Gandhinagar Institute of Technology

Academic Regulation & Curriculum

for

B.Tech

in

Robotics & Automation

***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 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. The B.Tech in Robotics & Automation is a four-year full-time undergraduate programme that integrates the foundational principles of mechanical engineering, electronics, computer science, and control theory with advanced topics in robot kinematics and dynamics, machine vision, autonomous systems, industrial automation, PLC/SCADA, IoT, and AI-driven intelligent systems.

The curriculum integrates core engineering domains including Robotics, Mechatronics,

Embedded Systems, Control Systems, Machine Vision, Artificial Intelligence, Industrial Automation, IoT, CAD/CAM, Fluid Mechanics, and Manufacturing Processes. Special emphasis is placed on Industry 4.0 technologies, intelligent manufacturing, autonomous systems, and computational 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 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 automation sector, intelligent manufacturing ecosystem, and the global robotics industry.

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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 Robotics & Automation 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): R&A (128)** | **GU Batch: 2nd** | **Year: 2025-26**

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
	10050101	Core Engineering		Programming for Problem Solving	IEEE	5	4	0	2	6	70	30	30	20	150
	10050102	Core Engineering		ICT Fundamental & Workshop	IEEE	4	3	1	0	4	70	30	0	0	100
	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
						24	**19**	**3**	**4**	**26**					**650**

Program Name: Bachelor of Technology (01) | **Branch Name (Code): R&A (128)** | **GU Batch: 2nd** | **Year: 2025-26**

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
	10050201	Engineering Science (Minor)		Basics of Python	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)

Program Name (Code): Bachelor of Technology (01)	Branch Name (Code): R&A (128)	GU Batch: 1st	Year: 2024-25
Semester / Year : Second Year / Semeter III	Effective From Academic Year:2025-26		

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit		Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
						L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 5.0	11280301	Professional Core	Principles of Robotics	4		3	0	2	5	70	30	30	20	150
	10010303	Professional Core	Manufacturing Processes	4		3	0	2	5	70	30	30	20	150
	10050304	Professional Core	Digital Electronics	3		3	0	0	3	70	30	0	0	100
	10020305	Professional Core	Mechanics of Solids	4		3	0	2	5	70	30	30	20	150
	VAC023	Humanities	Value Addition Course (VAC-III) Universal Human Values	2		2	0	0	2	25	25	0	0	50
	10000303	Basic Science	Statistics and Partial Differential Equations	4		3	1	0	4	70	30	0	0	100
			Total	**21**		**17**	**1**	**6**	**24**					**700**

Program Name (Code): Bachelor of Technology (01)	Branch Name (Code): R&A (128)	GU Batch: 1st	Year: 2024-25
Semester / Year : Second Year / Semeter IV	Effective From Academic Year:2025-26		

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit		Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
						L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 5.0	11280401	Professional Core	Programming Embedded Systems with Microcontrollers	4		3	0	2	5	70	30	30	20	150
	10010402	Professional Core	Kinematics & Theory of Machines	4		3	0	2	5	70	30	30	20	150
	10010403	Professional Core	Fundamental of Machine Design	4		3	1	0	4	70	30	0	0	100
	10040402	Professional Core	Control System Engineering	4		3	0	2	5	70	30	30	20	150
	SEC026	Multidisciplainary (open elective)	Skill Enhancement Course (SEC-III) Cyber Security	2		1	0	2	3	25	25	0	0	50
	IKS-0401	IKS	IKS - Vedic Mathematics	2		2	0	0	2	0	50	0	0	50
			Total	**20**		**15**	**1**	**8**	**24**					**650**

Gandhinagar Institute of Technology (01)

Program Name (Code): Bachelor of Technology (01)	Branch Name (Code): R&A (128)	GU Batch: 1st Year: 2024-25
Semester / Year : Third Year / Semeter V	Effective From Academic Year:2026-27	

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit		Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
						L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF -5.5	11280501	Professional Core	Kinematics & Dynamics of Robotic Manipulators	4		3	1	0	4	70	30	0	0	100
	10040505	Professional Core	Internet of Things	3		3	0	0	3	70	30	0	0	100
	10010503	Professional Core	Design of Machine Elements	5		4	0	2	6	70	30	30	20	150
	10010504	Professional Core	Operation Research	3		2	1	0	3	70	30	0	0	100
	10010505	Professional Core	Industrial Automation	2		2	0	0	2	70	30	0	0	100
		Professional Core	Open Elective-I	4		3	0	2	5	70	30	30	20	150
	10010506	Humanities	Basic Principles of Management	2		2	0	0	2	50	0	0	0	50
				23		**19**	**2**	**4**	**25**					**750**
			Open Elective - I											
	11280511	Open Elective-I	Smart Manufacturing											
	11280512	Open Elective-I	Robotics & Automation for Manufacturing											

Institute Name (Code): Gandhinagar Institute of Technology (01)

Program Name (Code): Bachelor of Technology (01)	Branch Name (Code): R&A (128)	GU Batch: 1st Year: 2024-25
Semester / Year : Third Year / Semeter VI	Effective From Academic Year:2026-27	

NCrF LEVEL	Subject Code	Course Type	Subject Name	Credit		Hours per week				Theory (Marks)		Practical (Marks)		Total (Marks)
						L	T	P	Total	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
NCF - 5.5	11280601	Professional Core	Wheeled Mobile Robots	5		4	0	2	6	70	30	30	20	150
	11280602	Professional Core	Artificial Intelligence and Machine Learning for Robotics	4		3	0	2	5	70	30	30	20	150
	10010603	Professional Core	Dynamics of Machinery	5		4	0	2	6	70	30	30	20	150
		Professional Core	Program Elective-I	2		2	0	0	2	70	30	0	0	100
		Professional Core	Program Elective-II	4		3	1	0	4	70	30	0	0	100
	IKS0601	IKS	Minor Project on IKS	2		0	0	4	4	0	0	0	50	50
				22		**16**	**1**	**10**	**27**					**700**
	Elective-I			**Elective-II**										
	11280611	Program Elective-I	Design Thinking for Robotics	10010623	Program Elective-II				Industrial Engineering					
	11280612	Program Elective-I	Product Design in Robotics	10010624	Program Elective-II				Maintenance Engineering and Management					

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 Robotics & Automation 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 Robotics & Automation 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 Robotics & Automation 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:

- Robotics and Automation Industries
- Industrial Automation and PLC/SCADA Companies
- Embedded Systems and IoT Solution Providers
- Automobile and Electric Vehicle Industries
- Aerospace and Defence Manufacturing Organizations
- Manufacturing and Smart Manufacturing Industries
- Machine Vision and AI-based Systems Companies
- Mechatronics and Control Systems Organizations
- Research and Development Organizations
- CAD/CAM/CAE and Product Design Companies
- Government and Public Sector Engineering Units
- MSMEs and Industrial Workshops

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

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

7.4 Discipline Rules

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

Students are expected to:

- Attend classes, laboratories, and workshops regularly
- Follow institutional rules, regulations, and safety practices
- Respect faculty members, staff, fellow students, and institutional property
- Maintain academic honesty and integrity in assignments, projects, practical work, and examinations
- Properly use laboratory equipment, machines, tools, and workshop facilities

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

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

7.5 Anti-Ragging Policy

The programme shall strictly comply with:

- UGC Anti-Ragging Regulations
- AICTE Anti-Ragging Guidelines
- Anti-Ragging Affidavit requirements
- Institutional disciplinary procedures

Ragging in any form is strictly prohibited and shall invite strict disciplinary action as per applicable regulations.

7.6 Ethical use of Technology and AI Tools

Students are encouraged to effectively utilize modern engineering software, digital tools, simulation platforms, and AI-based technologies for learning, design, analysis, research, and innovation purposes.

Students may use:

- Robotics Simulation Platforms (ROS, Gazebo, Webots, CoppeliaSim)
- PLC/SCADA and Industrial Automation Software
- Embedded Systems and Microcontroller Development Platforms
- CAD/CAM/CAE Software and Simulation Tools
- Machine Vision and Image Processing Tools
- AI and Machine Learning Frameworks
- IoT Development Platforms and Protocols
- Programming Environments (Python, C/C++, MATLAB)
- Digital Manufacturing and Design Tools
- Virtual Laboratories and Engineering Software
- Data Analytics and Visualization 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 Robotics & Automation programme.

Such collaborations may include:

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

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

8.2 Research and Consultancy

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

Students may undertake:

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

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

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

8.3 Library and Laboratory Facilities

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

The department shall facilitate access to:

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

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

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

8.4 Student Support and Mentoring

A structured system for student support, academic mentoring, and professional guidance shall be implemented for students enrolled in the B.Tech Robotics & Automation 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:

- Robotics and Automation Companies
- Industrial Automation and PLC/SCADA Solution Providers
- Automobile and Electric Vehicle Industries
- Aerospace and Defence Manufacturing Organizations

- Machine Vision and AI-based Systems Companies
- Embedded Systems and IoT Solution Providers
- Manufacturing and Smart Manufacturing Industries
- Mechatronics and Control Systems Organizations
- Research and Development Organizations
- Government and Public Sector Engineering Units
- MSMEs and Startup Ecosystems
- Consulting and Engineering Service Companies

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

9. Program Credibility

9.1 Executive Summary

The B.Tech Robotics & Automation programme is designed to develop industry-ready engineers with strong foundations in robot kinematics and dynamics, mechatronics, embedded systems, industrial automation, machine vision, artificial intelligence, control systems, IoT, and emerging intelligent engineering technologies aligned with modern Industry 4.0 requirements.

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

The curriculum is delivered by qualified faculty members with expertise in various domains of Robotics & Automation including robot design and programming, control systems, embedded systems, PLC/SCADA, machine vision, AI and machine learning, mechatronics, and intelligent manufacturing systems. The teaching-learning process is supported through dedicated robotics laboratories, embedded system design facilities, simulation platforms, industrial training, project-based learning, and industry interaction activities to ensure strong practical and application-oriented learning.

The programme integrates modern robotics tools, computational methods, automation platforms, AI frameworks, simulation environments, and industry-standard development tools to enhance technical competency and industry readiness among students.

Students are encouraged to participate in research activities, robot design and development, innovation projects, national and international robotics 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 robotics, automation, intelligent manufacturing, automotive, aerospace, embedded systems, IoT, AI-driven systems, research organizations, and public sector industries 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 Robotics, Automation, and allied disciplines.

9.2 Scope and Career Opportunities

Graduates of the programme may find career opportunities in:

- Robotics and Automation Industries
- Automobile and Electric Vehicle Industries
- Aerospace and Defence Manufacturing Organizations
- Industrial Automation and PLC/SCADA Companies
- Embedded Systems and IoT Solution Providers
- Machine Vision and AI-based Systems Companies
- Smart Manufacturing and Industry 4.0 Enterprises
- Mechatronics and Control Systems Organizations
- Research and Development Organizations
- Government and Public Sector Engineering Units
- MSMEs and Industrial Enterprises
- Consulting and Engineering Service Companies
- Healthcare Robotics and Medical Device Industries
- Agriculture and Field Robotics Companies

9.3 Potential Job Roles

Graduates of the programme may work in roles such as:

- Robotics Engineer
- Automation Engineer
- Embedded Systems Engineer

- Control Systems Engineer
- PLC/SCADA Engineer
- Mechatronics Engineer
- Machine Vision Engineer
- IoT Solutions Engineer
- AI and Machine Learning Engineer
- Robot Programmer
- Industrial Automation Specialist
- Autonomous Systems Engineer
- Research and Development Engineer
- Product Development Engineer
- Technical Consultant
- Robotics Integration Engineer
- Drone and UAV Systems Engineer

9.4 Higher Study & Professional Opportunities

Students graduating from the B.Tech Robotics & Automation programme may pursue:

- M.Tech in Robotics, Automation, Mechatronics, or related specializations
- M.Tech in Artificial Intelligence and Machine Learning
- MBA and Management Studies
- Ph.D. in Robotics, Automation, Control Systems, or Interdisciplinary Engineering Domains
- Research and Innovation-Oriented Higher Studies
- Professional Certification Programs in ROS, PLC/SCADA, and Industrial Automation
- Machine Vision and AI Specialized Certifications
- Embedded Systems and IoT Certifications
- Robotics Competition and Innovation Programs
- Government and Competitive Examinations (GATE, ESE, PSU)
- Entrepreneurship and Startup Ventures in Robotics and Automation
- International Technical Certification Programs

10. Collaborative Field Work / Experimental Work

The B.Tech Robotics & Automation 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 automation plant exposure to gain hands-on understanding of real-world robotics and automation systems
- Robot design, fabrication, programming, and testing activities using industry-standard platforms and development environments
- Embedded systems design, microcontroller programming, sensor integration, and actuator control experiments
- PLC/SCADA programming, industrial automation panel wiring, and process control laboratory exercises
- Machine vision system design, image processing, and AI-based object detection and classification projects
- ROS-based robot simulation, path planning, and autonomous navigation experiments using platforms such as Gazebo and Webots
- IoT system design, wireless communication, and smart sensor network development activities
- Mechatronics and control systems experiments involving PID tuning, servo control, and closed-loop system design
- Research projects, innovation challenges, national and international robotics competitions, and interdisciplinary engineering activities
- Internship programs, industry-oriented mini projects, and major project work in collaboration with robotics industries, automation companies, and research organizations

The programme shall encourage experiential learning, systems thinking, problem-solving ability, teamwork, innovation, technical communication, and practical engineering competency aligned with modern robotics, automation, and intelligent systems requirements.

11. Market Survey

11.1 Executive Summary

India is witnessing unprecedented growth in robotics, automation, artificial intelligence, embedded systems, IoT, electric vehicles, aerospace, and intelligent manufacturing sectors driven by technological advancement, Industry 4.0 adoption, infrastructure development, and increasing industrial investment. Gujarat, particularly Ahmedabad and Gandhinagar, has emerged as a major industrial and manufacturing hub with strong presence in automation industries, automobile sectors, engineering MSMEs, process industries, and smart manufacturing ecosystems.

A market survey and industry interaction conducted with robotics companies, automation industries, embedded systems solution providers, and technical professionals indicated strong and growing demand for skilled robotics and automation engineers with practical knowledge, technical competency, programming capability, and hands-on exposure to modern robotics and intelligent automation technologies.

The survey also identified the growing need for engineers trained in robot programming, PLC/SCADA, embedded systems, machine vision, AI-driven automation, IoT, and autonomous systems development. Industries emphasized the importance of practical exposure, internships, project-based learning, robotics competition experience, and industry-oriented training for improving employability and professional readiness among graduates.

The findings clearly indicate that the B.Tech Robotics & Automation programme is academically relevant, industry-oriented, and strongly aligned with present and future technological and industrial requirements of India and the global engineering community.

11.2 Market Demand & Industry Trends

The Robotics & Automation sector is among the fastest growing engineering domains globally and in India, driven by increasing industrial automation, smart manufacturing adoption, electric vehicle revolution, defence modernization, and AI integration across industries. Major growth areas include:

- Industrial Robotics and Collaborative Robots (Cobots)
- Autonomous Mobile Robots (AMR) and Automated Guided Vehicles (AGV)
- PLC/SCADA based Industrial Automation and Process Control
- Embedded Systems and IoT-enabled Smart Devices
- Machine Vision and AI-based Quality Inspection Systems
- Electric Vehicles and Automotive Automation
- Aerospace, Defence, and UAV Systems
- Healthcare Robotics and Medical Automation
- Agriculture Robotics and Precision Farming
- Warehouse Automation and Logistics Robotics

Industries are increasingly seeking engineers with multidisciplinary skills, strong programming capability, practical robotics exposure, and innovation-oriented thinking aligned with modern industrial automation practices.

11.3 Skill Gap Identified by Industry

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

- Limited hands-on experience with industrial robots, cobots, and automation systems
- Insufficient knowledge of PLC/SCADA programming and industrial communication protocols
- Lack of proficiency in ROS, robot simulation platforms, and autonomous systems development
- Limited exposure to machine vision, AI frameworks, and intelligent control systems
- Weak embedded systems design, sensor integration, and real-time programming skills
- Insufficient understanding of IoT architectures, wireless protocols, and smart device development
- Limited experience with industry-standard tools, automation panels, and instrumentation systems
- Weak problem-solving, systems thinking, and project management skills

The industry strongly emphasized the need for technically competent graduates capable of contributing effectively from day one in robotics, automation, embedded systems, and intelligent engineering domains.

11.4 Employment Opportunities & Industry Support

Graduates of the programme shall have strong employment opportunities in robotics companies, industrial automation industries, automobile and electric vehicle sectors, aerospace and defence organizations, embedded systems and IoT solution providers, machine vision companies, research organizations, MSMEs, and public sector engineering units.

Industries have also expressed willingness to support the programme through:

- Internships and industrial training
- Industrial visits and expert lectures
- Collaborative projects and workshops
- Skill development initiatives
- Placement and career support activities

The programme is therefore expected to significantly contribute towards developing industry-ready robotics and automation engineers equipped with modern technical knowledge, practical competency, innovation capability, and professional skills to meet the growing demands of India's automation and intelligent systems 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 Robotics & Automation 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 robotics, automation, artificial intelligence, and allied engineering technologies, 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 robotics, automation, AI, and intelligent systems
- Feedback from industry partners, alumni, students, and academic peers
- Changes in AICTE guidelines, UGC norms, and NEP 2020 implementation frameworks
- Advancements in engineering tools, 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 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

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GANDHINAGAR INSTITUTE OF TECHNOLOGY
B.TECH 1st SEMESTER
CE/IT/CSE/ICT/CS/AI/EC/EE/R&A

DOC NO: 4061

Subject Code: 10050101	**Subject Title: Programming for Problem Solving**
Pre-requisite: - Nil	

Course Objective:

- To understand the various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs
- To learn to write programs (using structured programming approach) in C to solve problems.
- To provide complete knowledge of C language

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	4	5	70	30	30	20	150

	Subject Contents			
Sr. No	**Topic**	**IEEE BLENDED**	**Total Hours**	**Weight (%)**
1	**Introduction:** Basic block diagram and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high level programming, Flowcharts and Algorithms NPTEL, CH.1: RB.1	IEEE	3	5
2	**Fundamentals:** Introduction to C, structure of C Program, comments, header files, data types, constants, variables, declarations, expression statements, arithmetic operations, unary operations, relational and logical, conditional, library functions, single character input and output, entering and writing data, Evaluation of expressions, type conversion, precedence and associativity, I/O functions. CH.1: RB.1	IEEE	4	10
3	**Control structure in C:** Simple statements, Decision making statements,Looping statements, Nesting of control structures, break and continue, The Case control structure switch and goto	IEEE	5	10

	statement. NPTEL, CH.5: RB.1			
4	**Array & String:** Concepts of array, processing an array, declaration and initialization of arrays, passing arrays to function, multidimensional array. String, string storage, Built-in string functions, command line arguments. NPTEL, CH.8: RB.1	IEEE	5	10
5	**Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function: different way of solving problems, recursive program for finding factorial, fibonacci series etc. NPTEL, CH.9: RB.1	IEEE	8	25
6	**Pointers:** Basics of pointers, pointer to pointer, pointer and array, pointer to array, array to pointer, function returning pointer NPTEL, CH.13: RB.1	IEEE	6	15
7	**Structure:** Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers NPTEL, CH.13: RB.1	IEEE	6	15
8	**Dynamic memory allocation and File management:** Introduction to Dynamic memory allocation, malloc, calloc. Introduction to file management and its functions NPTEL, CH.12: RB.1	IEEE	8	10

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

- Write a C program using correct syntax and execute it.
- Write programs using conditional, branching, iteration, and recursion.
- Write programs using array and strings.
- Decompose a problem into function.
- Develop an application using the concepts of array, pointer,structure, and file management to solve engineering /scientific problems.

List of References:

1. Programming in ANSI C, Balagurusamy, 8 Edition 2018 MCGraw Hill
2. Lets C, Y. Kanitkar, BPB
3. Programming with C, Gottafried, Schaum Series
4. C The Complete Reference, Scholdt, TMH
5. Structured Programming Approach Using C, B. Forouzen, Thomas

Open e-Resource:

1. NPTEL C Programming: https://nptel.ac.in/courses/106104128
2. NPTEL Problem Solving through C: https://onlinecourses.nptel.ac.in/noc22_cs101/preview

List of Suggested Experiments:

1. Write a program that performs as a calculator (addition, multiplication, division, subtraction).
2. Write a C program to interchange two numbers.
3. Write a program to read three numbers from the keyboard and find out the maximum out of these three.
4. Write a program to read marks from keyboard and your program should display equivalent grade according to following table(switch case)
   Marks Grade
   100 - 80 Distinction
   79 - 60 First Class
   59 - 40 Second Class
   < 40 Fail
5. a. Write a C program to input an integer number and check if the last digit of the number is even or odd.
   b. Write a C program to find the factorial of a given number.
   c. Write a program to reverse a number.
   d. Write a program to generate the first n number of Fibonacci series.
6. a. Write a C program to find the sum and average of different numbers which are accepted by the user as many as the user wants.
   b. Write a program to check whether the given number is prime or not.
7. Write a C program to find 1+1/2+1/3+1/4+…+1/n.
8. Write a program to print following patterns:

```
*                    *                12345
* *                  * *              1234
* * *                * * *            123
* * * *              * * * *          12
* * * * *            * * * * *        1
```

9. a. Write a program to find maximum element from 1-Dimensional array
   b. Write a program to sort given array in ascending order (Use Insertion sort, Bubble sort, Selection sort, Merge sort)
10. a. Write a program to find a character from a given string.
    b. Write a program to reverse the string.
    c. Write a program to convert string into upper case.
11. Write a program to find the factorial of a number using recursion.
12. Define a structure called cricket that will describe the following information:
    Player name
    Team name
    Batting average
    Using cricket, declare an array player with 50 elements and write a C program to read the information about all the 50 players and print team wise list containing names of players with their batting average.
13. Write a C program to swap the two values using pointers.

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GANDHINAGAR INSTITUTE OF TECHNOLOGY
CE/IT/CSE/ICT/CS/EE/EC/AI/R&A
B. TECH 1st/2nd SEMESTER

DOC NO: 4061

Subject Code: 10050102	**Subject Title: ICT Fundamental & Workshop**
Pre-requisite: - Nil	

Course Objective:

1. Understand the basics of Information and communication technology.
2. To explain the fundamentals of computers and peripherals.
3. To introduce hardware and software computers basics.
4. To brief the students regarding various operating systems.
5. Understand the basic functions and features of Google Workspace tools and explore emerging trends and technologies.

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	00	00	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to ICT:** Definition and Scope, Components, Data, Information and Knowledge, Data Collection, Data Storage and Data Transmission, Data Integrity, Information Quality.	03	10
2	**Introduction to computer system:** Introduction to various computer hardware and their application in ICT. Introduction to computer software and its application. Introduction to computer operating systems. What is Operating Systems, ERP, CRM, Service Architecture introduction — Concepts of SaaS, PaaS, IaaS[R.B-1 "Understanding Computers: Today and Tomorrow" CH-1,2,3]	05	15
3	**Fundamentals of computer Networks:** Introduction to computer networks, types of networks. Introduction to network devices.[R.B-7 Computer Networking: A Top-Down Approach" 1,2,3,4]	03	15
4	**Storage and Servers:** Primary and Secondary storage, Cloud technology, mail server, data server, Concept of Data centers.	03	10
5	**Microsoft office suite:** Professional Document writing using Word Processing Tool, Data Processing using Spreadsheet, Creating	04	10

	Dynamic and Informative Slide Show using Presentation Software		
6	**G Suite (Google Workspace):**Introduction to Google Workspace, Google Drive Basics, Google Docs, Google Forms, Google Calendar, Google Meet, Google Sites[R.B-3 CH-1,2]	05	10
7	**Introduction to the Web:** World Wide Web (WWW): A system of interlinked hypertext documents accessed via the internet. Internet: A global network of interconnected computers that communicate using standard protocols Website, Webpage, Web browser, Web server, Web development tools, web hosting and deployment.[R.B-2 CH-4,5],[R.B-3 CH:1,2,3]	05	10
8	**Cybersecurity Trends:** Emerging Threats, Advanced Security Technologies, Protective Measures, Ethical and Societal Implications[R.B-6 "Practical Malware Analysis hand book dissecting malicious code" CH-1,2,4,5]	04	10
9	**Introduction to Emerging Technologies:** Artificial Intelligence, Machine Learning, Big Data Analytics, Block chain, Data Science, Internet of Things (IoT), Virtual reality. [R.B-4 Computer Science: An Overview" CH-1,2,3,4],[R.B-5 Introduction to Computer Science: A Text-Based Approach"CH-4,5,6,7]	04	10

Course Outcome (COs):

1. Understand the basics of Information and communication technology.
2. Explore the applications of ICT for development.
3. A student can be able to use various G Suite, Microsoft office suite and computer Networks.
4. Students can explore Emerging technologies like IoT, Block chain, Data Science.

List of Reference Books:

1. "Understanding Computers: Today and Tomorrow" by Deborah Morley and Charles S. Parker
2. "Google Workspace for Dummies" by Blake R. Smith.
3. "Google Workspace: A Complete Guide to Google Workspace Tools" by Dr. Mikhail Kasyanov
4. "Computer Science: An Overview" by J. Glenn Brookshear and Dennis Bylaw
5. "Introduction to Computer Science: A Text-Based Approach" by Jean-Paul Tremblay and Paul G. Sorenson
6. "Practical Malware Analysis handbook dissecting malicious code" by Michael Sikorski and Andrew Hoing
7. "Computer Networking: A Top-Down Approach" by James F. Kurose

Web Resources:

1. https://www.w3schools.com
2. https://www.javatpoint.com
3. https://www.tutorialspoint.com/index.htm
4. https://teacher-network.in/OER/images/9/9a/ICT_student_textbook.pdf

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 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 Technology
B.Tech Computer Engineering/Information Technology
Semester 2

Subject Code: 10050201	**Subject Title: Basics of Python**
Pre-requisite: Basic Programming Knowledge of Computer System	

Course Objective:

1. Leran the syntax and semantic of Python Programming
2.Write Python functions to facilities code reuse and manipulate strings.
3. Ilustrate the process of structuring the data using lists,tuples and dictionaries.
4.Demostrate the use of built-in function to navigate the file system.
5. Appraise the need for networking on File system.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to python programming:** What is python language and its applications, Features of python language, Installing Python packages(Linux, Windows).	04	20
2	**Python Programming:** Data Types, Operators, Control Structures, Iterations, List, Tuple, Dictionary, Functions: Functions and scoping, List Operations, Recursion, Global Variable, modules, I/O operations, In Built Functions and Parameters, Python Library and its uses.	16	40
3	**Modularization and classes:** Classes and Object Oriented Programming-Procedural and Object – Oriented Programming-classes-working with Instances-Techniques for Designing classes, Inheritance-Introduction to inheritance-Polymorphism.	04	10
4	**Input and Output in Python:** Reading and writing text files, writing Text Files, Appending to Files and challenge, writing Binary Files Manually, Using Pickle to Write Binary Files.	07	20

5	Exception Errors in Python: Compile –time Errors, Runtime Errors, Logical Errors, What is Exception, Handling an exception, try…except…else, try-finally clause, Argument of an Exception, Python Standard Exception, Raising an exceptions, User–defined Exception.	04	10

Course Outcome:

1. Understand concepts of problem solving approach.
2. Able to write basic python code.
3. Understand the basics of Kali Linux & its importance.
4. Understand the security policies & cyber laws.

List of Textbooks:

1. Learn Python Programming Fundamentals: A Beginner's Guide.
2. Introduction to Computation and Programming Using Python, Third Edition by John V. Guttag.
3. Fundamentals of Python: First Programs with MindTap Author(s): Kenneth A. Lambert.

List of Reference Books:

1. Advanced Python Programming by Dr. Gabriele Lanro, Quan nyugen
2. Core Python Programming, By Dr.R Nagaeshwar Rao.
3. Python All-in-One for Dummies by John Sovic.

Open e-Resource:

1. https://www.w3schools.com/python/
2. https://www.javatpoint.com/python-tutorial
3. NPTEL Video lecture on Python Programming
4. Turtle - https://docs.python.org/2/library/turtle.html
5. PyLab - https://scipy.github.io/old-wiki/pages/PyLab
   Anaconda software

List of Suggested Experiments:

1. Write a program to perform basic mathematical operations.
2. Write a program to find largest element in array.
3. Write a program to use various string functions.
4. Write a program to print addition of 5 elements of an array using looping structure.
5. Write a program to demonstrate the use of conditional structure.
6. Write a program to find sum of all elements in the directory.
7. Write a program to swap to elements in a list.
8. Write a program to sort python directories by key or a value.
9. Write a program to demonstrate the user defined function creation & calling.
10. Demonstrate a program that show the use of python library.

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

Course Objective:

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

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	0	2	4	70	30	30	20	150

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

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

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

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

List of Textbooks:

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

List of Reference Books:

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

Open e-Resource:

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

List of Suggested Experiments:

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

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

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

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

Course Objective:

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

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

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

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

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

Course Outcome:

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

List of Textbooks:

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

List of Reference Books:

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

Open e-Resource:

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

List of Suggested Experiments:

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

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

Gandhinagar Institute of Technology
B.Tech CE/IT/CSE/CS/AI/ICT
Semester 3

Subject Code: 10050304	**Subject Title: Digital Electronics**
Pre-requisite: Fundamentals of Basic Electronics	

Course Objective:

1. To present a problem oriented introductory knowledge of digital circuits and its applications.
2. To focus on the study of electronic circuits.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	0	3	70	30	00	00	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Fundamentals Of Digital Systems & Logic Families** :Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, Number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, Binary Addition & Subtraction, codes, Error detecting and correcting codes. TB: 1 Ch-1 NPTEL	8	20
2	**Combinational Digital Circuits & Logic:** The Half adder, the Full adder, subtractor circuit. Multiplxer de-multiplexer, decoder, BCD to seven segment Decoder, encoder's functions, K-map representation, and simplification of logic functions using K-map, Minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders. TB: 1 Ch-4 NPTEL	8	20
3	**Flip Flop & Timing Circuit:** Set-reset laches, D- Flip-flop, R-S Flip-flop, J-K Flip-flop, Master slave Flip-flop, Edge triggered	5	15

	Flip-flop, T Flip-flop. TB: 1 Ch-5 NPTEL		
4	**Registers & Counters:** Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register. TB: 1 Ch-6 NPTEL	5	15
5	**Semiconductor Memories & Programmable Logic Devices:** Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA). RB: 1 Ch-18 NPTEL	5	15

Course Outcome:

1. Understand working of logic families and logic gates
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.

List of Text Books:

1. Digital Fundamentals by Morris and Mano, PHI Publication

List of Reference Books:

1. Fundamental of digital circuits by A. ANANDKUMAR,PHI Publication
2. Digital Fundamentals by FLOYD & JAIN, Pearsons Pub
3. Fundamentals of Logic Design by Charles H. Roth Thomson

Open e-Resource:

1. https://sourceforge.net/projects/circuit/
2. https://onlinecourses.nptel.ac.in/noc20_ee32/preview

Gandhinagar Institute of Technology
B.Tech Robotics & Automation
Semester 3

Subject Code: 11280301	**Subject Title: Principles of Robotics**
Pre-requisite: Familiarity with basic physics and algebra	

Course Objective:

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

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	-	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Robots and Robotics:** Definition and overview of Robotics, History and Evolution of Robots, Robotic System, Mechanics of Robotics (Multidisciplinary Areas in Robotics), Degrees of Freedom of a Joint, Degrees of Freedom of a System, Introduction to Manipulator, Classification of Robots, Workspace of Manipulators	4	15
2.	**Sensors and Actuators:** Overview of Sensors in Robotics, Classification of Sensors, Characteristics of Sensors, Overview of Actuators, Types of Actuators (Electric, Pneumatic, Hydraulic)	8	17
3.	**End Effectors and Application of Robots:** Robot End-Effectors, Classification of Grippers, Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications, Economic Analysis	8	18
4.	**Principles of Robot Kinematics:** Basics of 2D and 3D Transformation-Scaling, Rotation, Translation, Homogeneous transformation	10	25

5.	**Robot Programming and Control with Microcontroller:** Introduction to Arduino IDE, Digital and Analog I/O, Interfacing sensors (e.g., ultrasonic, IR, line follower) and actuators (e.g., DC motors, servo motors), Basic programming concepts for robot movement and decision making.	15	25

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

1. Gain a comprehensive understanding of the fundamentals of robotics, classification, and mechanics of robotic systems and manipulators.
2. Analyze and classify various types of sensors and actuators, along with their corresponding characteristics, within robotic systems.
3. Acquire knowledge about different robot end-effectors and the diverse applications of robots across various industries.
4. Understand the principles of basic robot kinematics and frame transformations for matrix practice.
5. Program and control simple robotic systems using the Arduino platform.

List of References:

1. R.K. Mittal and I.J. Nagrath, "Robotics and Control", Tata McGraw Hill, New Delhi, 2003.
2. S.K. Saha, "Introduction to Robotics", Tata McGraw Hill Education, 2008.
3. Introduction to Robotics by J.J. Craig, Addison-Wesley Publishing Company, 1986
4. James A Rehg, "Introduction to Robotics in CIM Systems", Prentice Hall of India, 2002.
5. Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", 2nd Edition, John Wiley & sons, Inc, 2007.
6. Deb S R, "Robotics Technology and Flexible Automation", Tata McGraw Hill, New Delhi, 1994.

Open e-Resource:

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

List of Suggested Practical:

1. To study and demonstrate various sensors and actuators for robotics systems.
2. To study robot applications in various trending fields.
3. To study and demonstrate the robotic arm, its configuration, and end effectors.
4. Introduction to Microcontrollers - Arduino UNO board.
5. Interfacing and programming an ultrasonic sensor with Arduino to measure distance and detect obstacles.
6. Controlling a servo motor for precise angular positioning using Arduino.
7. Implementing basic movements (forward, backward, left turn, right turn) for a mobile robot using Arduino and two DC motors.

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

Course Objective:

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

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

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

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

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

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

List of Reference Books:

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

Open e-Resource:

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

List of Suggested Experiments:

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

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 4

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

Course Objective:

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

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

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

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

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

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

List of Reference Books:

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

Open e-Resource:

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

List of Suggested Tutorials:

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

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Gandhinagar Institute of Technology
B.Tech Electronics and Communication Engineering
Semester 4

Subject Code: 10040402	**Subject Title:** Control System Engineering
Pre-requisite: Knowledge of Linear differential equations, Differential equations and its solution, and Laplace transform.	

Course Objective:

(1) Understanding and predicting behavior of the system.
(2) Differentiate between the open loop and closed loop systems.
(3) Design and analysis of closed loop control systems.
(4) Analyze the condition for system stability.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Introduction to Control Systems:** Introduction, Brief History of Automatic Control, Examples of Control Systems, Engineering Design, Mechatronic Systems, The Future Evolution of Control Systems.	3	8
2	**Mathematical Models of Systems:** Differential Equations of Physical Systems, Linear Approximations of Physical Systems, The Laplace Transform, The Transfer Function of Linear Systems, Block Diagram Models, Signal-Flow Graph Models.	6	14
3	**State Variable Models:** The State Variables of a Dynamic System, The State Differential Equation, Signal-Flow Graph and Block Diagram Models, Alternative Signal-Flow Graph and Block Diagram Models, The Transfer	8	18

	Function from the State Equation , The Time Response and the State Transition Matrix.		
4	**Feedback Control System Characteristics:** Error Signal Analysis, Sensitivity of Control Systems to Parameter Variations ,Disturbance Signals in a Feedback Control System, Control of the Transient Response, Steady-State Error, The Cost of Feedback. Test Input Signals, Performance of Second-Order Systems, Effects of a Third Pole and a Zero on the Second-Order System Response,	6	16
5	**The Stability of Linear Feedback Systems:** The Routh-Hurwitz Stability Criterion, The Relative Stability of Feedback Control Systems, The Stability of State Variable Systems. The Root Locus Concept. The Root Locus Procedure, Parameter Design by the Root Locus Method, Sensitivity and the Root Locus, Three-Term (PID) Controllers	7	18
6	**Frequency Response Methods:** Frequency Response Plots, Frequency Response Measurements, Performance Specifications in the Frequency Domain, Log Magnitude and Phase Diagrams. Mapping Contours in the s-Plane, The Nyquist Criterion, Relative Stability and the Nyquist Criterion, Time-Domain Performance Criteria in the Frequency Domain, System Bandwidth, The Stability of Control Systems with Time Delays	6	14
7	**The Design of Feedback Control Systems:** Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods.	5	12

Course Outcome:

CO1: Apply systems theory in order to obtain models that are expressed using differential equations and transfer functions.
CO2: Predict system behavior based on the mathematical model of that system in time or frequency Domain.
CO3: Analyze the behavior of closed loop systems using tools such as root locus, Routh Hurwitz, Bode and Nyquist.
CO4: Devise a safe and effective method of investigating a system identification problem in the lab

List of Text Books:

1. Control Systems Engineering by Nagrath and Gopal New Age Publication
2. Feedback and Control Systems by Joseph J Distefano 2nd Edition TMH

List of Reference Books:

1. Modern Control System by Richarc C. Drof and Robert H. Bishop,11th Edition Person Int.
2. Modern Control Engineering by Katsuhiko Ogata, 4th Edition, Prentice Hall of India.

3. Automatic Control Systems by Benjamin C.Kuo, 8th Edition, Farid Golnaraghi, John Wiley & Sons.

Open e-Resource:

Courses available through NPTEL.
- website : nptel.ac.in

List of Suggested Experiments:

1. Simulation of DC motor working
2. Simulation of synchros
3. Generating standard test signals i.e. step, ramp, unit impulse on a simulator
4. Analysis of time response of second order system
5. Effect of P, PD, PI, PID Controller on a second order systems.
6. Plotting root locus of a given transfer function using a simulator
7. Temperature control using PID
8. Plotting phase magnitude plot of a given transfer function with a simulator.
9. Obtaining frequency response of a common emitter amplifier and plotting on a Bode plot.
10. Simulation of a given transfer function using OPAMPs
11. Stability Analysis (Root locus, Bode, Nyquist) of Linear Time Invariant System.
12. Study of a PLL as a closed loop control system on a simulator..

Gandhinagar Institute of Technology
B.Tech Robotics & Automation (R&A)
Semester 4

Subject Code: 11280401	**Subject Title: Programming Embedded Systems with Microcontrollers**
Pre-requisite: Basic knowledge of electronics	

Course Objective:

This course introduces students to the foundational concepts of embedded systems and microcontrollers, with a focus on Arduino platforms. Students will learn the architecture, programming, and interfacing of microcontrollers to design automation and control systems. Through practical exposure and guided projects, learners will acquire skills in working with sensors, actuators, and communication protocols, which are essential in robotics and automation applications.

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	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Embedded Systems and Microcontrollers:** Definition, characteristics, and applications of embedded systems – Difference between microprocessor and microcontroller – Overview of 8051, AVR, Arduino – Functional block diagram of microcontroller – Embedded tools: IDEs, programmer, debugger	5	15
2.	**Arduino Architecture and Programming:** Arduino Uno architecture: CPU, memory, I/O ports – Pin configuration – Programming in Arduino IDE using C/C++ – Digital and analog I/O – Delay, loops, functions, decision-making – Arithmetic & logic operations	10	20
3.	**Peripheral Interfacing and I/O Devices:** Interfacing digital inputs/outputs (LED, switches, buzzers) – Display interfaces (7-segment, 16x2 I2C LCD) – Sensor interfacing (DHT11, IR, LDR, ultrasonic) – Actuators (relay, motor, servo, solenoid) – Motor control using PWM – Applications: Smart fan, traffic light system	10	20
4.	**Communication Protocols:** Serial communication (UART with Serial Monitor) – I2C and SPI with modules – Bluetooth (HC-05) communication using AT commands – Wi-Fi (ESP8266/NodeMCU) integration – Sending data to	10	20

	Blynk/Thingspeak/dashboard		
5.	**Embedded System Design and Applications:** Embedded system design flow – RTC and Watchdog Timer – Selection of microcontroller for real-world application – Case studies: line follower robot, smart bin, RFID attendance system – Mini project planning and documentation	10	25

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

1. Understand the architecture and basic operation of microcontrollers used in embedded systems.
2. Write simple programs for Arduino using embedded C for automation tasks.
3. Interface sensors, actuators, and displays with a microcontroller for real-world applications.
4. Apply communication protocols and wireless modules for data exchange.
5. Design small-scale embedded projects integrating hardware and software components.

List of References:

1. Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill, 2016
2. Muhammad Ali Mazidi, Rolin D. McKinlay and Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C For Pic 18", Pearson Education, 2016
3. Massimo Banzi & Michael Shiloh, "Getting Started with Arduino", Maker Media, 3rd Edition
4. Santanu Chattopadhyay, "Embedded system Design" 2nd Edition, PHI Learning Private Limited, 2013

Open e-Resource:

https://nptel.ac.in/courses/108102045

List of Suggested Practical:

1. To simulate and execute basic LED blinking and input control using the microcontroller
2. To interface a 16x2 I2C LCD with Arduino to display temperature and humidity using a DHT11 sensor.
3. To control the speed of a DC fan using PWM based on light intensity sensed by an LDR.
4. To implement an obstacle detection system using IR and ultrasonic sensors with visual and audio alerts.
5. To develop a gesture-controlled LED or servo system using a flex sensor and Arduino.
6. To measure and display heart rate using a heart rate sensor and trigger alerts based on threshold levels.
7. To automate device control using a Real-Time Clock (RTC) module and relay, based on scheduled timings.
8. To control actuators wirelessly using a Bluetooth module and a custom-built Android interface.
9. Mini Project: To design and develop an integrated embedded system application using sensors, actuators, and communication modules.

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Gandhinagar Institute of Technology
Bachelor of Technology
Semester 4

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

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

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

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

Course Outcome:

After Completion of this Course Students will be able to:

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

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

List of Reference Books:

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

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

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

Course Objective:

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

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

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

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

Course Outcome:

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

List of Reference Books:

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

Open e-Resource:

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

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

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

Course Objective:

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

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
4	0	2	5	70	30	30	20	150

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

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

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

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

List of References:

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

Open e-Resource:

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

List of Suggested Experiments:

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

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

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

Course Objective:

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

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

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

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

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

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

List of References:

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

Open e-Resource:

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

List of Suggested Tutorials:

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

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

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 5

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

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

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

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

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

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

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

List of References:

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

Open e-Resource:

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

GANDHINAGAR UNIVERSITY

Gandhinagar Institute of Technology
B.Tech Mechanical Engineering
Semester 5

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

Course Objective:

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

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

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

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

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

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List of References:

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

Open e-Resource:

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

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Gandhinagar Institute of Technology
B.Tech ECE
Semester V

Subject Code: 10040505	**Subject Title: Internet of Things**
Prerequisite: C Programming, Microprocessor, Networking	

Course Objective:

1. To understand the application areas of IoT.
2. To understand the building blocks of the Internet of Things and characteristics.
3. To understand the revolution of the Internet in Mobile Devices, Cloud & Sensor networks.

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	3	70	30	0	0	100

	Subject Contents			
Sr. No.	**Topic**	**IEEE Blended**	**Total Hours**	**Weight (%)**
1	**Introduction to Internet of Things:** Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling, technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN, Industrial IOT and Consumer IOT, IOT Functional Blocks. CH.1 : TB.1	**IEEE**	5	15
2	**Sensors, Microcontrollers, and Their Interfacing:** Sensor interfacing,Types of sensors, Controlling sensors, Microcontrollers, ARM, Thing Architecture. NPTEL : week 4	**IEEE**	5	15
3	**Protocols for IoT :** Messaging protocols, Transport protocols, IPv4, IPv6,URI (Layer), Information Sensing Actuation. NPTEL : week 3	**IEEE**	8	10

4	**Cloud for IoT:** IoT and cloud, Fog computing, Security in cloud, Case study, Nano Technology & Industry 4.0, (Technology that support IOT growth – cloud). NPTEL : week 9	**IEEE**	6	10
5	**Application Building with IoT:** Various application of IoT : Food,Healthcare, Lavatory maintenance, Water quality, Warehouse, Retail, Driver Assistance, Collision impact, M2M & IOT. CH.6 & 7 : TB.1	**IEEE**	6	20
6	**Arduino and Raspberry Pi:** Arduino : Architecture, Programming and Application Raspberry Pi : Architecture, Programming and Application NPTEL : week 5	**IEEE**	8	15
7	**IoT Security:** Various security issues and need, architecture, requirement, challenges andalgorithms, Standards: National and International Scenario. CH.8 : TB.1	**IEEE**	4	15

Course Outcome:

1. Demonstrate the architecture and functioning of IoT systems including the sensors and microcontrollers with their interfacing and software need considering application areas.
2. Diagnose the various IoT protocols with detailing of their elements and overall functioning within IoT systems for efficient communication.
3. Design an IoT system to take the benefit of the Clouds for computing and storage considering security issues.
4. Leverage the benefits of IoT technologies for automating the various real-life challenges in various application areas.
5. Develop the software components of an IoT system using Arduino/Raspberry Pi Programming.

List of Textbooks:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet ofThings by David Hanes, Gonzalo Salgueiro, Patrick Grossetete
2. Learning Internet of Things by Peter Waher
3. 5G for the Connected World" by Devaki Chandramouli, Rainer Liebhart

List of Reference Books:

1. Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley India
2. IoT Fundamentals, David Hence at el, Cisco Press
3. 21 IoT Experiments, Yashavant Kanetkar, Shrirang Korde, BPB
4. IoT Based Projects, Rajesh Singh at el, BPB

Open e-Resource:

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. https://aws.amazon.com/iot/

List of Suggested Experiments:

Practical should be performed by students based on
- Using Arduino or Raspberry Ri boards and its software platforms

Gandhinagar Institute of Technology
B.Tech Robotics and Automation
Semester 5

Subject Code: 11280501	**Subject Title: Kinematics and Dynamics of Robotic Manipulators**
Pre-requisite: Engineering Mathematics (Matrices, vectors, and coordinate transformations), Principles of Robotics, Engineering Mechanics	

Course Objective:

1. To develop understanding of coordinate transformations and kinematic modeling of robotic manipulators.
2. To Analyze forward and inverse kinematics, velocity relationships, and Jacobian of robotic arms.
3. To Study dynamic modeling and trajectory planning of robotic manipulators.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	1	0	5	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Coordinate Frames and Homogeneous Transformations:** Representation of an Object in 3-D Space, Representation of the Position & orientation, Translator & Rotational operators, Frame transformation, Homogenous transformation matrix, Representations of position & orientation in other than cartesian coordinate system	8	13
2.	**Forward Kinematics of Robotic Manipulators:** Denavit–Hartenberg (D–H) parameters, D–H parameter assignment rules, Forward kinematics of 2-DOF planar robot, 3-DOF articulated robot, SCARA robot	12	20
3.	**Inverse Kinematics & Workspace Analysis:**	10	17

	Inverse kinematics problem formulation, Geometric and algebraic approaches, Multiple solutions and configuration space, Workspace constraints, Singularities in manipulators		
4.	**Differential Kinematics & Jacobian Analysis:** Linear and angular velocities, Relationship between joint rates and end-effector velocity, Jacobian matrix derivation, Jacobian singularities, Force and torque relationships	10	17
5.	**Dynamics of Robotic Manipulators:** Review of rigid body dynamics, Forces and torques in robotic arms, Newton–Euler formulation, Lagrange–Euler formulation, Equations of motion, Inertia, Coriolis, centrifugal, and gravity terms, Dynamics of a 2-DOF planar robot	12	20
6.	**Trajectory Planning of Robotic Manipulators:** Introduction to trajectory planning, Joint space vs Cartesian space trajectory, Various trajectory functions, Polynomial trajectory function, Linear trajectory function	8	13

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

1. Apply coordinate transformations and homogeneous matrices to represent position and orientation of robotic manipulators.
2. Develop forward kinematic models of robotic manipulators using Denavit–Hartenberg parameters.
3. Analyze inverse kinematics and workspace of robotic manipulators.
4. Evaluate velocity relationships and singularities using Jacobian matrices.
5. Formulate dynamic equations of motion of robotic manipulators using Newton–Euler and Lagrange methods.
6. Design basic trajectory planning methods for robotic manipulators.

List of Reference Books:

1. Introduction to Robotics: Mechanics and Control, John J. Craig, 3rd Edition, Pearson Education, 2005
2. Robot Modeling and Control, Mark W. Spong, Seth Hutchinson and M. Vidyasagar, John Wiley & Sons, 2006.
3. Robotics: Modelling, Planning and Control, Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani and Giuseppe Oriolo, Springer, 2009.
4. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Prentice Hall of India, 2009.
5. Introduction to Robotics, S. K. Saha, 2nd Edition, Tata McGraw Hill Education, 2014.

Open e-Resource:

1. https://nptel.ac.in/courses/112104298
2. https://nptel.ac.in/courses/112105249

List of Tutorials:

1. Homogeneous transformation matrix calculations.
2. Frame transformation problems.
3. DH parameter table development.
4. Forward kinematics numerical problems.
5. Inverse kinematics geometric solutions.
6. Workspace determination of manipulators.
7. Jacobian matrix derivation and velocity analysis.
8. Dynamic torque calculations for planar manipulators.
9. Polynomial trajectory calculations.

Gandhinagar institute of Technology
B.Tech Robotics & Automation Engineering
Semester 5

Subject Code: 11280511	**Subject Title: Smart Manufacturing**
Pre-requisite:- Zeal to learn the subject	

Course Objective:

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

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Unconventional Machining Processes:** **Mechanical Energy Based Processes** Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM). Working Principles – equipment used – Process parameters – MRR- Applications. **Electrical Energy Based Processes** Electric Discharge Machining (EDM)- working Principle- equipment used - Process Parameters - Surface Finish and MRR - electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications. **Chemical and Electro-Chemical Energy Based Processes** Chemical machining and Electro - Chemical machining (CHM and ECM) - Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR - Applications. Principles of ECM - equipments- Surface Roughness and MRR Electrical circuit-Process Parameters- ECG and ECH - Applications.	20	30
2.	**Rapid Prototyping** Introduction Stereo Lithography Systems Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP	10	30

	systems. Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application **Selective Laser Sintering Fusion Deposition Modelling** Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications. **Solid Ground Curing** Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application. **Concepts Modelers** Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems		
3.	**Introduction to Laser cutting** Definition and concept, Need in modern automated manufacturing, Comparison with conventional cutting **Types of Lasers cutting:** CO_2 Laser Fiber Laser Nd: YAG Laser Comparison: Wavelength Efficiency Suitable materials Power range, Working Principle Generation of laser beam, Beam focusing using optics, Interaction of laser with material, Melting, burning, vaporization mechanism Equipment Used, Process Parameters**,** Automation & Robotics Integration CNC based laser cutting, 3D laser cutting, Integration with CAD/CAM, Advantages, Limitations, Applications (Robotics Focused)	10	20
4.	**Composite Materials** Introduction, Classification of composites, Manufacturing methods : Spray Lay-Up, Wet/Hand Lay-up, Vacuum Bagging, Filament Winding, Pultrusion, Resin Transfer Moulding (RTM), Resin Film Infusion (RFI), Mechanical Properties -Stiffness and Strength	5	20

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

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

List of References:

1. Unconventional Machining process, Dr. Senthil, A R S Publishers
2. Modern Machining Processes, P. C. Pandey, H. S. Shan, Tata McGraw-Hill 3. Design for Advanced Manufacturing: Technologies and Processes, LaRoux K. Gillespie, McGraw-Hill Education

3. Advanced Machining Processes / Non Traditional and Hybrid Machining Processes, Hassan El-Hofy,McGraw-Hill
4. The Handbook of Glass Manufacture, F.Tooley, Tooley, New York : Books for Industry, [1974]
5. 3D Printing and Additive Manufacturing: Principles and Applications, Chee Kai Chua and Kah Fai Leong, World Scientific
6. Rapid Prototyping, Adithan M., Atlantic Publisher
7. Laser Cutting Guide for Manufacturing – Charles L. Caristan (Society of Manufacturing Engineers)
8. *Laser Material Processing* – W. M. Steen A classic comprehensive text covering fundamentals of lasers, material interactions, cutting, welding, surface processing, and automation.

Open e-Resource:

https://nptel.ac.in/courses/112104312

List of Suggested Experiments:

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

Gandhinagar Institute of Technology
B.Tech Robotics and Automation
Semester 5

Subject Code: 11280512	**Subject Title: Robotics & Automation for Manufacturing**
Pre-requisite: Engineering Mathematics, Principles of Robotics, Kinematics, Manufacturing Processes	

Course Objective:

1. To develop understanding of industrial robots, their classifications, and applications in modern manufacturing environments.
2. To analyze robot programming, end-effectors, and sensors used in automated manufacturing systems.
3. To study automation concepts, flexible manufacturing systems, and integration of robots in production lines.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
3	0	2	4	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Industrial Robotics:** Classification of robots (by geometry, motion, and control), Robot anatomy and joint notation, Work envelope and degrees of freedom, Robot specifications and performance parameters, Overview of robot manufacturers and industry standards	6	13
2.	**End-Effectors and Sensors in Manufacturing:** Types of end-effectors – grippers and tools, Mechanical, pneumatic, and vacuum grippers, Force/torque sensors, proximity sensors, vision sensors, Sensor integration for feedback control, Tool changers and compliance devices	8	20
3.	**Robot Programming and Simulation:** Teach pendant and online programming, Robot programming languages (VAL, RAPID, KRL), Offline	8	17

	programming and simulation tools, Path planning for pick-and-place and welding tasks, Safety standards and interlocks in robot programming		
4.	**Automation in Manufacturing Processes:** Robot applications in welding (arc, spot), painting and coating, Assembly automation, Machine loading/unloading, Inspection and quality control, Collaborative robots (Cobots) in manufacturing	8	17
5.	**Flexible Manufacturing Systems (FMS):** Introduction to FMS and its components, Material handling systems – AGVs and conveyors, Computer Numerical Control (CNC) and integration with robots, Group technology and cellular manufacturing, FMS layouts and scheduling	8	20
6.	**Industry 4.0 and Smart Manufacturing:** Introduction to Industry 4.0 concepts, IoT in manufacturing automation, Digital twin and cyber-physical systems, SCADA, PLC, and HMI integration, Robot-to-robot and robot-to-machine communication, Case studies in smart factory implementation	8	13

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

1. Classify industrial robots based on geometry, motion type, and application in manufacturing environments.
2. Select appropriate end-effectors and sensors for specific manufacturing automation tasks.
3. Develop robot programs using teach pendant and offline programming tools for manufacturing processes.
4. Apply robotic automation to welding, assembly, painting, and inspection operations.
5. Design and analyze flexible manufacturing systems integrating robots, CNC, and material handling equipment.
6. Evaluate Industry 4.0 technologies and their integration with robotic manufacturing systems.

List of Reference Books:

1. Industrial Robotics: Technology, Programming and Applications, Mikell P. Groover, McGraw-Hill, 2nd Edition, 2000.
2. Automation, Production Systems and Computer Integrated Manufacturing, Mikell P. Groover, Pearson Education, 4th Edition, 2015.
3. Robotics and Automation in Industry, K. Shimon, CRC Press, 2001.
4. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, Wiley, 2nd Edition, 2010.
5. Flexible Manufacturing Systems, A. Raouf and M. Ben-Daya, Chapman & Hall, 1995.

Open e-Resource:

1. https://nptel.ac.in/courses/112105319

List of Tutorials:

1. Study and identification of industrial robot components and joints.
2. Robot teach pendant programming – basic motion commands.
3. Pick-and-place operation using a robotic arm.
4. Simulation of robot trajectory using offline software (RobotStudio/KUKA Sim).
5. Gripper and sensor interfacing with a robot controller.
6. Robot-based assembly task programming.
7. PLC-robot integration for a conveyor loading task.
8. Vision-guided robot pick operation.
9. Study of an FMS model/simulation environment.
10. Mini-project: Design and implement an automated manufacturing cell.

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 6

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

Course Objective:

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

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	70	30	30	20	150

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

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

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

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

List of References:

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

Open e-Resource:

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

List of Suggested Experiments:

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

Gandhinagar institute of Technology
B.Tech Mechanical Engineering
Semester 6

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

Course Objective:

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

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

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

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

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

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

List of References:

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

Open e-Resource:

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

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

List of Suggested Tutorials:

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

Gandhinagar Institute of Technology
B.Tech Robotics and Automation
Semester 6

Subject Code: 11280601	**Subject Title: Wheeled Mobile Robots**
Pre-requisite: Engineering Mathematics (Matrices, vectors, and coordinate transformations), Principles of Robotics, Kinematics and Dynamics of Robotic Manipulators	

Course Objective:

1. To develop understanding of mobile robot classifications, locomotion principles, and kinematic/dynamic modeling of wheeled mobile robots.
2. To study sensor systems, localization techniques, and mapping methods used for mobile robot navigation.
3. To analyze motion planning, path planning, and motion control strategies for wheeled mobile robots.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Mobile Robots:** Types of mobile robots, locomotion principles, mobile manipulators, applications	10	13
2.	**Kinematics of Wheeled Mobile Robots:** DOF and maneuverability, wheel configurations, holonomic and non-holonomic robots	12	20
3.	**Dynamics of Mobile Robots:** Lagrange-Euler and Newton-Euler methods, numerical simulation of wheeled robots	12	17
4.	**Sensors for Navigation:** Position sensors, gyroscope, accelerometer, proximity sensors, laser scanner, vision systems	12	17
5.	**Localization and Mapping:** Localization methods, error propagation, probabilistic mapping, SLAM	8	20

6.	**Motion Planning and Control:** Path planning, obstacle avoidance, kinematic and dynamic control, swarm and autonomous robots	8	13

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

1. Classify mobile robots and explain their locomotion principles.
2. Develop kinematic and dynamic models of wheeled mobile robots.
3. Select appropriate sensors for mobile robot navigation and localization.
4. Apply SLAM and probabilistic methods for autonomous map building.
5. Design motion planning and control strategies for wheeled mobile robots.

List of Reference Books:

1. Introduction to Autonomous Mobile Robots, Roland Siegwart et al., MIT Press, 2nd Edition, 2011.
2. Probabilistic Robotics, Sebastian Thrun et al., MIT Press, 2005.
3. Robot Modeling and Control, Mark W. Spong et al., John Wiley & Sons, 2006.
4. Mobile Robotics: Mathematics, Models, and Methods, Alonzo Kelly, Cambridge University Press, 2013.

Open e-Resource:

1. https://nptel.ac.in/courses/112106298

List of Tutorials:

1. Study of wheeled mobile robot components and wheel configurations.
2. Kinematic model simulation of a differential drive robot.
3. Dynamic model simulation using Lagrange-Euler formulation.
4. Interfacing and calibration of IMU, encoder, and ultrasonic sensors.
5. Dead reckoning implementation for robot position estimation.
6. Obstacle detection and avoidance using proximity sensors.
7. SLAM implementation using simulation environment.
8. Path planning using A* algorithm in simulation.
9. Trajectory tracking using kinematic controller.
10. Mini-project: Autonomous navigation using a wheeled mobile robot.

Gandhinagar Institute of Technology
B.Tech Robotics and Automation
Semester 6

Subject Code: 11280602	**Subject Title: Artificial Intelligence and Machine Learning for Robotics**
Pre-requisite: Programming (Python/C++), Principles of Robotics	

Course Objective:

1. To introduce fundamental concepts of Artificial Intelligence and its applications in robotics.
2. To understand basic machine learning algorithms and their role in robotic perception and decision making.
3. To apply AI/ML techniques to simple robotic tasks such as classification, object detection, and path planning.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	0	2	5	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to AI for Robotics:** What is AI, history and evolution, AI vs traditional programming, applications of AI in robotics, overview of AI subfields	10	13
2.	**Python for AI and Robotics:** Python basics, NumPy, Pandas, Matplotlib, introduction to scikit-learn, data handling and visualization	12	20
3.	**Supervised Learning:** Regression and classification concepts, Linear regression, Logistic regression, Decision trees, K-Nearest Neighbors (KNN), Model evaluation and accuracy	12	17
4.	**Unsupervised Learning:** Clustering concepts, K-Means clustering, Principal Component Analysis (PCA), Applications in robot perception and data grouping	12	17

5.	**Neural Networks and Deep Learning Basics:** Biological vs artificial neuron, Perceptron, Multilayer neural network, Activation functions, Backpropagation, Introduction to Convolutional Neural Networks (CNN)	8	20
6.	**AI/ML Applications in Robotics:** Object detection and recognition, Robot vision basics, Reinforcement learning introduction, AI for path planning, Real-world robotic AI case studies	8	13

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

1. Explain the fundamental concepts of Artificial Intelligence and its relevance to robotics.
2. Use Python libraries to handle, process, and visualize data for AI applications.
3. Apply supervised learning algorithms for classification and regression tasks.
4. Implement unsupervised learning techniques for data grouping and dimensionality reduction.
5. Understand the structure and working of neural networks and basic deep learning models.
6. Apply AI/ML techniques to robotic perception, object detection, and navigation tasks.

List of Reference Books:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Pearson, 4th Edition, 2020.
2. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow, Aurélien Géron, O'Reilly, 2nd Edition, 2019.
3. Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016.
4. Programming Robots with ROS, Morgan Quigley et al., O'Reilly, 2015.

Open e-Resource:

1. https://nptel.ac.in/courses/112106298

List of Practicals:

1. Python basics – variables, data types, and simple input/output programs.
2. Python control flow – if-else conditions and loops (for, while).
3. Python functions – defining, calling, and returning values.
4. Python lists, tuples, and dictionaries – storing and accessing data.
5. NumPy basics – arrays, matrix operations, and mathematical functions.
6. Matplotlib – plotting graphs, bar charts, and scatter plots.
7. Pandas – loading a CSV file, exploring and filtering data.
8. Data preprocessing – handling missing values and normalizing data.
9. Teachable Machine – training an image classification model using Google Teachable Machine.
10. Teachable Machine – training a pose/sound recognition model and testing in real-time.
11. Implementing Linear Regression on a simple dataset using scikit-learn.

12. Mini-project: Train a model using Teachable Machine or Keras to classify robot sensor/image data.

Gandhinagar Institute of Technology
B.Tech Robotics and Automation
Semester 6

Subject Code: 11280611	**Subject Title: Design Thinking for Robotics**
Pre-requisite: Principles of Robotics, Basic Engineering Design	

Course Objective:

1. To introduce the design thinking process and its application in solving real-world robotics problems.
2. To develop creative problem-solving, prototyping, and user-centered design skills in robotics engineering.
3. To enable students to ideate, prototype, and test innovative robotic solutions through structured design methodology.

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	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Design Thinking:** What is design thinking, design thinking vs engineering design, five stages of design thinking – Empathize, Define, Ideate, Prototype, Test	4	13
2.	**Empathize and Define:** Understanding user needs, stakeholder analysis, observation and interview techniques, problem framing and defining the design challenge	4	20
3.	**Ideation Techniques:** Brainstorming, mind mapping, SCAMPER technique, lateral thinking, generating multiple solutions for a robotic design problem	6	17
4.	**Prototyping for Robotics:** Types of prototypes – paper, digital, physical, rapid prototyping tools (3D printing, CAD), low-fidelity vs high-fidelity prototypes	6	17
5.	**Testing and Iteration:** User testing methods, feedback collection, iterating on design, failure analysis and learning, design refinement	4	20

6.	**Design Thinking in Robotics Applications:** Case studies of human-centered robot design, social robots, assistive robots, wearable robots, design ethics and sustainability	4	13

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

1. Explain the five stages of design thinking and apply them to robotics problems.
2. Identify user needs and define clear problem statements for robotic system design.
3. Generate and evaluate multiple creative ideas using structured ideation techniques.
4. Create low-fidelity and high-fidelity prototypes for robotic concepts.
5. Test, gather feedback, and iterate on robotic designs effectively.
6. Apply design thinking principles to real-world robotics and automation challenges.

List of Reference Books:

1. Change by Design, Tim Brown, HarperBusiness, 2009.
2. Design Thinking: Understanding How Designers Think and Work, Nigel Cross, Berg Publishers, 2011.
3. Creative Confidence, Tom Kelley and David Kelley, Crown Business, 2013.
4. The Design of Everyday Things, Don Norman, Basic Books, Revised Edition, 2013.

Open e-Resource:

1. https://nptel.ac.in/courses/110106124

Gandhinagar Institute of Technology
B.Tech Robotics and Automation
Semester 6

Subject Code: 11280612	**Subject Title: Product Design in Robotics**
Pre-requisite: Engineering Drawing, Principles of Robotics	

Course Objective:

1. To introduce the product design process and its application in developing robotic products.
2. To understand mechanical, electrical, and software integration aspects of robotic product development.
3. To enable students to design, prototype, and evaluate a complete robotic product from concept to realization.

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	70	30	0	0	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Introduction to Product Design:** Product design vs engineering design, product development lifecycle, market needs and product specifications, introduction to robotic products	4	13
2.	**Concept Development and Selection:** Generating product concepts, morphological charts, concept screening and scoring, Pugh matrix, selecting the best concept	4	20
3.	**Mechanical Design for Robotics:** Structural design considerations, material selection, design for manufacturability, CAD modeling for robotic products	6	17
4.	**Electronics and Software Integration:** Sensor and actuator selection, PCB and wiring basics, microcontroller integration, software architecture for robotic products	6	17
5.	**Prototyping and Testing:** Rapid prototyping methods, 3D printing and fabrication, functional testing, design validation and verification	4	20

6.	**Product Launch and Design Ethics:** Packaging and branding basics, safety standards and certifications, intellectual property basics, sustainable and ethical design in robotics	4	13

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

1. Describe the product design lifecycle and apply it to robotic product development.
2. Generate and evaluate product concepts using structured selection methods.
3. Perform basic mechanical design and CAD modeling for a robotic product.
4. Integrate sensors, actuators, and microcontrollers into a functional robotic product.
5. Build and test a prototype of a robotic product and validate its performance.
6. Apply safety, ethical, and sustainability considerations in robotic product design.

List of Reference Books:

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, McGraw-Hill, 6th Edition, 2015.
2. Engineering Design: A Systematic Approach, Gerhard Pahl et al., Springer, 3rd Edition, 2007.
3. Making Things Move, Dustyn Roberts, McGraw-Hill, 2011.
4. Designing Robots, Roger Arrick and Nancy Stevenson, O'Reilly, 2016.

Open e-Resource:

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

Bloom's Taxonomy