Gandhinagar Institute of Technology

Academic Regulation & Curriculum

for

B.Tech

in

Energy 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 & 60 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 Energy 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): Energy Engineering (162)**

Semester / Year : First Year / Semeter I | **Effective From 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): Energy Engineering (162)**

Semester / Year : First Year / Semeter II | **Effective From 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)	**G U - 4th Batch - Year - 2025 - 26**
Program Name (Code): Bachelor of Technology (01)	**Branch Name (Code): Energy Engineering (162)**
Semester / Year : Second Year / Semeter III	**Effective in Academic Year - 2026 - 27 (July - Dec)**

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
					L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 5.0	10010302	Professional Core	Engineering Thermodynamics	4	3	1	0	4	70	30	0	0	100
	10030302	Professional Core	Electrical Measurement and Measuring Instrument	4	3	0	2	5	70	30	30	20	150
	11620301	Professional Core	Basics of Renewable Energy Technology	4	3	0	2	5	70	30	30	20	150
	11620302	Professional Core	Engineering Chemistry	4	3	1	0	4	70	30	0	0	100
	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**	**3**	**4**	**24**					**650**

Institute Name (Code): Gandhinagar Institute of Technology (01)	**G U - 4th Batch - Year - 2025 - 26**
Course Name (Code): Bachelor of Technology (01)	**Branch Name (Code): Energy Engineering (162)**
Semester / Year : Second Year / Semeter IV	**Effective in Academic Year - 2026 - 27 (July - Dec)**

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit	Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
					L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 5.0	10050404	Professional Core	Discrete Mathematics	5	3	2	0	5	70	30	0	0	100
	10010401	Professional Core	Fluid Mechanics	4	3	0	2	5	70	30	30	20	150
	11620401	Professional Core	Electrical Devices and Circuits	4	3	1	0	4	70	30	0	0	100
	11620402	Professional Core	Solar Thermal 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	**21**	**15**	**3**	**6**	**24**					**600**

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 Energy 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 Energy 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 Energy 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:

- Thermal and Power Plants
- Renewable Energy and Solar Energy Companies
- Wind Energy and Turbine Manufacturing Industries
- Oil and Gas Industries
- Energy Audit and Energy Management Firms
- Electrical Utilities and Power Distribution Companies
- Hydrogen and Fuel Cell Technology Organizations
- Green Building and Energy Efficiency Companies
- Research and Development Organizations
- Government and Public Sector Energy Units
- MSMEs and Industrial Energy Units

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:

- Energy Simulation and Modelling Software (HOMER, RETScreen, EnergyPlus)
- Thermal and Fluid Analysis Tools (ANSYS, MATLAB, Fluent)
- CAD/CAM/CAE Software and Design Tools
- PLC/SCADA and Industrial Automation Platforms
- AI and Machine Learning Frameworks for Energy Analytics
- IoT Platforms for Smart Energy Monitoring
- Programming Environments (Python, MATLAB, C/C++)
- Data Analytics and Visualization Tools
- Virtual Laboratories and Engineering Software
- Digital Manufacturing and Prototyping Tools

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 Energy 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 in renewable and sustainable energy
- Solar, wind, and hybrid energy system design and development
- Energy audit and energy management studies
- Thermal system analysis and simulation
- IoT-based smart energy monitoring projects
- Energy storage and battery technology 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 Energy Engineering programme.

The department shall facilitate access to:

- Engineering textbooks and reference books in energy and thermal domains
- National and international journals on renewable energy and sustainability
- Research publications and e-resources
- Standards, manuals, and technical databases
- Digital learning platforms and virtual laboratories
- Energy simulation software and computational 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 Energy 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:

- Thermal and Power Plant Industries
- Renewable Energy and Solar Energy Companies
- Wind Energy and Turbine Manufacturing Industries
- Oil and Gas Industries

- Energy Audit and Energy Management Firms
- Electrical Utilities and Power Distribution Companies
- Hydrogen and Fuel Cell Technology Organizations
- Green Building and Energy Efficiency Companies
- Electric Vehicle and Battery Technology Industries
- Research and Development Organizations
- Government and Public Sector Energy Units
- MSMEs and Startup Ecosystems in Clean Energy

Career development activities such as aptitude training, resume preparation, interview preparation, soft skill development, technical certification programs in energy engineering domains, 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 Energy Engineering programme is designed to develop industry-ready engineers with strong foundations in thermal engineering, renewable energy systems, energy storage, smart grid technologies, energy efficiency, sustainable energy solutions, fluid mechanics, thermodynamics, and emerging energy technologies aligned with modern Industry 4.0 and global energy transition 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 Energy Engineering including thermal systems, solar and wind energy, energy storage and management, smart grids, hydrogen energy, energy auditing, fluid mechanics, and sustainable engineering systems. The teaching-learning process is supported through dedicated energy laboratories, simulation platforms, industrial training, project-based learning, and industry interaction activities to ensure strong practical and application-oriented learning.

The programme integrates modern energy simulation tools, computational methods, automation platforms, AI-based energy analytics, IoT-enabled monitoring systems, and industry-standard development tools to enhance technical competency and industry readiness among students.

Students are encouraged to participate in research activities, energy system design and development, innovation projects, national and international 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 thermal and power industries, renewable energy sectors, oil and gas organizations, energy management firms, electric vehicle industries, research organizations, and public sector units 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 Energy Engineering and allied disciplines.

9.2 Scope and Career Opportunities

Graduates of the programme may find career opportunities in:

- Thermal and Power Plant Industries
- Renewable Energy and Solar Energy Companies
- Wind Energy and Turbine Manufacturing Industries
- Oil and Gas Industries
- Energy Audit and Energy Management Firms
- Electrical Utilities and Power Distribution Companies
- Hydrogen and Fuel Cell Technology Organizations
- Green Building and Energy Efficiency Companies
- Electric Vehicle and Battery Technology Industries
- Smart Grid and Energy Storage Companies
- Research and Development Organizations
- Government and Public Sector Energy Units
- MSMEs and Industrial Energy Enterprises
- Consulting and Energy Engineering Service Companies

9.3 Potential Job Roles

Graduates of the programme may work in roles such as:

- Energy Engineer
- Thermal Engineer

- Renewable Energy Engineer
- Solar Energy Engineer
- Wind Energy Engineer
- Energy Audit Engineer
- Power Plant Engineer
- Energy Management Specialist
- Smart Grid Engineer
- Hydrogen and Fuel Cell Engineer
- HVAC and Building Energy Engineer
- Energy Storage Engineer
- Environmental and Sustainability Engineer
- Research and Development Engineer
- Project Engineer
- Technical Consultant
- Energy Policy and Planning Analyst

9.4 Higher Study & Professional Opportunities

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

- M.Tech in Energy Engineering, Thermal Engineering, or related specializations
- M.Tech in Renewable Energy Systems and Sustainable Technologies
- MBA and Management Studies
- Ph.D. in Energy Engineering, Thermal Sciences, or Interdisciplinary Engineering Domains
- Research and Innovation-Oriented Higher Studies
- Professional Certification Programs in Solar, Wind, and Energy Audit domains
- LEED and Green Building Certifications
- Energy Management and Sustainability Certifications
- Smart Grid and Power Systems Certifications
- Government and Competitive Examinations (GATE, ESE, PSU)
- Entrepreneurship and Startup Ventures in Clean Energy and Sustainability
- International Technical Certification Programs

10. Collaborative Field Work / Experimental Work

The B.Tech Energy 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 power plant exposure to gain hands-on understanding of real-world energy generation, transmission, and distribution systems
- Solar photovoltaic system design, installation, and performance analysis experiments
- Wind energy system assessment, turbine study, and energy yield analysis activities
- Thermal system experiments including heat exchangers, boilers, turbines, and refrigeration systems
- Energy audit exercises for buildings, industrial units, and campus facilities
- IoT-based smart energy monitoring and data logging projects
- Energy storage system design, battery characterization, and performance testing activities
- Hydrogen energy and fuel cell experiments and technology demonstrations
- Research projects, innovation challenges, national and international energy competitions, and interdisciplinary engineering activities
- Internship programs, industry-oriented mini projects, and major project work in collaboration with energy industries, power companies, and research organizations

The programme shall encourage experiential learning, sustainability thinking, problem-solving ability, teamwork, innovation, technical communication, and practical engineering competency aligned with modern energy engineering and clean technology requirements.

11. Market Survey

11.1 Executive Summary

India is witnessing unprecedented growth in renewable energy, thermal power, electric vehicles, smart grid, energy storage, hydrogen energy, and sustainable infrastructure sectors driven by technological advancement, national energy transition goals, climate commitments, and increasing industrial and governmental investment. Gujarat, particularly Ahmedabad and Gandhinagar, has emerged as a major hub for solar energy, industrial energy management, power generation, and clean technology ecosystems.

A market survey and industry interaction conducted with energy companies, power utilities, renewable energy developers, energy audit firms, and technical professionals indicated strong and growing demand for skilled energy engineers with practical knowledge, technical competency, analytical capability, and hands-on exposure to modern energy systems and sustainable technologies.

The survey also identified the growing need for engineers trained in solar and wind energy systems, thermal engineering, energy storage, smart grid technologies, energy auditing, IoT-based energy monitoring, and hydrogen energy solutions. 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 Energy Engineering programme is academically relevant, industry-oriented, and strongly aligned with present and future technological, industrial, and national energy requirements of India and the global engineering community.

11.2 Market Demand & Industry Trends

The Energy Engineering sector is one of the fastest growing domains globally and in India, driven by the national renewable energy targets, energy transition commitments, electric vehicle revolution, smart city development, and increasing focus on sustainability and energy efficiency. Major growth areas include:

- Solar Photovoltaic and Concentrated Solar Power Systems
- Wind Energy and Offshore Wind Development

- Energy Storage Systems and Battery Technologies
- Smart Grid and Advanced Metering Infrastructure
- Hydrogen Energy and Green Hydrogen Production
- Electric Vehicles and EV Charging Infrastructure
- Thermal Power Plant Modernization and Efficiency Improvement
- Energy Audit and Industrial Energy Management
- Green Buildings and Net Zero Energy Systems
- Biomass, Biogas, and Waste-to-Energy Technologies

Industries are increasingly seeking engineers with multidisciplinary skills, strong analytical capability, practical energy systems exposure, and innovation-oriented thinking aligned with modern sustainable energy practices.

11.3 Skill Gap Identified by Industry

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

- Limited hands-on experience with solar, wind, and thermal energy systems
- Insufficient knowledge of energy audit methodologies and energy management tools
- Lack of proficiency in energy simulation software such as HOMER, RETScreen, and EnergyPlus
- Limited exposure to smart grid technologies, IoT-based energy monitoring, and data analytics
- Weak understanding of energy storage systems and battery technologies
- Insufficient knowledge of hydrogen energy, fuel cells, and emerging clean energy technologies
- Limited experience with industry-standard instrumentation, measurement, and testing equipment
- Weak problem-solving, project management, and technical communication skills

The industry strongly emphasized the need for technically competent graduates capable of contributing effectively from day one in energy engineering, renewable energy, thermal systems, and sustainable technology domains.

11.4 Employment Opportunities & Industry Support

Graduates of the programme shall have strong employment opportunities in thermal and power industries, renewable energy companies, oil and gas organizations, energy audit firms, electrical utilities, smart grid companies, electric vehicle industries, hydrogen energy organizations, research institutions, MSMEs, and public sector energy units.

Industries have also expressed willingness to support the programme through:

- Internships and industrial training in energy and power environments
- Industrial visits and expert lectures by energy professionals
- Collaborative projects, hackathons, and energy innovation competitions
- Skill development and certification initiatives in solar, wind, energy audit, and smart grid domains
- Placement and career support activities

The programme is therefore expected to significantly contribute towards developing industry-ready energy engineers equipped with modern technical knowledge, practical competency, innovation capability, and professional skills to meet the growing demands of India's energy transition and the global clean energy industry.

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 Energy Engineering programme from time to time in accordance with University regulations, statutory requirements, technological advancements, industry needs, and academic developments.

Given the rapidly evolving nature of energy engineering, renewable energy technologies, smart grid systems, and allied engineering domains, the curriculum and academic regulations of this programme shall be subject to periodic review to ensure continued relevance, industry alignment, and academic rigor. Revisions may be initiated based on:

- Emerging trends in renewable energy, energy storage, hydrogen energy, and clean technologies
- Feedback from industry partners, alumni, students, and academic peers
- Changes in AICTE guidelines, UGC norms, and NEP 2020 implementation frameworks
- National and international energy policy developments and sustainability goals
- Advancements in engineering tools, simulation platforms, and development environments
- Outcomes of academic audits, accreditation processes, and quality reviews

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: 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 Electrical Engineering
Sem 3

Subject Code: 10030302	**Subject Title: Electrical Measurement and Measuring Instrument**
Pre-requisite: NA	

Course Objective: (1) To provide an overview of electrical measurement techniques that is problem-oriented.
(2) To concentrate on researching electrical measurements.

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	Philosophy Of Measurement- Methods of Measurement, Measurement System**,** Classification of instrument system, Characteristics of instruments & measurement system**,** Errors in measurement & its analysis, Standards.	04	10
2	Analog Measurement of Electrical Quantities – Electro dynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electro dynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energy meter. Instrument Transformer and their applications, Introduction to measurement of speed, frequency and power factor.	10	20
3	Bridge Measurement of Resistance: Measurement of low, medium & high resistances, insulation resistance measurement, localization of cable fault, Loop tests. Bridge Measurement of Inductance and Capacitance: A. C. bridges for inductance measurement Maxwell, Hays, anderson and owen bridges, capacitance measurement – Desauty and Schering Bridge. Measurement of frequency by Wien's bridge.	10	25
4	Digital Measurement of Electrical Quantities - Concept of digital measurement, block diagram and study of digital voltmeter, frequency meter, Power Analyzer and Harmonics Analyzer; Electronic Multimeters.	04	10

5	Transducers: Definition - different types of transducers – criteria for selection –general characteristics–dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications Instrumentation amplifiers – differential amplifiers – Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.	10	25
6	Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications only)	04	10

Course Outcome:

(1) The student can acquire the basic knowledge of measurement principles and their application in electrical engineering.

(2) The students will be able to effectively employ electrical and electronics instruments for measurements of various electrical quantities.

List of Text Books:

1. J. B. Gupta - A course in Electronic and Electrical measurements and Instrumentation, S. K. Kataria Publication
2. R.K.Rajput - Electrical and Electronic Measurements and Instrumentation

List of Reference Books:

1. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co.
2. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books
3. H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill.
4. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill.
5. H.K.P. Neubert, Instrument transducers, Oxford University press.

Open e-Resource:

Open Source Sfteware:
- LTSpice for circuit simulation,
- KiCAD for CAD application

Web-based tools for design:
- http://www.fairchildsemi.com/support/design-tools/power-supply-webdesigner/
- http://www.ti.com/lsds/ti/analog/webench/overview.page

Circuit Lab:
- https://www.circuitlab.com/editor/

Open source Math Tools:
- http://www.scilab.org/
- http://www.gnu.org/software/octave/

Learning website
- http://www.electrical-engineering-portal.com/
- http://nptel.iitm.ac.in/courses.php

List of Suggested Experiments:

1. Measurement of resistance using Wheastone's Bridge and Kelvin Double bridge.
2. Extension of range of wattmeter using CT & PT
3. Measurement of displacement using LVDT
4. Measurement of current/ voltage using Hall effect transducer.
5. Thermocouple based ON – OFF controller
6. Measurement of physical quantities – strain, torque and angle
7. Measurement of temperature by RTD method
8. Measurement of low resistance by Kelvin‟s double bridge.
9. Measurement of voltage, current and resistance using dc potentiometer.
10. Measurement of inductance by Maxwell‟s bridge, Hay‟s bridge, Anderson‟s bridge.
11. Measurement of capacitance by Owen‟s bridge, De Sauty bridge, Schering bridge.
12. Measurement of flow rate by anemometer.

Gandhinagar Institute of Technology
B. Tech Energy Engineering
Semester 3

Subject Code: 11620301	**Subject Title: Basics of Renewable Energy Technology**
Pre-requisite: - Zeal to learn the subject	

Course Objective:

- To introduce students to global energy resources, environmental aspects of energy utilization, and the fundamentals of solar energy conversion and solar cell technologies.
- To provide understanding of biomass energy conversion processes and other renewable energy sources such as geothermal and hydropower systems.
- To develop knowledge of ocean-based renewable energy sources such as tidal, wave, and ocean thermal energy systems and their environmental aspects.
- To understand conventional energy resources such as petroleum and coal, their availability, utilization, and sustainability issues.

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.	**Unit I** World energy use, reserves of energy resources-energy cycle of the earth-environmental aspects of energy utilisation-renewable energy resources and their importance. Conversion of solar energy to heat energy, solar energy to electrical energy-solar cells, Inorganic and organic solar cells.	12	25
2.	**Unit II** Biomass Energy, Biomass Conversion, Biogas Production, Bio-ethanol Production, Pyrolysis and Gasification, Direct Combustion and Applications. Bio photolysis, Basic theory and types of turbines, Geothermal Energy, Geothermal resource assessment, Resource based applications for heating and electricity generation, Basic concepts of Hydropower, Site selection, types of turbines, Small hydropower stations.	12	25
3.	**Unit III**	12	25

	Origin of tides, Power generation schemes, Wave Energy, Basic theory of wave power devices, Open and Closed OTEC cycles, Ocean Currents, Salinity Gradient Devices, Environmental Aspects, Potential impacts of harnessing the different renewable energy resources.		
4.	**Unit IV** Introduction to petroleum resources, availability, production and distribution, Petroleum refining, Coal resource availability, types of coal. Depletion of petroleum and coal resources, Sustainability issues of conventional energy resources. Importance of non-renewable resources, Indian scenario. Impact of use of non-renewable recourses on environment.	12	25

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

1. Explain the importance of renewable energy resources and the basic principles of solar energy conversion into heat and electricity using solar cells.
2. Describe biomass energy conversion methods such as biogas production, pyrolysis, gasification, and the basic concepts of geothermal and hydropower systems.
3. Explain the working principles of tidal, wave, and ocean thermal energy conversion systems and evaluate their environmental impacts.
4. Explain the availability, refining, and environmental impact of non-renewable energy resources in the Indian context.

List of References:

1. Alternative Energy Sources, S. Michaelides, E. Efstathios, Springer
2. Renewable Energy Sources and Emerging Technologies, D. P. Kothari, K. C. Singhal, R. Ranjan, PHI Learning Pvt. Ltd.
3. Energy Technology (3rd Edition), L. Rao, B. B. Parulekar, Khanna Publishers
4. Alternative Energy Sources (Vol. 5 & 6), T. N. Veziroglu, Tata McGraw Hill
5. Solar Engineering of Thermal Processes, J. A. Duffie, W. A. Beckman, John Wiley & Sons
6. Principles of Solar Engineering, F. Kreith, J. F. Kreider, Taylor & Francis

Open e-Resource:

1. https://nptel.ac.in/courses/112107208
2. https://nptel.ac.in/courses/121106014
3. https://nptel.ac.in/courses/112104233
4. https://nptel.ac.in/courses/121106013
5. https://nptel.ac.in/courses/121106012

List of Suggested Experiments:

1. Measurement of Solar Radiation using a pyranometer and analysis of solar intensity variation during the day.
2. Performance Analysis of Solar Water Heater and determination of thermal efficiency.
3. V–I and P–V Characteristics of Solar Photovoltaic Cell/Module under different load conditions.
4. Study and Efficiency Determination of Solar Air Heater.
5. Experimental Study of Biomass Briquetting Process and determination of briquette properties.
6. Biogas Production from Biomass using a laboratory-scale digester and analysis of gas yield.
7. Study of Biomass Gasification System and analysis of gasification parameters.
8. Performance Study of Micro / Small Hydropower Turbine and efficiency calculation.
9. Demonstration Experiment on Tidal Energy Conversion System using a laboratory model.
10. Experimental Study of Wave Energy Conversion Device (model-based demonstration).
11. Determination of Properties of Biofuels/Biodiesel (viscosity, density, calorific value, flash point).
12. Energy Audit of a Laboratory/Building to analyse energy consumption and suggest conservation measures.

Gandhinagar Institute of Technology
B. Tech Energy Engineering
Semester 3

Subject Code: 11620302	**Subject Title: Engineering Chemistry**
Pre-requisite: - Zeal to learn the subject	

Course Objective:

- To develop an understanding of basic concepts of inorganic, organic, and physical chemistry relevant to engineering applications.
- To study the chemical principles involved in materials, fuels, corrosion, and water treatment used in engineering fields.
- To enable students to understand chemical reactions, thermodynamics, and electrochemical processes in practical engineering systems.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Unit I** **Chemical Thermodynamics:** Second law of thermodynamics, entropy and its physical significance, entropy change of ideal gases, free energy, Maxwell's relations, Gibbs-Helmholtz equation, thermodynamic equilibrium, Van't Hoff equation, Clausius-clapeyron equation, Nernst heat theorem, third law of thermodynamics.	8	17
2.	**Unit II** **Organic Chemistry:** Structures, functions and classification of biologically important molecules (Amino acids, peptides, proteins, Nucleic acids, Carbohydrates); Preparative methods of amino acids and Peptides; Peptides sequencing; 3D structure of proteins; Reactions of monosaccharides **Polymers:** Types of Polymerization; Classification and structures of polymers; commercial uses of some important polymers (e.g. Nylons, polyester, polyurethane, rubber, Teflon, polycarbonate, Bakelite, epoxy resin, silicones, etc.)	15	33

3.	**Unit III** **Electrochemistry:** Electromechanical cells, EMF and application of its measurement, commercially important cells, corrosion (its electrochemistry and remedial measures) **Chemical Kinetics:** reactions of different orders- general discussion, rate law with example of zero, first and second order reactions, problem based on zero, first and second order reactions, pseudo-uniorder reaction, activation energy and role of catalyst in reaction-collision theory and activation energy.	15	33
4.	**Unit IV** **Water and its hazard in industry:** Soft and Hard water and estimation of hardness of water, hazards of hard water in industry and treatment of industrial water (external and internal methods) **Fundamentals of Spectroscopy:** Microwave, Infra-red and UV-VIS spectroscopic techniques.	8	17

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

1. Explain the fundamental principles of inorganic chemistry, including atomic structure, bonding, and coordination compounds.
2. Describe the structure, reactions, and mechanisms of organic compounds relevant to industrial and engineering applications.
3. Apply physical chemistry concepts such as thermodynamics, chemical kinetics, and electrochemistry to engineering problems.
4. Analyze water chemistry, corrosion mechanisms, and methods of corrosion prevention in engineering materials.
5. Evaluate the chemical properties of fuels, polymers, and engineering materials used in industrial applications.

List of References:

1. Advanced Inorganic Chemistry (Vol. I & II), Prakash, Tuli, Basu and Madan, S. Chand & Company Ltd.
2. Organic Chemistry (6th Edition), Morrison and Boyd, Prentice Hall of India, Reprinted.
3. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publishing Company.
4. Physical Chemistry (5th Edition), I. N. Levine, Tata McGraw Hill

Open e-Resource:

1. https://nptel.ac.in/courses/122105021
2. https://nptel.ac.in/courses/104106119
3. https://nptel.ac.in/courses/104104087

4. https://nptel.ac.in/courses/104105089

5. https://nptel.ac.in/courses/104106090

List of Suggested Tutorials:

1. **Atomic Structure and Chemical Bonding**
   Numerical problems related to quantum numbers, hybridization, and molecular geometry.
2. **Periodic Properties of Elements**
   Problems on atomic radius, ionization energy, electronegativity, and periodic trends.
3. **Coordination Compounds**
   IUPAC nomenclature, calculation of oxidation states, coordination number, and isomerism.
4. **Thermodynamics**
   Numerical problems based on enthalpy, entropy, Gibbs free energy, and spontaneity of reactions.
5. **Chemical Kinetics**
   Rate laws, order of reactions, half-life calculations, and activation energy problems.
6. **Electrochemistry**
   EMF calculation, Nernst equation, electrochemical cells, and corrosion mechanisms.
7. **Water Chemistry and Water Treatment**
   Hardness calculations, alkalinity determination, and methods of water softening.
8. **Fuels and Combustion**
   Calorific value calculation, combustion reactions, and analysis of fuel properties.
9. **Organic Reaction Mechanisms**
   Identification of electrophilic and nucleophilic reactions, reaction intermediates, and mechanisms.
10. **Polymers and Engineering Materials**
    Classification of polymers, degree of polymerization, and applications in engineering.

GANDHINAGAR UNIVERSITY

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)

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Gandhinagar Institute of Technology
B.Tech. Computer Engineering/Information Technology
Semester IV

Subject Code: 10050404	**Subject Title: Discrete Mathematics**
Pre-requisite: Basics of algebra and logic	

Course Objective: **(1)** The fundamental ideas of sets, logic, functions, relations, graph theory, and algebraic structures are introduced in this course.
(2) The advanced concepts of functions and algebraic structures are applied to finite state machines and coding theory.

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	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Set theory:** Definition and properties of Sets, operations on sets, Venn diagrams, Cartesian product, relations, functions **Functions**: Introduction & definition, Co-domain, range, image, value of a function, one-one onto correspondence, Composition of functions, Inverse function, Identity map, Inverse of composite functions, Properties of Composition of functions **Combinatorics**: Basic of Counting, Permutations, Permutations with Repetitions, Circular Permutation, Combinations, Combinations with repetitions, Binomial Coefficient, Pigeonhole Principle	**06**	**12%**
2	**Relations**: Binary Relations, Properties of Binary Relations: reflexivity, symmetry, transitivity, Anti-symmetric Relations, Equivalence Relations, Equivalence Classes, Composite Relation, Closure of relation and Properties, Relation Matrix and Graph of a Relation **Partial ordering relations**: Definition, Examples, Simple or Linear Ordering, Totally Ordered Set, Partially Ordered Relations, Representation of Partially Ordered Sets, Hesse Diagrams, Least & Greatest Members, Minimal & Maximal Members, Least Upper Bound, Greatest Lower Bound, Well-ordered Partially Ordered Sets (Posets). Lattice as Posets, complete, distributive modular and complemented lattices, Boolean and pseudo-Boolean lattices (Definitions and simple examples only)	**10**	**25%**
3	**Mathematical logic**: Statements and notations, connectives, well-formed formulas, truth tables, tautology, equivalence implication; Normal forms: Disjunctive normal forms, conjunctive normal forms, principle disjunctive normal forms, principle conjunctive normal forms; Predicative logic, statement	**06**	**13%**

	functions, Universal variables and quantifiers, free and bound variables, Multiple quantifiers and negation		
4	**Graphs**: Definition of different types of graphs, incidence and degree, Basic Concepts Isomorphism and Sub graphs, path and circuits, Euler graphs, Hamiltonian graphs, Matrix representations, Warshall's algorithm to find shortest path **Trees**: Basic properties of trees, m-ary tree, Binary trees, converting any m-ary tree to a binary tree, Tree traversal: Pre-order, in-order, post-order traversal, spanning trees, minimal spanning trees	**10**	**25%**
5	**Algebraic Structures:** Algebraic structures with one binary operation- Group, Group, Subgroup, Normal subgroup, Group Permutations, Semigroup, Monoid, Coset, Homomorphic subgroups, Lagrange's theorem, Congruence relation and quotient structures. Algebraic structures: Ring, Integral domain and field (Definitions and simple examples only)	**10**	**25%**

Course Outcome:

Sr No.	CO Statement	Marks % weightage
1	Understand the fundamental concepts of sets and set operations, and use counting principles to calculate probabilities, define a function's domain and range, recognize one-to-one relationships, compose functions, and apply the attributes of functions to practical issues.	12
2	Calculate relations utilizing operations on relations after determining the attributes of the relations to look for equivalence relations and partial order relations. Create a hasse diagram to identify the pertinent partial ordered sets in the binary relation.	25
3	Understand logical connectives and compound prepositions for building compound statements. Formulate truth table and understand equivalency. To express a logic sentence in terms of predicates, quantifiers, and logical connectives.	13
4	Analyze various traversal strategies for trees and graphs. Utilizing graphs and trees, model computer science issues.	25
5	Apply the ideas of groups, subgroups, monoids, rings, integral domain and field to the construction of various algebraic structures.	25

List of Text Books:

1. Rosen Kenneth: Discrete mathematics and its applications. McGraw hill- New Delhi.
2. Swapan Kumar Sarkar, A Textbook of Discrete Mathematics, 9th Edition, S Chand publication.

List of Reference Books:

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science,Tata McGraw-Hill,1997.
2. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill,1999.
3. David Liben-Nowell, Discrete Mathematics for Computer Science, Wiley publication, July 2017.
4. Eric Gossett, Discrete Mathematics with Proof, 2nd Edition,Wiley publication, July 2009.

Open e-Resource: NPTEL Discrete Mathematics lecture: https://swayam.gov.in/

Gandhinagar Institute of Technology
B. Tech Energy Engineering
Semester 4

Subject Code: 11620401	**Subject Title: Electrical Devices and Circuits**
Pre-requisite: - Zeal to learn the subject	

Course Objective:

- To understand the working principles, construction, characteristics, and applications of DC machines and transformers.
- To study the construction, working principles, and performance characteristics of three-phase and single-phase induction motors and stepper motors.
- To introduce the fundamentals of control systems including transfer functions, system modeling, and open-loop and closed-loop control systems.
- To develop understanding of time response, stability analysis, and frequency response techniques of control systems.

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

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Unit I** DC Machines: Principle of DC Generator, Methods of excitation, Characteristics and Applications, Principle of DC Motor, Types, Speed – Torque Characteristic, Speed Control. Transformers: Working principle of Transformers, Equivalent Circuit, Transformer tests.	10	22
2.	**Unit II** Three Phase Induction Motor: Construction, Production of rotating field, Slip, Torque and Slip. Single Phase Induction Motor: Double field revolving theory, Shaded Pole single phase induction motor. Stepper Motors.	10	22
3.	**Unit III** Electrical analogy of simple mechanical systems; concept of transfer function and its determination for simple systems. Open loop and closed loop controls, servo mechanisms, concept of various types of	10	22

	system. Unit step, unit ramp, Unit Impulse and periodic signals with their mathematical representation and characteristics.		
4.	**Unit IV** Time response of a standard second order system and response specifications, steady state errors and error constants. Concept and types of stability, Routh-Hurwitz Criteria and its application for determination of stability, limitations; Polar plot, Nyquist stability. Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots.	15	34

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

1. Explain the operating principles, characteristics, speed control of DC machines, and analyze transformer equivalent circuits and tests.
2. Describe the operation of induction motors, analyze slip–torque characteristics, and explain the working of single-phase induction motors and stepper motors.
3. Derive transfer functions of simple systems and explain different control systems, servo mechanisms, and standard input signals.
4. Analyse time response characteristics, determine system stability using Routh–Hurwitz criterion, and evaluate system performance using Bode and Nyquist plots.

List of References:

1. Engineering Circuit Analysis (6th Edition), W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Tata McGraw Hill
2. Control Systems: Principles and Design, M. Gopal, Tata McGraw Hill
3. Electrical Technology (Vol. II), B. L. Thereja, A. K. Thereja, S. Chand & Company Ltd.
4. Network Analysis (3rd Edition), M. E. Van Valkenburg, Prentice Hall of India.
5. Networks and Systems, D. Roy Choudhury, New Age International Publishers.
6. Automatic Control Systems, F. Golnaraghi, B. C. Kuo, Wiley India Pvt. Ltd.

Open e-Resource:

1. https://nptel.ac.in/courses/108105017
2. https://nptel.ac.in/courses/108105018
3. https://nptel.ac.in/courses/108105057
4. https://nptel.ac.in/courses/108106098
5. https://nptel.ac.in/courses/108106072

List of Suggested Tutorials:

1. **DC Generator Calculations**
   Problems on EMF equation, types of excitations, and output voltage calculation.
2. **Speed–Torque Characteristics of DC Motors**
   Numerical problems related to torque, speed, and speed control methods.
3. **Transformer Equivalent Circuit**
   Calculation of parameters using open circuit and short circuit test data.
4. **Three Phase Induction Motor Performance**
   Numerical problems on slip, rotor speed, torque, and efficiency.
5. **Torque–Slip Characteristics of Induction Motor**
   Problems related to maximum torque and starting torque.
6. **Single Phase Induction Motor Analysis**
   Conceptual and numerical problems based on double field revolving theory and shaded pole motor.
7. **Transfer Function Determination**
   Derivation of transfer function for simple electrical and mechanical systems.
8. **Open Loop and Closed Loop Systems**
   Block diagram representation and analysis of control systems.
9. **Time Response of Second Order Systems**
   Numerical problems for rise time, settling time, peak overshoot, and steady-state error.
10. **Stability Analysis of Control Systems**
    Application of **Routh–Hurwitz criterion, Bode plot, and Nyquist stability analysis**.

Gandhinagar Institute of Technology
B. Tech Energy Engineering
Semester 4

Subject Code: 11620402	**Subject Title: Solar Thermal Technology**
Pre-requisite: - Basics of Renewable Energy Technology	

Course Objective:

- To understand the solar geometry, earth–sun relationship, and the characteristics of solar radiation reaching the earth's surface.
- To study the design, construction, and performance analysis of flat-plate and evacuated tube solar collectors.
- To introduce the principles and classification of concentrating solar collectors and solar thermal power systems.
- To understand the applications of solar thermal systems and solar passive technologies for heating and cooling.

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.	**Unit I** Earth and Sun Relation, Solar angles, day length, angle of incidence on tilted surface, Sun-path diagrams, Shadow determination, Extra-terrestrial characteristics, Effect of earth atmosphere on terrestrial solar radiation.	12	25
2.	**Unit II** Flat-plate Collectors, Glazing Materials, collector Plates. Evacuated tubular collectors, Types of Air flat-plate Collectors. Testing of collector, Orientable test ring, series connected test ring, intermittent output method. ASHRAE method. Effective energy losses, top, bottom, side and overall loss coefficient.	12	25
3.	**Unit III** Concentrating Collector, Characteristic parameters, Classification, tracking and non-tracking concentrators, Central receiver systems, parabolic trough and compound parabolic systems, Solar furnaces.	12	25
4.	**Unit IV**	12	25

	Solar Thermal Energy Systems, Solar still, Solar cooker, Solar pond, Solar passive heating and cooling systems, Trombe wall, Fundamentals of Greenhouse technology, design, modelling and applications, Development of computer package for solar heating and cooling applications.		

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

1. Analyze solar angles, sun-path diagrams, and the effect of the atmosphere on terrestrial solar radiation
2. Explain different types of solar collectors and evaluate their performance using standard testing methods and heat loss analysis.
3. Describe concentrating collector systems such as parabolic troughs, central receivers, and solar furnaces with their working principles.
4. Explain the design and working of solar thermal devices such as solar cookers, solar stills, solar ponds, Trombe walls, and greenhouse systems.

List of References:

1. Solar Energy: Fundamentals, Design, Modelling and Applications, G. N. Tiwari, Narosa Publishing House.
2. Solar Engineering of Thermal Processes, J. A. Duffie, W. A. Beckman, John Wiley & Sons.
3. Concentrating Solar Power Technology, K. Lovegrove, W. Stein, Woodhead Publishing.
4. Financial Evaluation of Renewable Energy Technology, T. C. Kandpal, H. P. Garg, Macmillan India Ltd., New Delhi.
5. Principles of Solar Engineering, F. Kreith, J. F. Kreider, Taylor & Francis.
6. Tracking Solar Concentrators, Z. Jagoo, Springer.
7. Solar Energy Fundamentals and Modelling Techniques, Z. Sen, Springer.

Open e-Resource:

1. https://nptel.ac.in/courses/112104233
2. https://nptel.ac.in/courses/112107208
3. https://nptel.ac.in/courses/121106014
4. https://nptel.ac.in/courses/121106013
5. https://nptel.ac.in/courses/121106012

List of Suggested Experiments:

1. Measurement of Solar Radiation using a pyranometer or solarimeter and analysis of solar intensity variation during the day.
2. Determination of Solar Angles and plotting of sun-path diagram for a specific location.
3. Performance Evaluation of Flat Plate Solar Collector and determination of collector efficiency.
4. Heat Loss Analysis of Solar Collector by calculating top, bottom, and side heat loss coefficients.
5. Experimental Study of Evacuated Tube Solar Collector and comparison with flat plate collector performance.
6. Testing of Solar Collector using ASHRAE Standard Method.
7. Performance Analysis of Parabolic Trough Concentrating Collector.
8. Experimental Study of Solar Cooker and determination of cooking power and thermal efficiency.
9. Experimental Study of Solar Still and determination of water productivity.
10. Study of Solar Passive Heating System (Trombe Wall / Greenhouse Model) and evaluation of temperature variation.

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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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UNIVERSITY

- 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

Bloom's Taxonomy