Learning website:

1. http://nptel.ac.in/
2. http://npti.in/default.aspx

Industrial Visit:

It is strongly suggested and recommended to arrange a visit to Thermal Power Plant / Hydro Power Plant / Nuclear Power Plant / Solar Power Plant.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 7

Subject Code: 10010702	**Subject Title: Advance Machine Design**
Pre-requisite: Fundamental of Machine Design, Kinematics and Theory of Machines, Design of Machine Elements	

Course Objective:
(1) Understand and apply design principles for gears, gearboxes, and bearings.
(2) Analyze and design IC engine and material handling components.
(3) Apply engineering concepts for safe and efficient mechanical design.

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	70	30	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Gear Design:** Classification of gears, Selection of type of gears, Standard system of gear tooth, Force analysis, Gear tooth failures, selection of material, Beam strength of gear tooth, Wear strength of gear tooth, Design of spur gear, helical gear, bevel gear, worm gear.	11	20
2.	**Design of Gear Box for Machine Tools:** Introduction, Determination of variable speed range, Structure formula, Structure diagram, Ray and Speed diagram, Rules and guidelines or gear box layout, Procedure for designing multi – speed gear box.	5	10
3.	**Journal Bearings:** Introduction, Classification of bearings, Journal bearing types, types of lubrication, Thin and thick film lubrication, Hydrodynamic Bearing, Term used	6	18

	in hydrodynamic bearing, Mckee's investigation, Design procedure of journal bearing, bearing materials, bearing failures.		
4.	**Rolling Contact Bearings:** Classification, Static load carrying capacity, Dynamic load carrying capacity, Equivalent bearing load, Load-Life relation, Selection of bearing life, Design for cyclic loads and speeds, Bearing with probability of survival other than 90%, Bearing failure, Lubrication of rolling contact bearing.	5	16
5.	**IC Engine Components:** Design of cylinder and Cylinder head, Design of piston, Design of connecting rod, crankshaft.	9	20
6.	**Design of Cranes:** Introduction, Basic objectives of material handling system, Types of load, Classification and application of various Material handling equipment, Basic principles in selection of material handling system, Classification of cranes, Wire rope design.	8	16

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

1. Design various types of gears considering strength, material selection, and failure modes.
2. Develop multi-speed gearboxes using diagrams and layout principles.
3. Design journal and rolling contact bearings based on load, lubrication, and failure analysis.
4. Design IC engine components and crane systems with emphasis on strength and functionality

List of Reference Books:

1. Sighley J. E., Mechanical Engineering Design, Tata McGraw Hill Education.
2. Bhandari V. B., Design of Machine Elements, Tata McGraw Hill Education.
3. Sharma P. C. and Aggarwal D. K., A Textbook of Machine Design, S K Kataria & sons.
4. Norton. R. L., Design of Machinery, Tata McGraw Hill Education.
5. Juvinall R. C, Fundamentals of Machine Component Design, John Wiley & Sons.
6. Kannaiah P., Machine design by, Scitech Publication.

Open e-Resource:

1. https://archive.nptel.ac.in/courses/112/106/112106137/

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Bachelor of Technology – Civil/Mechanical/Robotics & Automation/ Electrical/ Electronics & Communication

Subject Code: 10010703	**Subject Title:** Minor Project
Pre-requisite: --	

Course Objective:

- To introduce students to the process of identifying and defining research or design-based engineering problems relevant to industry or society.
- To develop the students' ability to conduct literature reviews, formulate objectives, and propose appropriate methodologies under faculty guidance.

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	12	06	0	0	80	20	100

Selection of project topic:

- The project topic must be selected in consultation with a faculty mentor and finalized only upon their approval.
- Topics should reflect the student's area of interest, and align with departmental research areas or industrial challenges.
- Projects may involve:
  - Literature surveys
  - Conceptual designs
  - Feasibility studies
  - Initial computational models
  - Simulation frameworks
  - Field surveys or data collection

Evaluation:

Criteria	**Weightage**
Regularity and Timely Submission (Continuous Assessment)	20 Marks
Problem Identification and Literature Review	15 Marks
Methodology Framing and Technical Content	25 Marks
Quality of Report (Structure, Referencing, etc.)	20 Marks
Oral Presentation and Communication Skills	20 Marks

GANDHINAGAR UNIVERSITY

Course Outcomes:

- Identify and define an engineering problem relevant to industry or societal needs.
- Conduct a comprehensive literature review using credible academic sources.
- Formulate clear objectives and propose feasible methodologies.
- Initiate technical work through conceptual design, analysis, or modeling.
- Communicate ideas effectively through presentations and technical reports.
- Work independently and collaboratively with ethical responsibility.

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Bachelor of Technology – Civil/Mechanical/Robotics & Automation/ Electrical/ Electronics & Communication

Subject Code: 10010704	**Subject Title:** Summer Internship
Pre-requisite: --	

Course Objective:

1. To provide students with exposure to industry practices and enhance practical knowledge.
2. To develop real-time technical and managerial skills through practical assignments.
3. To cultivate experience in project/report writing, technical presentations, and industry ethics.
4. To understand the impact of engineering solutions within societal and economic contexts.

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	0	1	0	0	0	50	50

Types of Internships:

1. **Offline Internship in Industry**:
   Students will be assigned to industry sectors where they will complete tasks under the guidance of an industry mentor. The completion of this internship requires submission of a joining and relieving letter from the respective organization.
2. **Online Internship**:
   Students may participate in approved online internship programs, facilitated through platforms like Internshala or other AICTE-recognized bodies.
3. **Mini-Project**:
   A hands-on mini-project related to the student's branch of study. This can be a fabrication, experimental analysis, simulation, or design/analysis of systems, and must be carried out individually by the student.

Internship Report and Evaluation:

- **Report Submission**:

A detailed report on the internship must be prepared and submitted by the student. The report will be evaluated by both the internal mentor (faculty) and an external industry mentor.

- **Continuous Evaluation – 50 Marks**

The evaluation will be based on continuous assessment throughout the internship. Both the internal mentor and external industry mentor will evaluate the student's performance on a continuous basis.

1. Internship Regularity & Task Performance (20 marks):

This includes the student's attendance, regularity, task completion, and proactive engagement in the assigned tasks. The internal mentor tracks the student's consistency, work ethics, and ability to carry out the tasks effectively.

2. Adequacy & Quality of Work (15 marks):

Evaluation of the quality, depth, and relevance of the tasks completed during the internship. This includes the execution of assigned tasks and how well the objectives of the internship were met.

3. **Tools & Techniques Used (5 marks):**

Assessment of the methods, tools, and techniques the student employed during the internship. The student will be evaluated on how effectively they used these tools to complete the work assigned by the industry mentor.

4. **Report Quality & Presentation (10 marks):**

The clarity, technical depth, and overall quality of the internship report. The presentation includes the student's ability to clearly and effectively communicate their work and findings.

Report Submission and Documentation:

- Internship report signed by both the internal and external mentors.
- Softcopy of the internship presentation approved by both mentors.
- A CD containing scanned copies of the report and presentation for departmental record.

Steps for Internship Completion:

- **Joining Report Submission**:

Upon joining the internship, students must submit a joining report to the institute.

- **Continuous Assessment**:

Students will be continuously assessed throughout the internship on their regularity, task performance, and the quality of their work and report.

- **Midterm Evaluation**:

The internal mentor will evaluate the student's progress midway through the internship.

- **Final Report Submission**:

After completing the internship, students will submit the final report for evaluation.

- **Training Certificate:**

Students must obtain a completion certificate from the industry, verifying their participation and successful completion of the internship.

Course Outcome:

Upon successful completion, students will have gained exposure to real-world industrial practices and developed technical skills to apply in future career opportunities.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 7

Subject Code: 10010711	Subject Title: Computer Integrated Manufacturing
Pre-requisite:- Zeal to learn the subject	

Course Objective: Now days, Computer integrated manufacturing system are widely used in industries. This course develops capability in students to demonstrate and use of CIM in fabrication industry. Students can demonstrate and use automated assembly lines, group technology, Flexible manufacturing system for welding, material handling and identification technology. Students can utilize various automated inspection system / instruments in fabrication industries. Students can prepare planning and scheduling of process equipment fabrication using CALL software.

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	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to CIM:** Concepts of Computer Integrated Manufacturing, Nature and type of manufacturing system, Evolution, Benefits of CIM	04	15%
2.	**NC/CNC Machine Tools:** Numerical Controls, Types, Evolution of Controllers, Components of NC/CNC system, Specification of CNC system. Classification of NC/CNC machines, Transduces used, salient features, Tape, Tape codes and Tape readers used in NC machnes, constructional details of CNC machines, Axis designation, NC/CNC tooling. Fundamentals of Part programming, Types of formats, Part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric subroutines Programmable Logical Controller (PLC), Automated Programmable tool, Language – its types of statement, command and programming	09	30%
3.	**Group Technology** Introduction, part families, part classification and coding systems, Machining Cells, Benefits of group technology	02	10%
4.	**Flexible Manufacturing System:** Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages of FMS. Automated material handling system and AS/RS,	06	15%

	AGVC, RGV, Manufacturing Cells, Cellular and Flexible manufacturing, JIT & amp, GT applied to FMS, FMC and FMS, Tool Management, Tool supply system, Tool Monitoring system, Work Piece handling, Flexible fixturing, Flexible assembly system, Flexibility. FMS scheduling, FMS layout and essentials		
5.	**Robot Technology:** Introduction, Industrial Robots, Robot physical configuration, Basic robot, motions, Robotic power sources, Sensors, Actuators, Transduces and Grippers. Technical features such as a work volume, precision of movement speed of movement, weight carrying capacity, programming of robot, Introduction to robot language, End erectors, work cell control and interlocks, robot applications and economics, intelligent robots, interfacing of a vision system with robot.	07	15%
6.	**CIM Advances:** Role of management in CIM, Expert system and participate management, Impact of CIM on personnel, Role of Manufacturing engineers, CIM Wheel	07	15%
7.	**Computer Aided Production Management:** Introduction, PPC fundamentals, Problems with traditional PPC, Use of computer in PPC such as CAPP, MRPI, MRPII, CAGC etc.	07	15%

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

1. Illustrate Computer Aided Manufacturing with NC, CNC and PLC technology for Industry
2. Describe the Group Technology and Computer Aided Process Planning
3. Describe Flexible Manufacturing System with tools and equipment's
4. Describe Robot technology for Computer Aided Manufacturing system.
5. Demonstrate Integrated Production Management system

List of References:

1. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education.
2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P Groover, Pearson Education.
3. Robotics Technology and Flexible Automation, by S R Deb, S Deb, McGraw Hill Education Private Limited.
4. Flexible Manufacturing Cells and System -William. W. Luggen Hall, England Cliffs, Newjersy.
5. P.Radhakrishnan, "Computer Numerical Control ", New Central Book Agency, 1992.
6. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India.
7. System Approach to Computer Integrated Manufacturing. Nanua Singh, Wiley and sons Inc, 1996.
8. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993.
9. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010.
10. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007.

Open e-Resource:

1. www.nptel.ac.in
2. Videos on CNC programming, PLC, Robotics and FMS

List of Suggested Experiments:

1. Study of Computer Integrated System: Basics, Types of Manufacturing, role of management and CIM wheel
2. NC/CNC technology: Definition, Classification, Specification, Construction details, Sensors and Actuators, and different controllers.
3. CNC part Programming: Lathe and Milling jobs
4. Exercise on PLC for Simple problems.
5. Problems on GT and Industrial case problems on coding
6. Problems on CAPP and Industrial case problems
7. Study of Flexible Manufacturing system
8. Study of Robotics Technology
9. Study of Expert System in Manufacturing and MIS

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 7

Subject Code: 10010712	**Subject Title: Refrigeration and Air Conditioning**
Pre-requisite:- Zeal to learn the subject	

Rationale: The course is designed to give fundamental knowledge of types of refrigeration, refrigeration cycles, refrigerants and behavior under various conditions, different air conditioning terms and load calculation, designing of components of air distribution system.

Teaching and Examination Scheme:

Teaching Scheme Hours per week)				Evaluation Scheme (Marks)						Total Marks
				Theory			Practical			
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment		University Assessment		Continuous Assessment	
3	0	2	4	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction**: Brief history and need of refrigeration and air conditioning, methods of producing cooling, ton of refrigeration, coefficient of performance, types and application of refrigeration and air condensing systems.	2	3
2	**Refrigerants:** Classification, nomenclature, desirable properties, secondary refrigerants, future industrial refrigerants	2	4
3	**Air refrigeration:** Reversed Carnot cycle and its limitation, Bell-Coleman cycle, aircraft refrigeration, working and analysis of Simple; Bootstrap; Reduced ambient and Regenerative air refrigeration systems	4	8
4	**Vapour Compression system:** Simple system on P-h and T-s diagrams, analysis of the simple cycle, factors affecting the performance of the cycle, actual cycle **Compound Compression System:** Compound compression with intercooler, flash gas removal and flash intercooler, multiple evaporators with back pressure valves and with multiple expansion valves without flash inter cooling, analysis of two evaporators with flash intercooler and individual expansion valve and multiple expansion valve, cascade refrigeration system	7	16
5	**Absorption refrigeration system:** Desirable characteristics of refrigerant, selection of pair, practical H_2O -NH_3 cycle, LiBr – H_2O system and its working, h-x diagram and simple calculation of various process like adiabatic mixing and mixing with heat transfer, throttling, Electrolux refrigeration system*	3	8
6	**Refrigeration system components:** Types; construction; working; comparison and selection of compressors*; condensers; expansion devices; and evaporators, refrigeration piping accessories*, evacuation and charging of refrigerant*, properties and classification of thermal insulation	5	12
7	**Psychrometry:** Dalton's law of partial pressure, Properties of moist air, temperature and humidity measuring instruments, psychrometric chart, psychrometric processes such as sensible heating and cooling, heating and humidification cooling and dehumidification, chemical dehumidification, adiabatic saturation	5	13
8	**Human comfort:** Selection of inside design conditions, thermal comfort, heat balance equation for a human being, factors affecting thermal comfort, Effective temperature, comfort chart and factors governing effective temperature, selection of outside design conditions	1	3

9	**Load analysis:** Site survey, outdoor and indoor design conditions, classification	6	15
	of loads, flywheel effect of building material and its use in design, effect of wall construction on cooling load, instantaneous heat gain (IHG) and instantaneous cooling load (ICL) heat transmission through sunlit and shaded glass using tables, method of reduction of solar heat gain through glass, calculations of cooling load TETD due to sunlit and shaded roof and walls using tables, ventilation and air infiltration, load due to outside air, heat gain from occupants; electric lights; product; electric motor and appliances, load calculations for automobiles, use of load estimation sheet*, introduction of CLTD method		
10	**Duct design and air distribution:** Function; classification and economic factors influencing duct layout, equal friction method of duct design, use of friction chart, dynamic losses and its determination, Requirements of air distribution system, air distribution, grills, outlets, application, location	4	10
11	**Air-conditioning systems:** Classification, system components, all air; all water; and air-water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems	3	8

* To be covered in practical sessions only.

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**15**	**10**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd.
2. Refrigeration and Air-conditioning by Ramesh Arora , Prentice Hall of India
3. Refrigeration and Air Conditioning by Manohar Prasad, New Age International Publisher
4. Principles of Refrigeration by Roy. J Dossat, Pearson Education
5. Refrigeration and Air Conditioning by Jordon and Prister, Prentice Hall of India Pvt. Ltd.
6. Refrigeration and Air Conditioning by W.F. Stocker and J. W. Jones, McGraw-Hill
7. Refrigeration and Air Conditioning by Ameen Ahmadul, PHI India
8. Automobile Air conditioning by Crouse and Anglin, McGraw Hill Publications

Course Outcome:

After learning the course the students should be able to:

- Understand the basic concepts of refrigeration and air conditioning systems
- Understand and analysis of various refrigeration cycles
- Make basic calculation of psychometric properties and process
- Do basic calculations of heating and cooling load requirements of a room.
- Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to refrigeration and air conditioning.

List of laboratory experiments: (Any 10 of the following experiments to be performed)

1. To understand different components of VCR system and to determine its COP
2. To understand working of Electrolux refrigerator and to determine its COP.
3. To understand construction and working of reciprocating, rotary and centrifugal compressor used for R&AC.
4. To understand various tools used for refrigeration tubing and and to perform various operations like flaring, swaging, bending, brazing etc.
5. To perform different psychrometric processes and analyze the same using psychrometric chart.
6. To understand construction and working of window air-conditioner/ split air-conditioner and to determine its capacity.
7. To determine COP and apparatus dew point of an air conditioning test rig.
8. To calculate cooling load of a confined space using table and compare the same with load estimation

sheet.

9. Study of domestic refrigerator and to determine % running time at different thermostat settings.
10. To determine $(COP)_C$ and $(COP)_H$ of heat pump
11. To determine saturation efficiency of air cooler/air washer
12. Study of packaged plant

Design based Problems (DP)/Open Ended Problem:

- Calculation of cooling load for a shopping mall or a large building.
- Make calculation of thermal insulation for a small cabin to prevent heat loss.
- Design and construction of a personal cooler.
- Determine evaporative cooling capacity of a desert cooler.
- Prepare duct layout for a shopping mall or a large building using any one method. (Different groups can take one method for same building and discuss the results).
- Thermal design of condenser used for R&AC

Major Equipment:

- Vapor compression test rig
- Vapor absorption test rig
- Sectional models of various type of compressors
- Air conditioning test rig
- Air cooler apparatus
- Apparatus to perform various psychrometric processes
- Tools for refrigeration tubing
- Mechanical heat pump

List of Open Source Software/learning website:

1. http://nptel.ac.in/
2. www.learnerstv.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GANDHINAGAR INSTITUTE OF TECHNOLOGY

B.TECH 7th SEMESTER

MECHANICAL ENGINEERING (THERMAL ENGINEERING)

DOC NO: 4061

Subject Code: 10010721	**Subject Title: Renewable Energy Engineering (Program Elective-4)**
Pre-requisite: - Fluid Mechanics, Heat Transfer	

Course Objective: The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.

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	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Scenario of Renewable Energy (RE) Sources:** Need of RE, advantages and limitations of RE, present energy scenario of conventional and RE sources.	1	2
2	**Solar Energy:** Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation on horizontal, radiation on and tilted surface. Solar energy conversion into heat, types and working of solar collectors, evacuated and non-evacuated solar air heater, concentrated collectors, losses in liquid flat plate collector, thermal analysis of liquid flat plate collector, air heater and cylindrical parabolic concentrating collector, solar energy thermal storage, Solar space heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air-conditioning, solar pond, heliostat, solar furnace, photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages.	19	42
3	**Wind Energy:** Energy available from wind, basics of lift and drag, basics of wind energy conversion system, Betz limit theory, effect of density, angle of attack and wind speed, wind mill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm, Safety and environmental aspects, wind	8	18

	energy potential and installation in India**.**		
4	**Bio Energy:** Biomass energy – modern energy carrier, energy plantation, gasification, types and applications of gasifiers, types of biogas plants, design of biogas plant, factors affecting biogas generation. advantages and disadvantages**.**	4	9
5	**Ocean Energy:** OTEC principle, open, closed and hybrid cycle OTEC system, Energy from tides, estimation of tidal power, tidal power plants, single and double basin plants, site requirements, advantages and limitations **Wave energy:** Wave energy conversion devices, advantages and disadvantages, Present scenario. Geothermal energy: Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications. **MHD Power generation:** concept and working principle.	7	16
6	**Economic Analysis:** Initial and annual cost, Basic definitions Fundamentals of economic analysis, time value of money, payback period, present worth calculations, repayment of loan in equal annual installments, annual solar savings, cumulative saving and life cycle cost analysis, economic analysis of solar system, clean development mechanism	6	13

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

- To design and develop solar systems for various applications To estimate solar radiation on the various surfaces and its applications for thermal and photovoltaic systems.
- To analyze the performance of various solar collectors
- To evaluate the potential of wind energy conversion systems
- To illustrate Bio energy, Wave energy, Ocean energy and Geothermal Energy
- To evaluate the life cycle cost and carry out economic analysis of renewable energy sources.

List of References:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGrawHill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional Energy Resources, B. H. Khan, Tata McGraw Hill
4. Non-Conventional Resources of Energy, G. S. Sawhney, PHI
5. Non-conventional energy resources, Shobh Nath Singh, Pearson India
6. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press.
7. Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York
8. Solar Energy: Fundamentals and Applications, H P Garg & Jai Prakash, McGraw Hill

Open e-Resource:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed119/preview
2. https://onlinecourses.swayam2.ac.in/nou25_es12/preview

3. https://onlinecourses.swayam2.ac.in/nou25_ge56/preview

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 7

Subject Code: 10010722	**Subject Title: Entrepreneurship**
Pre-requisite: - Zeal to learn the subject	

Course Objective: Students will develop skills for evaluating, articulating, refining, and pitching a new product or service offering, either as a start-up business or a new initiative within an existing firm. This course is appropriate for all students interested in innovation and design as necessary components of new businesses today. The aim is to acquaint the students with challenges of starting new ventures and enable them to investigate, understand and internalize the process of setting up a business.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Tutorial**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	0	3	70	30	--	--	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Entrepreneurship:** Concept, knowledge and skills requirement; characteristic of successful entrepreneurs; role of entrepreneurship in economic development; entrepreneurship process; factors impacting emergence of entrepreneurship; managerial vs. entrepreneurial approach and emergence of entrepreneurship.	10	20%
2.	**Starting the venture:** generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study: market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors.	12	30%
3.	**Functional plans:** marketing plan – marketing research for the new venture, steps in preparing marketing plan, contingency planning; organizational plan: form of ownership, designing organization structure, job design, manpower planning; Financial plan: cash budget, working capital, Performa income statement Performa cash flow, perform balance sheet, break even analysis.	12	30%

4.	**Sources of finance:** debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; legal issues: intellectual property rights patents, trademarks, copyrights, trade secrets, licensing; franchising.	10	20%

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

1. Understand Entrepreneurship.
2. Understand Business Models and Planning for Business.
3. Understand Operations and Management in business

List of References:

1. Entrepreneurship, Hisrich, Robert D., Michael Peters and Dean Shepherded, Tata McGraw Hill, ND
2. Entrepreneurship, Brace R., and R., Duane Ireland, Pearson Prentice Hall, New Jersy (USA).
3. Entrepreneurship, Lall, Madhurima, and Shikha Sahai, Excel Book, New Delhi.
4. Entrepreneurship Development and Small Business Enterprises, Charantimath, Poornima, Pearson Education, New Delhi.

Open e-Resource:

1. https://onlinecourses.nptel.ac.in/noc25_mg81/preview
2. https://archive.nptel.ac.in/courses/110/106/110106141/
3. https://onlinecourses.swayam2.ac.in/cec20_mg19/preview

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 7

Subject Code: 10010723	**Subject Title: Industrial Safety**
Pre-requisite: - Zeal to learn the subject	

Course Objective: Safety is a major concern in any industry. Awareness about safety helps students to prevent major accidents. Understanding about various safety rules and regulations enables them to apply these practices in the industry, leading to improved performance and productivity. Knowledge of fire, its types, and prevention methods contributes to creating a safer work environment and helps to protect the industry from significant damage by enabling effective first aid responses.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Tutorial**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	0	3	70	30	--	--	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Industrial Safety:** Overview, Accidents - its preventions, PPE; Safety - objectives, management, organization, auditing, promotion, policy, safety act, safety manager, government role- National Safety Council, Safety color codes.	6	13%
2.	**Safety Management:** Security management of industrial plants, Organization, administration & management - responsibility in the field of safety. Salient points of factories act 1948 w.r.t. health & environment, plant & machinery.	8	18%
3.	**Industrial Safety Analysis:** Locating injury sources, identify causes of injury, injury investigation, safety analysis techniques -FAULT TREE, THERP, FMEA; Risk tolerability, ten-point scale for workplace hazards.	8	18%
4.	**Fire Prevention:** Fire- Fundamentals, elements, classification, initiation & causes Types, extinguishing techniques-agents & application, Prevention; Electrical fires & its prevention, Fire detection, Fire alarm and Firefighting systems.	8	18%
5.	**Electrical Safety, Electric Shocks, and their Prevention:** Precautions & safety in use of electricity, electrical hazards, shocks & electric shock-	9	20%

	phenomenon, various types, its precautions, safety procedure in electrical plant, earthing system, grounding, Safety systems & training.		
6.	**First Aid:** Principal, Resuscitation, training, general rule, electrical shocks/burns, Artificial Respiration- methods, first aid for-open wounds, bleeding, burns& scalds, fracture& dislocations, heat stroke, eye injuries, fainting etc.	6	13%

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

1. To understand the importance of safety and its management systems.
2. To accomplish the industrial safety analysis.
3. To analyze fire and fire-fighting systems.
4. To identify electrical safety, electric shocks, and their prevention.
5. To familiarize about the First aid methods.

List of References:

1. Industrial Safety Health & Environment Management Systems by R. K. Jain & Sunil S. Rao Khanna Pub. (2017 Reprint)
2. Industrial Handbook by William Handling, Mc-Graw-Hill.
3. Industrial Safety & Environment by A.K. Gupta Laxmi Publications; second edition.
4. Industrial Safety and Health Management by David W. Rieske C. Ray Asfahl, Pearson Education.
5. Industrial Safety, Health Environment and Security by Basudev Panda Laxmi Publications; 1st edition

Open e-Resource:

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

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Bachelor of Technology – Civil/Mechanical/Robotics & Automation/ Electrical/ Electronics & Communication

Subject Code: 10010801	**Subject Title:** Internship/Major Project
Pre-requisite: --	

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	22	11	0	0	100	100	200

Course Objective:

- To develop students' ability to identify, define, and systematically approach real-world research problems, ensuring alignment with industry and societal needs.
- To equip students with modern research tools, techniques, and ethical practices, fostering effective teamwork and enhancing their communication skills for professional success.

Selection of project topic:

The research project will be closely aligned with the objectives of the engineering program and its specialized fields, fostering a culture of research among students. It may focus on contemporary technological advancements in engineering, incorporating computational methods, system or process analysis, evaluation of construction/fabrication/production or testing techniques, as well as design methodologies, analytical formulation, and problem-solving approaches. Students will have the opportunity to undertake an in-depth research project at an academic institution, R&D organization, or industry, concentrating on areas such as process enhancement or development, simulation, software development or application, integration of software and hardware, data analysis, surveys, prototype design, product development, laboratory experiment setup fabrication, literature reviews with new insights, industrial problem-solving research, and the design of sustainable infrastructure systems.

The project topic must be chosen in consultation with a faculty member. The topic will be finalized only after receiving approval from the faculty. Each student is required to provide regular progress updates to the assigned faculty, and a record of these updates must be maintained.

Submission of the Project Report:

Bound copies of the report should be submitted within the given deadline to the designated faculty.

Evaluation of the project will be done based on the following criteria:

- Technical Content: Considerations will be given for Analysis and Design
- Quality of Technical Report
- Contents of Presentation

- Overall sincerity and regularity

Evaluation:

In general, the student will submit a good technical report and make a power point presentation of roughly about 30-45 minutes.

Course Outcomes:

1. Identify and define a research problem addressing both industry needs and societal challenges.
2. Develop research methodologies with a comprehensive, systematic, and structured approach.
3. Choose and apply modern tools and techniques that are appropriate for solving real-world problems.
4. Engage in collaborative activities and demonstrate effective teamwork.
5. Uphold ethical standards and practices during the research project.
6. Understand the potential scalability of the research and the scope of intellectual property rights.
7. Compile, present, and communicate the research findings effectively to peers, faculty, and mentors.
8. Cultivate lifelong learning skills to support continuous professional development and career growth.

GANDHINAGAR UNIVERSITY

GANDHINAGAR INSTITUTE OF TECHNOLOGY

Bachelor of Technology – Civil/Mechanical/Robotics & Automation/ Electrical/ Electronics & Communication

Subject Code: 10010802	**Subject Title:** Technical Seminar
Pre-requisite: --	

Course Objective:

- To develop the ability to explore, analyze, and synthesize technical literature on emerging topics in respective engineering domain.
- To foster self-directed learning, enhance analytical reasoning, and strengthen the ability to engage with technical queries in academic and professional forums.

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	2	1	0	0	0	50	50

Course Description:

This course provides a platform for students to investigate and present a technical topic of relevance to their discipline. Students will select a topic in consultation with a faculty mentor, perform a critical literature review, prepare a structured technical report, and deliver a formal presentation. Participation in peer seminars is mandatory to promote collaborative learning and feedback exchange.

Course Deliverables:

Deliverable	**Description**
Seminar Topic Approval	Student proposes topic in consultation with assigned faculty guide.
Literature Review Summary	Minimum of 10 journal articles; focus on problem definition and gaps.
Seminar Report	Structured report (approx. 15–20 pages) with standard referencing (APA/IEEE).
Presentation	15-20-minute seminar followed by Q&A session.
Participation Log	Attendance and feedback during peer seminars.

Evaluation Scheme (Continuous Assessment – 50 Marks):

Component	**Weightage**
Topic Relevance & Clarity	5 Marks
Depth of Literature Review	10 Marks
Technical Content & Originality	10 Marks
Report Structure & Quality	10 Marks

Oral Presentation & Communication	10 Marks
Response to Questions	5 Marks

Course Outcomes:

After completing this course, students will be able to:

1. Select and explore a contemporary technical topic in their engineering discipline.
2. Conduct a structured literature review and identify knowledge gaps.
3. Prepare a professional seminar report with proper citations.
4. Deliver effective presentations using appropriate visual tools.
5. Respond confidently and thoughtfully to technical questions.
6. Demonstrate academic integrity and communication ethics.

Bloom's Taxonomy