



Three-Year Diploma Programme

Diploma in Mechatronics Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering & Technology
Diploma in Mechatronics Engineering

1. Vision of the Department

To be recognized for world-class technical education and research catering to the ever-changing industrial demands and social needs.

2. Mission of the Department

M1 To offer high-quality application-oriented education and prepare our graduates to become innovators in their profession.

M2 To pave the way to research and discovery in emerging disciplines and in related interdisciplinary areas.

M3 To inculcate communication skills, leadership, ethics, and entrepreneurship among students for their continuous growth

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the B.Tech. Electrical Engineering curriculum enables graduates to attain.

PEO 1	To develop technical skills (critical investigation, communication, analytical and computer) and human relations skills (group dynamics, team building, organization and delegation) to enable students to transform the acquired knowledge into action.
PEO 2	To inculcate critical analysis and communication skills into students to effectively present their views, both in writing and through oral presentations.
PEO 3	To provide an environment for exploring the Research & Development attitude, to help the students in Research and Development field.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	Engineering knowledge:	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	Problem analysis:	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	Design/development of solutions:	Design solutions for complex engineering problems and design system components or processes that meet the specified needs

		with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
PLO 4	Conduct investigations of complex problems:	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	Modern tool usage:	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	The engineer and society:	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	Environment and sustainability:	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PLO 8	Ethics:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	Individual and team work:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	Communication:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO 11	Project management and finance:	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	Life-long learning:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Learning Outcomes

PSO 1	Demand as per recent development	Design the solutions as per the recent industrial demand objective.
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PSO 2	Software skill	Test any apparatus and system with appropriate usage of software tools, and gather data for modelling system.
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6. Credit Framework

Semester wise Credit distribution of the programme		Category wise Credit distribution of the programme	
		Category	Credit
Semester-1	16.00	Major Core	60
Semester-2	19.00	Minor Stream	18
Semester-3	22.00	Multidisciplinary	16
Semester-4	21.00	Ability Enhancement Course	8
Semester-5	22.00	Skill Enhancement Courses	7
Semester-6	20.00	Value added Courses	2
		Summer Internship	2
		Research Project/Dissertation	09
Total Credits:	122	Total Credits:	122

7. Program Curriculum

Semester 1						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03602107	Applied Chemistry	3	3	0	0
2	03602108	Applied Chemistry Lab	1	0	2	0
3	03605101	Environmental Science	0	2	0	0
4	03605151	Engineering Mechanics	3	3	0	0
5	03605152	Engineering Mechanics Lab	1	0	2	0
6	03691101	Mathematics - I	3	2	0	1
7	03692153	Basic Physics	3	3	0	0
8	03692154	Basic Physics Lab	1	0	2	0

9	03693101	Communication Skills - I	1	1	0	0
Total			16	14	6	1
Semester 2						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
10	03606101	Introduction to IT Systems	1	1	0	0
11	03606102	Introduction to IT Systems Lab	2	0	4	0
12	03607151	Fundamentals of Electrical and Electronics Engineering	3	2	0	1
13	03607152	Fundamentals of Electrical and Electronics Engineering Lab	1	0	2	0
14	03609102	Engineering Graphics Lab	2	0	4	0
15	03609151	Fundamentals of Mechanical Engineering	3	2	0	1
16	03609154	Engineering Workshop Practice	2	0	4	0
17	03691151	Mathematics-II	4	3	0	1
18	03693151	Communication Skills - II	1	1	0	0
Total			19	9	14	3
Semester 3						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
19	03600201	Entrepreneurship and Start-ups	1	1	0	0
20	03633207	Fundamentals of Programming	3	3	0	0
21	03633208	Fundamentals of Programming Lab	1	0	2	0
22	03634201	Material Science and Metallurgy	3	3	0	0
23	03634202	Material Science and Metallurgy Lab	1	0	2	0
24	03634203	Analog and Digital Electronics	3	3	0	0
25	03634204	Analog and Digital Electronics Lab	1	0	2	0
26	03634207	Theory of Machines for Mechatronics	3	3	0	0
27	03634208	Theory of Machines for Mechatronics Lab	1	0	2	0
28	03634209	Measurements & Instrumentation	3	3	0	0
29	03634210	Measurements & Instrumentation Lab	1	0	2	0
30	03693201	Professional Communication and Critical Thinking	1	1	0	0
Total			22	17	10	0
Semester 4						

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
31	03600251	Essence of Indian Knowledge and Tradition	0	2	0	0
32	03633255	Control Engineering	3	3	0	0
33	03633256	Control Engineering Lab	1	0	2	0
34	03634251	Manufacturing Process	3	3	0	0
35	03634252	Manufacturing Process Lab	1	0	2	0
36	03634257	Microprocessor and Microcontroller	3	3	0	0
37	03634258	Microprocessor and Microcontroller Lab	1	0	2	0
38	03634259	Power Electronics	3	3	0	0
39	03634260	Power Electronics Lab	1	0	2	0
40	03634263	Design of Machine Elements	3	3	0	0
41	03634264	Design of Machine Elements Lab	1	0	2	0
42	03634268	Minor Project	1	0	2	0
Total			21	17	12	0
Semester 5						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
43	03634301	Hydraulic and Pneumatic Systems	3	3	0	0
44	03634302	Hydraulic and Pneumatic Systems Lab	1	0	2	0
45	03634303	Programmable Logic Controllers	3	3	0	0
46	03634304	Programmable Logic Controllers Lab	1	0	2	0
47	03634306	PROJECT-I	4	0	8	0
48	03634308	SUMMER INTERSHIP	2	0	0	0
49		PEC 01-LAB (Compulsory Subjects :1)	1	0	2	0
50		PEC 01 (Compulsory Subjects :1)	3	3	0	0
51		PEC 02 (Compulsory Subjects :1)	3	3	0	0
52		PEC 02-LAB (Compulsory Subjects :1)	1	0	2	0
Total			22	12	16	0
5PEC 01						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03634331	Computer Aided Design	3	3	0	0
2	03634333	Advanced Control Systems	3	3	0	0
5PEC 01-LAB						

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03634332	Computer Aided Design Lab	1	0	2	0
2	03634334	Advanced Control Systems Lab	1	0	2	0
5PEC 02						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03634335	Artificial Intelligence	3	3	0	0
2	03634337	Advanced Microcontrollers	3	3	0	0
5PEC 02-LAB						
Sr. No	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03634336	Artificial Intelligence Lab	1	0	2	0
2	03634338	Advanced Microcontrollers Lab	1	0	2	0
Semester 6						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
53	03600351	Indian Constitution	0	2	0	0
54	03633357	Internet of Things	3	3	0	0
55	03633358	Internet of Things Lab	1	0	2	0
56	03634351	Robotics Engineering	3	3	0	0
57	03634352	Robotics Engineering Lab	1	0	2	0
58	03634356	PROJECT-II	2	0	4	0
59	03634357	Quality and Reliability Engineering	4	3	0	1
60	03634358	Mechatronics Software Lab	2	0	4	0
61		PEC 03 (Compulsory Subjects :1)	3	3	0	0
62		PEC 03-LAB (Compulsory Subjects :1)	1	0	2	0
Total			20	14	14	1
6PEC 03						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03634381	Computer Integrated Manufacturing	3	3	0	0
2	03634383	Mechatronics System Design	3	3	0	0
3	03634385	Process Control	3	3	0	0
6PEC 03-LAB						

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03634382	Computer Integrated Manufacturing Lab	1	0	2	0
2	03634384	Mechatronics System Design Lab	1	0	2	0
3	03634386	Process Control Lab	1	0	2	0

8. Detailed Syllabus

Semester 1

(1)

- a. **Course Name:** Applied Chemistry
- b. **Course Code:** 03602107
- c. **Prerequisite:** Understanding of Basic knowledge of science for the application.
- d. **Rationale:** Science is the foundation for all technician courses. The basic aim of teaching science is to develop in the students the habit of scientific inquiry, ability to establish the cause and effect, relationship. Chemistry forms the part of applied science. The study of basic concepts of chemistry like chemical bonding, corrosion, water treatment, Organic chemistry and different engineering materials like polymers, adhesives, paints, lubricants, etc. will help the students understanding engineering subjects where the emphasis is laid on the application of these concepts Chemistry is concerned with the changes in structure and properties of matter. Many of the process which are involved to bring out this change forms the basis of engineering activities. Teaching of chemistry should be aimed at developing the right type of aptitude in the students and the ability to predict the result under given condition Thus good foundation basic science will help the students in their self-development.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of atomic structure, chemical bonding, and periodicity.
CLOBJ 2	Analyse and predict chemical reactions and their industrial applications.
CLOBJ 3	Apply principles of thermodynamics and electrochemistry to solve real-world problems.
CLOBJ 4	Explore the properties and applications of organic and inorganic materials in engineering
CLOBJ 5	Investigate water quality parameters and methods for water treatment.
CLOBJ 6	Demonstrate safe handling, storage, and disposal of chemicals in laboratory and industrial settings.

f. Course Learning Outcomes:

CLO 1	Understand the basic principles of chemistry, including atomic structure and chemical bonding.
CLO 2	Apply knowledge of materials chemistry to select suitable materials for mechatronic systems.
CLO 3	Analyse chemical reactions and their applications in energy production and industrial processes.
CLO 4	Understand the properties and behaviours of polymers, metals, and composites used in mechatronics.
CLO 5	Explore the environmental impact of chemicals and apply sustainable practices in engineering design.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Chemical Bonding and Catalysis Rutherford model of atom, Bohr's theory, Heisenberg uncertainty principle, Quantum numbers – orbital concept. 2. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration, Theory Of Valency , Electronic Configuration , Types of chemical bonds - Electrovalent bond, & its characteristics ,Covalent bond & its characteristics ,Coordinate bond , Hydrogen bond, its types and Significance , Metallic bond, Explanation of Metallic properties, Electron Sea Model , Intermolecular force of attraction ,Vander Waals force of attraction ,Catalysis, Types of catalysis , Theory of Catalysis , Characteristics of Catalyst , Types of Catalyst , Positive	10%	06

	Catalyst ,Negative Catalyst , Auto-catalyst Catalytic Promoter and Catalytic inhibitor Industrial Application of Catalyst.		
2	Concepts of Electrochemistry Introduction, Arrhenius theory of ionization., Degree of ionization, Factors affecting the degree of ionization, Definition of pH, pH of acid, base and neutral solution, pH calculations of acid, base and salt solution at different concentration, Importance of pH in various fields, Definition of buffer solution, Buffer Action & Types of buffer Solution, Application of buffer solutions, Electrolytes and Non-electrolytes, Types of electrolytes Definition the term ' Electrode ' the Types of Electrodes Inert electrode, Working electrode & Reference electrode; with suitable Illustrations. Construction & working of reference electrode, Hydrogen electrode, Calomel electrode, Quinhydrone electrode, Glass electrode, Ag/ Agcl/ Kcl electrode Kohlrausch Law of independent, Migration of ions, Construction and working of electrochemical cell , Standard conditions, Standard hydrogen electrodes, Nernst theory of single electrode potential & Nernst equation, Electrochemical series, galvanic series , Electrolysis, Faradays laws of electrolysis,. Industrial application of Electrolysis, conductance of solution (a) Conductivity (b) Specific Conductivity (c) Equivalent conductivity (d) Molar conductivity.	20%	08
3	Corrosion of metals & its prevention Definition of corrosion, Types of corrosion, Dry corrosion: Oxidation corrosion mechanism corrosion-mechanism, Nature of oxide film, Wet corrosion-mechanism, Concentration cell corrosion, Pitting corrosion, Waterline corrosion, Crevice corrosion, Stress Corrosion, Erosion Corrosion, Factors affecting the rate of corrosion, - Nature of film, Nature of Environment of Solution, Area of cathode anode and, Temperature, Moisture, Purity of metal, Methods of prevention of corrosion, Modification of environment, Modification of the properties of metal, Use of protective coatings., Anodic and cathodic protection, Modification in design and choice of material.	10%	05
4	Water Treatment Graphical presentation of water distribution on Earth (pie or bar diagram). Hard water and soft water. Types of hardness of water, Salts producing hardness of water, Method to express the hardness of water, Estimation of total hardness by EDTA Method, Examples to calculate the hardness, Effect of hard water in Boiler operation i. Scale and sludge formation and its	20%	07

	Prevention, Priming and foaming and its prevention, Caustic embrittlement and its prevention. Corrosion and its prevention, Softening of Water, Soda-Lime process, Permutt process, Ion Exchange process, Reverse Osmosis process, Treatment of Drinking water, Sedimentation, Coagulation, Filtration, Sterilization of water by chlorination Break-point chlorination-Graph., enlist Indian standard specification of drinking water.		
5	Lubricants Introduction and definition of lubricants and lubrication, function of lubricants, Types of lubrication, Fluid film lubrication, Boundary lubrication, Classification of lubricants, Solid lubricants, Semi-solid lubricants, Liquid lubricants, Synthetic oils, Physical Properties of lubricants and their significance like. Viscosity and viscosity index, Flash point and fire point, Pour point and cloud point, oiliness Chemical Properties of lubricants, Saponification value, Neutralization number iii. Emulsification number, Selection of lubricants for, Gears, Cutting tools, Steam turbine.	10%	05
6	Polymer, Elastomers & Adhesives Introduction and Definition of Polymer and Monomer, Classification of Polymer on basis of Molecular structure as Linear, Branch and Cross-linked polymers, Classification on basis of monomers (homopolymer and copolymer) Classification of Polymers on basis of Thermal behavior, (Thermoplastics& Thermosetting), Types polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis, properties and application of i. Polyethylene, Polypropylene iii. Polyvinyl chloride iv. Teflon v. Polystyrene vi. Phenol formaldehyde vii. Acrylonitrile viii. Epoxy Resin, Define the term-elastomer, Natural, rubber and its properties 5. vulcanization of rubber 6. Synthetic rubber, Synthesis, properties and uses, Buna-S Rubber ii. Buna-N Rubber, Neoprene Rubber, Definition of adhesives and Examples, Characteristics of adhesives Classification of adhesives and their uses.	20%	06
7	Chemistry of Fuel Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), Bomb Calorimeter, calculation of HCV and LCV using Dulong's formula, Proximate analysis of coal, solid fuel petrol and diesel - fuel rating (octane and cetane numbers), Chemical composition, calorific values and,	10%	05

	applications of LPG, CNG, water gas, coal gas, producer gas and biogas.		
		100%	42

i. Text Book and Reference Book:

1. A Text Book of Polytechnic Chemistry, V.P. Mehta; Jain Brothers.
2. A Text Book of Applied Chemistry J. Rajaram.
3. Engineering Chemistry Jain & Jain; Dhanpat Rai.
4. Engineering Chemistry, B. Sivasankar; Tata MacGraw hill.
5. Engineering Chemistry, Shashi Chawla; Dhanpat Rai and Co.
6. Engineering Chemistry, O.P Agrawal; Khanna.

j. Experiment List:

Sr. No.	Experiment List
1	Determine the strength of given acidic solution using standard solution of base
2	Standardize KMnO_4 solution by preparing standard oxalic acid and to estimate ferrous ions.
3	Standardize $\text{Na}_2\text{S}_2\text{O}_3$ solution by preparing standard potassium dichromate and to estimate percentage of copper from brass.
4	Determine the viscosity of given lubricating oil by using Red-wood Viscometer
5	Determine PH-Values of given samples of Solution by using Universal Indicator and PH-meter.
6	To Determine molecular weight of a polymer using Ostwald viscometer.
7	Preparation of (any one) polystyrene, urea formaldehyde, phenol formaldehyde and its Characterisation.
8	To Determine Acid Value of given lubricating Oil.
9	Determine of the percentage of moisture in a given sample of coal by proximate analysis.
10	To Determine of saponification value of an lubricating oil.
11	Study of corrosion of metals in medium of different pH.
12	To Determine the COD of given water sample.
13	Determine Flash & Fire point of given lubricating oil.
14	Study of Corrosion of Metals in the different Mediums.

(2)

- a. **Course Name:** Environmental Science
- b. **Course Code:** 03605101
- c. **Prerequisite:** Zeal to learn the subject
- d. **Rationale:** The course is designed to give developers a general awareness of these and related issues so that every student will start acting as a responsible citizen to make the country and the world a better place to live in.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of ecosystems, biodiversity, and environmental sustainability
CLOBJ 2	Analyse the impact of human activities on natural resources and climate change.
CLOBJ 3	Explore methods for waste management, pollution control, and sustainable practices.
CLOBJ 4	Evaluate environmental laws, policies, and their implications for industrial practices.
CLOBJ 5	Investigate renewable and non-renewable energy sources and their environmental impact.
CLOBJ 6	Promote awareness and propose solutions for current environmental challenges.

- f. **Course Learning Outcomes:**

CLO 1	Understand the ecosystem and terminology and solve various engineering problems applying
CLO 2	Ecosystem knowledge to produce eco – friendly products.
CLO 3	Understand the suitable air, the extent of noise pollution, and control measures and acts.
CLO 4	Understand the water and soil pollution, and control measures and acts.
CLO 5	Understand different renewable energy resources and efficient process of harvesting.
CLO 6	Understand solid Waste Management, ISO 14000 & Environmental Management.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	0	20	20	-	-	-	40

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Ecosystem Structure of ecosystem, Biotic & Abiotic components, Food chain and food web Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global warming -Causes, effects, process, Green House Effect, Ozone depletion.	15%	03
2	Air and Noise Pollution Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator). Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler, Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.	22%	06
3	Water and Soil Pollution Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation. Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis), Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.	24%	08

4	Renewable Sources of energy Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy. New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.	24%	08
5	Solid Waste management Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.	16%	03
		100%	28

i. Text Book and Reference Book:

1. Principles of Solar Engineering, By Yogi Goswami D., Frank Kreith, Jan F. Kreider, Taylor & Francis, 2003, Second Edition.
2. Environmental Studies by M.P. Poonia, S.C. Sharma | Khanna Publishing House, NewDelhi, 2017.
3. Renewable Energy Sources, by Twidell, J.W. and Weir. A, EFN Spon Ltd.
4. Environmental Sciences by Daniel B Botkin & Edward A Keller, John Wiley & Sons.
5. Air Pollution by M. N. Rao and H. V. N. Rao, Tata McGraw-Hill Publishing Company.
6. Environmental Pollution Control Engineering, by Rao C.S, 2nd edition.
7. Solid Waste Treatment and Disposal by G. Tchabanoglous | McGraw Hill Pub.

(3)

- a. **Course Name:** Engineering Mechanics
- b. **Course Code:** 03605151
- c. **Prerequisite:** Knowledge of Applied science
- d. **Rationale:** Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of forces, equilibrium, and their applications in engineering.
CLOBJ 2	Analyse structures and mechanical systems using concepts of free-body diagrams and equilibrium equations
CLOBJ 3	Apply concepts of friction, centroids, and moment of inertia to solve real-world engineering problems.
CLOBJ 4	Study kinematics and kinetics of particles and rigid bodies in planar motion.
CLOBJ 5	Evaluate work, energy, and power relationships in mechanical systems
CLOBJ 6	Use the principles of dynamics and vibrations to analyse mechanical behaviour.

- f. **Course Learning Outcomes:**

CLO 1	Identify the force systems for given conditions by applying the basics of mechanics.
CLO 2	Determine unknown force(s) of different engineering systems.
CLO 3	Apply the principles of friction in various conditions for useful purposes.
CLO 4	Find the Centroid and centre of gravity of various components in engineering systems.
CLO 5	Apply the principles of work, power and energy for useful purposes.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basics of Mechanics Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.	10%	02
2	Centroid and Centre of Gravity Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle) Centroid of composite figures composed of not more than three geometrical figures. Centre of Gravity of simple solids (Cube, cuboids, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids.	10%	06
3	Coplanar Concurrent Forces Force – Unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Newton's first, second and third Law of motion Principle of transmissibility of force, Principle of superposition of force, Force system and its classification. Lami's Theorem – statement and explanation, Application for various engineering problems. Resolution of a forces, Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.	25%	10
4	Equilibrium and Coplanar Non-Concurrent Forces Types of Equilibrium, Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analysing	25%	10

	equilibrium. Moment and couple, Varignon's Theorem. Types of beams, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load. Beam reaction graphically for simply supported beam subjected to vertical point loads only		
5	Friction Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Ladder Friction, Engineering Problems.	10%	06
6	Simple Lifting Machine Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, Work – work done, force displacement diagram, Power, Engineering Problems Energy – Kinetic & Potential energy and Engineering Problems. Law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines.	20%	08
		100%	42

i. Text Book and Reference Book:

1. Applied Mechanics by H. J. Shah and S. B. Junarkar, Charotar publication.
2. A Text Book of Engineering Mechanics by Bansal R K, Laxmi Publishers, New Delhi.
3. Engineering Mechanics by J.L. Meriam, and L.G.Kraige, John Wiley and sons, New York.
4. Engineering Mechanics by S.S. Bhavikatti and K. G. Rajashekarappa, Wiley 'Eastern Ltd.

j. Experiment List:

Sr. No.	Experiment List
1	Verify and calculate resultant force through Law of Parallelogram.
2	Verify and calculate resultant force through triangle Law of Forces.
3	Verify and calculate resultant force through Lami's Theorem.
4	Verify and calculate resultant force through Polygon Law of Forces.
5	Verify reactions in beam through Graphical & analytical method.
6	Calculate Co efficient of Sliding Friction and angle of repose for different surfaces – Wood, Glass.
7	To find out efficiency, velocity ratio and M.A for differential wheel and axle.
8	To find out efficiency, velocity ratio and M.A for simple lifting machine using simple screw jack.
9	Solve numerical problems on Centroid and Centre of Gravity.

(4)

- a. **Course Name:** Mathematics – I
- b. **Course Code:** 03691101
- c. **Prerequisite:** Knowledge of basic concept studied till 10th std.
- d. **Rationale:** The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of algebra, including matrices and determinants.
CLOBJ 2	Solve linear and quadratic equations relevant to engineering applications.
CLOBJ 3	Analyse and apply trigonometric functions to solve real-world problems.
CLOBJ 4	Explore the basics of calculus, including differentiation and its engineering applications.
CLOBJ 5	Use co-ordinate geometry to solve problems involving straight lines, circles, and conic sections.
CLOBJ 6	Apply mathematical techniques to develop problem-solving and analytical skills.

- f. **Course Learning Outcomes:**

CLO 1	Understand and apply fundamental concepts of algebra, calculus, and trigonometry in engineering contexts.
CLO 2	Solve linear and non-linear equations using various mathematical methods.
CLO 3	Apply differential equations to model and analyse dynamic systems.
CLO 4	Use matrix algebra and determinants in solving engineering problems.
CLO 5	Develop problem-solving skills using numerical methods and approximation techniques.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	LOGARITHM Logarithms: Definition, Logarithm as a transformation, Antilogarithm, Rules of Logarithms and examples, Use logarithmic functions for simplifying arithmetic computations. Partial fractions: Definition of partial fractions. Types of partial fraction (Denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors).	17%	04
2	Trigonometry Trigonometry: Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Trigonometric identities, Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, submultiple angles ($2A$, $3A$, $A/2$). Graphs of all trigonometric functions	23%	07
3	Permutations and Combinations Permutations and Combinations: Value of nPr and nCr with related examples, first principal of Mathematical Induction (without proof) Binomial theorem: Binomial theorem (without proof) for positive Page 2 of 2 integral index (expansion and general form); binomial theorem for rational index (expansion without proof) first and second binomial approximation with applications to engineering problems	09%	03
4	Complex Numbers Complex Numbers: Definition of a complex number, real and imaginary parts of a complex number, Polar and Cartesian	17%	04

	representation of complex number, Conjugate of complex number, Geometric representation of complex numbers and their operations, Modules and Amplitude form, De Moivre's Theorem, Root of Complex Number, Use of De Moivre's Theorem to simplify mathematical expressions.		
5	Calculus Definition of function; Concept of limits and standard forms of limits and Definition of continuous function and examples. Definition of derivative, differentiation of standard function by first principle, Rule of Differentiation, Differentiation of algebraic, trigonometric, Exponential, Logarithmic, Implicit functions and Composite functions, Higher order derivatives.	34%	10
		100%	28

i. Text Book and Reference Book:

1. Higher Engineering Mathematics, B. S. Grewal; Khanna Publications.
2. A textbook of Engineering Mathematics by N.P. Bali, Laxmi Publication.
3. Advanced Mathematics for Polytechnic, Pandya N R; Macmillan Publishers India Ltd.,2012
4. Polytechnic Mathematics Deshpande S P; Pune Vidyarthi Gruh Prakashan,1984

(5)

- a. **Course Name:** Basic Physics
- b. **Course Code:** 03691101
- c. **Prerequisite:** High School Level Physics
- d. **Rationale:** Diploma Programmes in which this subject is offered Semester in which offered
Information Technology Electronics & Communication, Biomedical Engineering 1st semester,
Electrical Engineering Computer Engineering 2nd semester.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of mechanics, motion, and energy.
CLOBJ 2	Analyse the properties of matter, including elasticity, viscosity, and fluid dynamics.
CLOBJ 3	Explore concepts of heat, thermodynamics, and their practical applications.
CLOBJ 4	Study the basics of optics, including reflection, refraction, and wave behaviour.
CLOBJ 5	Understand the principles of electricity, magnetism, and their use in engineering systems.
CLOBJ 6	Apply physics concepts to solve real-world problems and develop analytical skills.

f. Course Learning Outcomes:

CLO 1	Understand the fundamental concepts of mechanics, including motion, force, and energy.
CLO 2	Apply principles of thermodynamics to real-world mechatronic systems.
CLO 3	Explain the behaviour of materials under stress and the concepts of elasticity and deformation.
CLO 4	Understand the principles of electricity, magnetism, and electromagnetism in relation to mechatronic systems.
CLO 5	Use basic physics principles to analyse and solve problems in mechanical and electrical systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Wave motion and its applications Wave motion, transverse and longitudinal waves with examples, definitions of wave velocity, frequency and wave length and their relationship, Sound and light waves and their properties, wave Equation amplitude, phase, phase difference, principle of superposition of waves and beat formation. Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency etc. Simple harmonic progressive wave and energy transfer, study of vibration of Cantilever and determination of its time period, Free, forced and resonant vibrations with examples. Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications, Ultrasonic waves – Introduction and properties, engineering and medical applications of ultrasonic.	12%	04
2	Optics Basic optical laws; reflection and refraction, refractive index, Images and image formation by mirrors, lens and thin lenses, lens formula, power of lens, magnification and defects. Total internal reflection, Critical angle and conditions for total internal reflection, applications of total internal reflection in optical fibre. Optical Instruments; simple and compound microscope, astronomical telescope in normal adjustment, magnifying power, resolving power, uses of microscope and telescope, optical projection systems.	12%	04
3	Electrostatics Coulombs law, unit of charge, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and	12%	04

	potential difference, Gauss law: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical), dielectric and its effect on capacitance, dielectric break down		
4	Current Electricity Electric Current and its units, Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, carbon resistances and colour coding. Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only), Concept of terminal potential difference and Electro motive force (EMF) Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy	14%	07
5	Electromagnetism Types of magnetic materials; dia, para and ferromagnetic with their properties, Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and units, magnetization. Concept of electromagnetic induction, Faraday's Laws, Lorentz force (force on moving charge in magnetic field). Force on current carrying conductor, force on rectangular coil placed in magnetic field. Moving coil galvanometer; principle, construction and working, Conversion of a galvanometer into ammeter and voltmeter	14%	07
6	Semiconductor Physics Energy bands in solids, Types of materials (insulator, semiconductor, conductor), intrinsic and extrinsic semiconductors, p-n, junction, junction diode and V-I characteristics, types of junction diodes. Diode as rectifier – half wave and full wave rectifier (centre tapped). Transistor; description and three terminals, Types- pnp and npn, some electronic applications (list only). Photocells, Solar cells; working principle and engineering applications	18%	08
7	Modern Physics Lasers: Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, optical feedback, Types of lasers; Ruby, He-Ne and semiconductor, laser characteristics, engineering and	18%	08

	medical applications of lasers. Fibre Optics: Introduction to optical fibres, light propagation, acceptance angle and numerical aperture, fibre types, applications in; telecommunication, medical and sensors. Nanoscience and Nanotechnology: Introduction, nanoparticles and nanomaterials, properties at nanoscale, nanotechnology, and nanotechnology-based devices and applications		
		100%	42

i. Text Book and Reference Book:

1. Concepts Of Physics by H C Verma.
2. Physics Part 1 And 2 by NCERT.
3. Optics by Brijlal and Subramanyam, S. Chand.

j. Experiment List:

Sr. No.	Experiment List
1	To verify Ohm's law by plotting graph between current and potential difference.
2	To verify laws of resistances in series and parallel combination.
3	To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.
4	To convert a galvanometer into an ammeter.
5	To convert a galvanometer into a voltmeter.
6	To verify Kirchhoff's law using electric circuits.
7	To determine A.C. frequency with the help of sonometer.
8	Measurement of Energy.
9	To Measure A.C. Power using resistive load.
10	To calculate SA/V ratio of simple objects to understand nanotechnology.
11	To determine and verify the time period of a cantilever.
12	To verify laws of refraction (Snell's law) using a glass slab.
13	To determine focal length and magnifying power of a convex lens.
14	To verify inverse square law of radiations using a photo-electric cell.

(6)

- a. **Course Name:** Communication Skills - I
- b. **Course Code:** 03693101
- c. **Prerequisite:** Knowledge of English Language.
- d. **Rationale:** Communication confidence laced with knowledge of English grammar is essential for all engineers.
- e. **Course Learning Objective:**

CLOBJ 1	Develop the ability to communicate effectively using verbal and non-verbal methods.
CLOBJ 2	Enhance vocabulary and grammar for accurate and impactful communication.
CLOBJ 3	Practice writing skills for drafting professional documents such as letters, emails, and reports.
CLOBJ 4	Improve listening skills for better comprehension and interaction in various contexts.
CLOBJ 5	Build confidence in delivering presentations and participating in group discussions.
CLOBJ 6	Foster interpersonal skills to communicate effectively in diverse professional environments.

f. Course Learning Outcomes:

CLO 1	Develop effective verbal and non-verbal communication skills for professional interactions.
CLO 2	Enhance writing skills for clear and concise technical reports and documentation
CLO 3	Improve listening skills for better understanding and collaboration in team settings.
CLO 4	Practice professional etiquette in presentations, meetings, and discussions.
CLO 5	Build confidence in expressing ideas and technical concepts in both individual and group settings.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Ice breaker + Introducing your friend This is one activity which will build the bond between the students in the class and work as a team in the task given to them. The students will be asked to introduce their new best friend in the class. This will ensure that the bond being created here will stay strong and also breaks the ice between them.	05%	02
2	Picture connector In this class the students will be trained to form a logical connection between a set of pictures which will be shared with them. This geared towards building creativity and presentation skills.	05%	02
3	Crazy Scientist The students will be taught the importance of invention and innovation using some examples that changed the world the way it worked.	05%	02
4	Shopping role play This activity topic gears towards making students do role play based on shopping scenarios. It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on to enact it.	05%	02
5	Vocabulary and Grammar Glossary of administrative terms (English and Hindi). One word substitute, idioms and phrases. Parts of speech, Active and Passive voice, Tenses, Punctuation.	20%	09

6	Communication: Theory & Practice Basics of communication: Introduction, meaning, definition, Process of communication. Types of communication: Formal, Informal, Verbal / Non-verbal and Written barriers to effective communication. 7 Cs of effective communication: (considerate, concrete concise, clear, complete, correct and courteous). Technical Communication.	12%	06
7	Soft Skills Soft skills and hard skills, Importance of soft skills, Life skills, self-awareness& self-analysis, adaptability, resilience, emotional intelligence and empathy.	12%	06
8	Debate Students are trained to let go of inhibitions and come forward and speak openly on passionate topics. The students will be divided into teams and made to share their ideas and views on the topics.	05%	02
9	Extempore To change the average speakers in the class to some of the best Orator. This will be done by making the students give variety of impromptu speeches in front of the class.	05%	02
10	Professional Writing The art of precis writing, Letters – business and Personal, Drafting e mail, notices, minutes of meeting etc., Filling of different forms such as banks and online forms for placements.	12%	06
11	Reading Comprehension Malgudi Days – An astrologer Days, Dabbawallas, A Snake in the grass, Internet.	14%	06
		100%	45

i. Text Book and Reference Book:

1. Active English (Textbook), Juneja & Qureshi; Macmillan.
2. Technical Communication: Principles And Practice, Sangeetha Sharma, Meenakshi Raman; Oxford University Press.
3. Better English Pronunciation, J. D. O'Connor; Cambridge University Press, 1980; 2nd, 1980.
4. Effective Technical Communication, Dr. Bharti Kukreja, Dr. Anupama Jain; S.K. Kataria & Sons; 1st edition.

Semester 2

(1)

- a. **Course Name:** Introduction to IT Systems
- b. **Course Code:** 03606101
- c. **Prerequisite:** Basic knowledge of Computer
- d. **Rationale:** This course aims to teach students basics of computer including hardware and software.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic components and functioning of computer hardware and software systems.
CLOBJ 2	Explore operating systems and their role in managing computer resources.
CLOBJ 3	Develop skills in using productivity tools such as word processors, spreadsheets, and presentations.
CLOBJ 4	Understand the fundamentals of computer networking and internet technologies.
CLOBJ 5	Gain knowledge of data security, ethical practices, and IT system troubleshooting.
CLOBJ 6	Apply IT concepts to solve practical problems and improve workplace efficiency.

- f. **Course Learning Outcomes:**

CLO 1	Know about different computer components& different types of memory
CLO 2	Create excel sheet, power point, word, access database etc.
CLO 3	Use internet effectively
CLO 4	Create dynamic webpages including style sheet
CLO 5	Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	2	1	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basic Internet skills Understanding browser, Efficient use of search engines, Awareness about Digital India portals (state and national portals) and college portals, General understanding of various computer hardware components – CPU, Memory, Display, Keyboard, Mouse, HDD and other Peripheral Devices.	10%	02
2	OS Installation OS Installation: Linux and MS Windows, Unix Shell and Commands, vi editor.	10%	02
3	HTML4 and CSS Basic HTML4 Tags, Making basic personal webpage, Introduction to CSS.	40%	05
4	Office Tools Open Office Writer, OpenOffice Spreadsheet (Excel), Open Office Impress, Office Power Point, Office MS Word	20%	03
5	Information security best practices Basics of Cryptography	20%	02
		100%	14

i. Text Book and Reference Book:

1. Computer Fundamentals by P.K. Sinha, BPB Publications.
2. Basic Computer Course Made Simple by Satish Jain, BPB Publication.
3. Basic Computer Engineering by Sanjay Silakari and Rajesh K Shukla, Wiley India Pvt. Limited, Pub. Year 2011.
4. HTML & CSS: The Complete Reference by Thomas A. Powell, McGraw Hill.

j. Experiment List:

Sr. No.	Experiment List
1	Study practical of computer components.
2	Study practical of different OS installation (Windows, Linux, Ubuntu)
3	Write a script for basic OS commands
4	Write a script for basic operators in OS
5	Study practical of Internal structure and components of storage devices(Hard disk components)
6	Study practical of input working devices (Keyboard, Mouse, scanner)
7	Study practical of output working devices (Monitor, Printer)
8	Write a HTML code to display "hello world"
9	Write a HTML code to create a table for student marksheet.
10	Write a HTML code to create a simple registration form
11	Write a CSS to create user define tag
12	Write an HTML code to create static website using CSS
13	Study practical of evolution and working of internet
14	Study practical of surfing techniques in internet
15	Create your Gmail account and use different services provided by Google like Google drive, sharable sheet etc.
16	Perform various DOS commands
17	Develop an excel sheet which has record of 50 students result of 5 subjects and make following analysis 1) Fetch the data of the student who has distinction 2) Fetch the data of students with minimum marks in each subject. 3) Sort the data based on percentage
18	Develop an excel sheet which has record of 50 students result of 5 subjects and make following analysis 1) Fetch the data of the student who has distinction 2) Fetch the data of students with minimum marks in each subject. 3) Sort the data based on percentage
19	Create a presentation of your favourite movie using animation
20	Create a word file for your resume
21	Create library management database in access with minimum 5 tables in it.

(2)

- a. **Course Name:** Fundamentals of Electrical and Electronics Engineering
- b. **Course Code:** 03607151
- c. **Prerequisite:** Knowledge of Physics and Mathematics up to 10th Standard Level
- d. **Rationale:** Electrical and electronics engineering equipment is widely used in mechanical/ metallurgy/mining /Auto mobile / Aeronautical engineering applications and a diploma engineer from any of these disciplines have to identify the related equipment being used in the industry with respect to their working and major faults that could occur. Electronics is an integral part of computers; hence students of computer engineering and information technology need to know the fundamental of electronics. This course has been designed to provide the needful inputs to handle simple electronic components and circuits. Students after studying this course will be able to understand the basics of analog electronics, various electronics components and develop skills to use simple electronic instruments needed for computer-based working environment.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic concepts of electrical circuits, components, and their applications.
CLOBJ 2	Analyse AC and DC circuits using Ohm's Law, Kirchhoff's laws, and network theorems.
CLOBJ 3	Study the principles of electromagnetism and their applications in electrical systems.
CLOBJ 4	Explore the functioning of electronic components such as diodes, transistors, and operational amplifiers.
CLOBJ 5	Understand the working principles of electrical machines, including motors and transformers.
CLOBJ 6	Develop skills in measuring electrical parameters using appropriate instruments and tools.

f. Course Learning Outcomes:

CLO 1	Understand the basic circuit elements.
CLO 2	Understand logic gates and apply them in various electronic circuits.
CLO 3	Understand the basic concepts of op-amps, and their applications.
CLO 4	Solve basic problems related to electrical circuits and machines.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Overview of Electronic Components & Signals Passive Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current source, independent/dependent voltage current sources.	15%	06
2	Introduction of Semiconductor Components P-N junction diode, V-I Characteristics of P-N junction Diode, Zener Diode, Classification of Transistor, Transistor construction, Types of transistors (NPN & PNP)	10%	05
3	Overview of Digital Electronics Number systems, Base Conversion -BINARY -DECIMAL -HEX -OCTAL, Complements - 2' and 10's Complement -1's and 9's Complement, Binary addition, subtraction, multiplication and division Logic Gates -Basic Gates (AND, OR, Not), Universal Gates (NAND and NOR Gate), Complementary Gates-(EX-OR, EX-NOR), De-Morgan's Theorems, Adder and Subtractor, Multiplexer and De-multiplexer.	25%	10
4	Electric Circuit Generation of electricity, Different terms related to electric circuit, Concept of AC and DC, Concept of 1-phase and 3-phase supply, Electrical circuit elements – Resistor Inductor and Capacitor, Resistor in series and parallel, Ohm's law and its limitations, Factors affecting the value of resistance	20%	08

5	Magnetic Circuit Terms Related to magnetic circuit, Terms Related to AC circuit, Faraday's Law, Fleming's law, Lenz's Law, Hysteresis loop (B/H Curve), Types of Induced EMF, Comparison between Electric and Magnetic Circuit	20%	08
6	Transformer and Machines General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations of motors.	10%	05
		100%	42

i. Text Book and Reference Book:

1. Basic Electrical Engineering by Ritu Sahdev, Khanna Publishing House.
2. Basic Electrical Engineering by Mittle and Mittal, McGraw Education.
3. Fundamentals of Electrical Engineering by Saxena, S. B. Lal, Cambridge University Press.
4. Electrical Technology Vol-1 by Theraja, B. L., S. Chand, New Delhi.
5. Principles of Electronics by V.K. Mehta, S. Chand and Company.

j. Experiment List:

Sr. No.	Experiment List
1	Determine the permeability of magnetic material by plotting its B-H curve.
2	Measure voltage, current and power in 1-phase circuit with resistive load.
3	Measure voltage, current and power in R-L series circuit.
4	Determine the transformation ratio (K) of 1-phase transformer.
5	Connect single phase transformer and measure input and output quantities.
6	Identify various active and passive electronic components.
7	Connect resistors in series and parallel combination on bread board and measure its value using digital multi-meter.
8	Use multi-meter to measure the value of given resistor. Determine the value of given resistor using digital multi-meter to confirm with colour code.
9	Test the performance of PN-junction diode.
10	Test the half wave rectifier using CRO.
11	Test the Bridge rectifier and capacitor filter using CRO.
12	Test the performance of Zener diode.
13	Identify the pins of IC 741.
14	Test the performance of CE NPN transistor.
15	Test the performance of transistor amplifier circuit.

(3)

- a. **Course Name:** Engineering Graphics Lab
- b. **Course Code:** 03609102
- c. **Prerequisite:** Zeal to learn the subject
- d. **Rationale:** Engineering Drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link between ideas and realization.
- e. **Course Learning Objective:**

CLOBJ 1	Develop skills in drawing and interpreting engineering drawings using conventional methods.
CLOBJ 2	Understand and apply the principles of projection, including orthographic and isometric views.
CLOBJ 3	Learn to create and read technical sketches for mechanical and civil engineering applications.
CLOBJ 4	Gain proficiency in dimensioning and detailing of drawings for clarity and accuracy.
CLOBJ 5	Use CAD software to create and modify 2D and 3D engineering models.
CLOBJ 6	Apply principles of design and drafting to produce clear and precise engineering documents.

- f. **Course Learning Outcomes:**

CLO 1	Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing.
CLO 2	Draw views of given object and components 3) Sketch orthographic projections into isometric projections and vice versa.
CLO 3	Apply computer aided drafting tools to create 2D engineering drawings.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Engineering Drawing Practice for Schools and Colleges by Bureau of Indian Standards, Government of India, Pub. Year 1998.
2. Engineering Drawing by N. D. Bhatt, Charotar Publishing House, Pub. Year 2010.
3. Engineering Graphics & Design by Jain & Gautam | Khanna Publishing House.
4. Engineering Drawing by D. A. Jolhe | Tata McGraw Hill Edu.
5. Engineering Drawing by R. K. Dhawan | S. Chand and Company.

i. Experiment List:

Sr. No.	Experiment List
1	USE OF DRAWING INSTRUMENTS Teacher will demonstrate: Use of drawing instruments, Planning and layout as per IS, Scaling technique. Draw following: - Drawing horizontal, vertical, 30-degree, 45 degrees, 60- & 75-degrees lines using Tee and Set squares/ drafter, Types of lines, Types of dimensioning. Alphabets & numerical (Vertical & inclined as Per I.S.).
2	GEOMETRIC CONSTRUCTION Drawing of set of lines with different conditions (Two problems). Drawing Polygons (Three Problems). Drawing circles and arcs with different geometric. Conditions and with line constraints (Three problems).
3	ENGINEERING CURVES – I Construction of ellipse using any two methods from arc of circle method, four centre method, rectangular method, eccentricity method and concentric circle method. Construction of parabola with any one method from rectangular method, tangent method and eccentricity method. Construction of hyperbola with any one method from eccentricity method and rectangular method. Construction of spiral.
4	ENGINEERING CURVES – II Construction of cycloid. Construction of hypocycloid & epicycloids. Construction of involute (circle). Construction of involute (polygon).
5	PROJECTIONS OF POINTS AND LINE Draw projection of points-For 10 various conditions (One problem). Draw projection of lines with different conditions (Four problems).

6	PROJECTIONS OF PLANE Draw projection of different planes with different conditions (triangle, square / rectangular, pentagonal / hexagonal, and circular -one for each) (Four problems).
7	ORTHOGRAPHIC PROJECTIONS Draw Orthographic projections of different objects (Two problems) (Draw four views of each object).
8	ISOMETRIC DRAWINGS Draw isometric drawings from given orthographic views (Three problems).

(4)

- a. **Course Name:** Fundamentals of Mechanical Engineering
- b. **Course Code:** 03609151
- c. **Prerequisite:** Learn about fundamental of mechanical.
- d. **Rationale:** This course mainly encompasses the major and general areas of mechanical engineering which are being used by common man to large industrial sectors. A technician has to know many times the implications and knowledge of other disciplines so as to conclude the solution of his/her own branch tasks.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic principles of mechanics, thermodynamics, and material science in mechanical systems.
CLOBJ 2	Analyse the behaviour of forces, moments, and equilibrium in structures and machines.
CLOBJ 3	Study the thermodynamic processes and cycles in engines, refrigeration, and HVAC systems.
CLOBJ 4	Learn about the properties and selection of materials for mechanical design and manufacturing.
CLOBJ 5	Apply basic concepts of fluid mechanics and heat transfer to real-world mechanical engineering problems.
CLOBJ 6	Develop skills in mechanical system design, maintenance, and troubleshooting through practical applications.

f. Course Learning Outcomes:

CLO 1	Understand the representation of materials used in machine drawing.
CLO 2	Draw the development of surfaces for sheet metal working applications.
CLO 3	Draw the machine elements including keys, couplings, and cotters, riveted, bolted and welded Joints.
CLO 4	Represent tolerances and the levels of surface finish of machine elements

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction Introduction of mechanical engineering. Use of mechanical engineering: In day-to-day life, Interdisciplinary use. Items in general use- identification criteria, major types, specifications and uses: such as bolts, nuts, washers, bearings, bushes, belts, springs, levers, couplings, brakes, screws, rivets, keys' rings, oil seals, gears, pulleys, shafts, axles, etc. Hand and power tools: Types, specifications and uses of spanners (such as fix, ring, box, pipe, allen, adjustable, etc.). Types, specifications and uses of hand tools (such as pliers, screw drivers, saws, hammers, chisels, cutters, planes, etc.). Types, specifications and uses of power tools (drill, chipper, etc.).	10%	04
2	Power Transmission & Safety Power transmission: Importance, Modes (belt drives, rope drives, chain drives and gear trains). Types of belts, Gear train-concept, transmission ratio, Applications. Types and applications of couplings in power transmission. Causes and remedies of general accidents in power transmission. Safety norms to be followed for preventing accidents and damage in power transmission. Safety norms to be followed in mechanical based industries.	20%	08
3	Processes On Material Welding: Types, working setup of arc and gas welding, accessories and consumables, Types of work carried out by welding, Precautions and safety during arc and gas welding. Brazing and Soldering: General setup, Applications. Gas cutting: Working setup, accessories and consumables, Types of work carried out, Precautions and safety during gas cutting. Foundry: Concept, Process of getting cast material,	20%	08

	Applications. Other metal forming and cutting operations - bending, shearing- concept and applications. Basic machine tools: Working principle of hacksaw, lathe, drill and milling machines, Types of operations / jobs which can be performed on machine tools listed above.		
4	Steam Generation & Prime Movers Steam: Generation process, Properties. Boilers: Classification, Working, Accessories and mountings-types and applications, Regulations and safety requirements, Common troubles and remedies. Prime movers: Meaning, Classification, Working, Steam turbine-working, Gas turbine-types and applications. Common troubles and remedies.	10%	04
5	Internal Combustion Engines Internal combustion engines: Meaning, Classification. Main parts and functions. Applications.	13%	06
6	Hydraulic & Pneumatic Devices Concept of theory of fluid flow. General properties of fluids. Pump: Working principle, Types, Working of centrifugal and reciprocating pumps, Performance parameters, Main parts of pumps and their functions, Common troubles and remedies. Water turbines-working principle, types and applications. Common troubles and remedies of water turbine. Air compressor: Working principle, Types, Performance parameters, Applications. Other hydraulic/pneumatic/hydro-pneumatic equipment's: Principle of working-hydraulic lift, hydraulic pump, hydraulic power pack, hydraulic jack, Applications of above.	13%	06
7	Material Handling Need of material handling: Types, principle of working and applications of material handling equipment's, hoisting equipment's, conveying equipment's, Surface & overhead equipment's, Earth moving machineries, Construction machineries. Criteria for selection of material handling equipment's. Factors affecting selection of material handling equipment's. Selection of suitable material handling equipment for the given situation. Common troubles and remedies.	14%	06
		100%	42

i. Text Book and Reference Book:

1. Theory of Machine by R. S. Khurmi and J. K. Gupta, S. Chand.
2. Hydraulic Machines by Jagdish Lal, S.K. Kataria & Sons.
3. Elements of Workshop Technology by Hajra Choudhary, Media Promoters and Publishers Pvt. Ltd.
4. Heat engines by N C Pandya, C S Shah, S S Khandare | Charotar Publishing House | 10th edition, Pub. Year 2005.

(5)

- a. **Course Name:** Engineering Workshop Practice
- b. **Course Code:** 03609154
- c. **Prerequisite:** Learn about fundamental of mechanical and electrical engineering.
- d. **Rationale:** Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems. The workshop experiences would help to build the understanding of the complexity of the industrial job, along with time and skills requirements of the job. Workshop curricula build the hands-on experiences which would help to learn manufacturing processes and production technology courses in successive semesters. Workshop practice is also important since only practice can make the man perfect.
- e. **Course Learning Objective:**

CLOBJ 1	Develop practical skills in using common workshop tools and machinery for fabrication and assembly.
CLOBJ 2	Understand the safe operation and maintenance of workshop equipment such as lathe, drilling, and milling machines
CLOBJ 3	Learn basic techniques for metalworking, including cutting, welding, and shaping materials.
CLOBJ 4	Gain experience in measuring, testing, and fitting components to ensure precision and quality.
CLOBJ 5	Understand the principles of carpentry, fitting, and sheet metal work for various engineering applications.
CLOBJ 6	Apply workshop practices to produce prototypes, assemblies, and mechanical components with accuracy.

f. Course Learning Outcomes:

CLO 1	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines.
CLO 2	Understand job drawing and complete jobs as per specifications in allotted time.
CLO 3	Inspect the job for the desired dimensions and shape. Operate, control different machines and equipment's adopting safety practices.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Mechanical workshop practice by K.C. John Engineering.
2. A Textbook of Electrical Workshop Practices by Dr. Umesh Rathore, S.K. Kataria & Sons.
3. A Course in Workshop Technology by Raghuwamsi B S, Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi., Pub. Year 1982.
4. Workshop Practice Manual by K. Venkat Reddy, BS Publications.
5. Elements of Workshop Technology Vol. I by Hajra Chaudhary S.K., Asia Publishing House.
6. Comprehensive Workshop Technology by S.K. Garg, Laxmi publications.

i. Experiment List:

Sr. No.	Experiment List
1	To A Perform a Job in Carpentry Shop. Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc., Types of woods and their applications., Types of carpentry hardware's and their uses., Demonstration of carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, etc., Preparation of wooden joints., Safety precautions.
2	To A Perform a Job in Tim Smithy. Concept and conversions of SWG and other gauges in use., Use of wire gauge., Types of sheet metal joints and applications. Types, sketch, specification, material, applications and methods of using tin smithy tools-hammers, stakes, scissors/snips, etc. Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining. Preparation of tin smithy job., Safety precautions
3	To Perform a Job on Fitting Practice. Sketch, specification and applications of fitting work holding tools-bench vise, V-block with clamp and C-clamp., Sketch, specification, material, applications and methods of using fitting marking and measuring tools-marking table, surface plate, angle plate, universal cribbing block, try-square, scribe, divider, centre punch, letter punch, callipers, Vernier calliper, etc., Types, sketch, specification, material, applications and methods of using of fitting cutting tools hacksaw, chisels, twist drill, taps, files, dies., Types, sketch, specification, material, applications and methods of using of fitting finishing tools-files, reamers., Sketch, specification and applications of miscellaneous tools-hammer,

	spanners, screw drivers sliding screw wrench., Demonstration of various fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping., Preparation of simple and male- female joints., Safety precautions.
4	To Perform a Job on Soldering.
5	To Perform a Job on Welding. Demonstration of different welding tools / machines., Demonstration on Arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding., One simple job involving butt and lap joint., Safety precautions.
6	Types, specification, material and applications of pipes., Types, specification, material and applications of pipe fittings., Types, specifications, material, applications and demonstration of pipe fitting tools., Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling, etc., Types and application of various spanners such as flat, fix, ring, box, adjustable, etc., Preparation of pipe fitting jobs., Safety precautions.
7	To Perform a Job on Sheet Metal Practice.
8	Demonstration of electrical symbol used in domestic or industrial wiring., Demonstration of electrical wiring tools and accessories., Demonstration of electrical measuring instruments like voltmeter, Ammeter, Wattmeter., Demonstration of advanced tools used in testing of electrical installation like Multi meter, Clip-on meter, Megger, Tachometer, Tester etc.
9	Demonstration of electrical wiring tools and accessories.
10	Demonstration of electrical measuring instruments like voltmeter, Ammeter, Wattmeter.
11	Demonstration of advanced tools used in testing of electrical installation like Multi meter, Clip-on meter, Megger, Techometer, Tester etc.
12	Single core cable, multicore cable, single strand wire, multi strand wire, shielded wire.
13	Demonstration of different switches like Toggle switch, Rotary switches, Push button switch etc.
14	Demonstration of protective devices like fuse, MCB, ELCB.
15	Demonstration on one lamp controlled by one Switch., Demonstration on Staircase wiring., Demonstration on connection of Tube light Wiring., Demonstration on different earthing used in electrical installation.

(6)

a. **Course Name:** Mathematics-II

b. **Course Code:** 03691151

c. **Prerequisite:** Knowledge of Basic concept of mathematics studied till first semester

d. **Rationale:** This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, Integral Calculus coordinate geometry, Basic elements of vector algebra and First Order Differential Equations.

e. **Course Learning Objective:**

CLOBJ 1	Apply integral calculus to solve problems related to areas, volumes, and engineering applications.
CLOBJ 2	Understand and use differential equations to model and solve engineering problems
CLOBJ 3	Study vector algebra and its application to engineering fields such as fluid mechanics and electromagnetism
CLOBJ 4	Explore and apply complex numbers and their properties in solving engineering problems.
CLOBJ 5	Solve problems related to Laplace transforms and their use in engineering systems.
CLOBJ 6	Apply the principles of probability and statistics to analyse data and solve real-world engineering problems

f. **Course Learning Outcomes:**

CLO 1	Apply algebraic operations on matrices and Analysis solution of systems of linear equations.
CLO 2	Use Indefinite and Definite Integration to solve engineering problems.
CLO 3	Apply algebra of vectors in finding work done, moment, velocity.
CLO 4	Solve differential equation arising in different Engineering branch and able to form mathematical & physical interpretation of its solution which place important role in all branches of Engineering.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	1	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Determinants and Matrices Elementary properties of determinants up to 3rd order, consistency of equations, Cramer's rule. Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.	22%	08
2	Vector Algebra Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.	13%	05
3	Co-Ordinate Geometry Straight line Inclination and slope of a line, different forms of equations to a straight line, Slope-intercept form, Point slope form, Two-point form, Intercept form. General equation of a Straight line, Family of lines. Conditions for concurrency of lines. Circle Definition, Equation of a circle with given centre and radius, General form of equation of circle, Equation of a circle when intercepts are given, circle passing through three points, Equation of chord, Equations of tangents and normal at a point on a circle.	15%	07
4	Integral Calculus Integration as inverse operation of differentiation, Integration of simple functions, Integration by substitution, by parts and by partial fractions (for linear factors only). Definite integral: Definition, Properties of Definite integral, Odd and Even functions, Use of formulas, and for solving problems Where m and n are positive integers. Applications of integration for i. Simple problem on evaluation of area bounded by a curve and	37%	14

	axes. ii. Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems)		
5	Differential Equations Solution of first order and first-degree differential equation by variable separation method (simple problems), Exact differential equations (simple problems), Linear differential equations (simple problems), MATLAB – Simple Introduction.	13%	05
		100%	39

i. Text Book and Reference Book:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publications.
2. Polytechnic Mathematics by S P Deshpande, Pune Vidyarthi Gruh Prakashan.

(7)

- a. **Course Name:** Communication Skills - II
- b. **Course Code:** 03693151
- c. **Prerequisite:** Knowledge of English Language and Communication Skills – I
- d. **Rationale:** Basic Communication skills are essential for all Engineers.
- e. **Course Learning Objective:**

CLOBJ 1	Enhance verbal communication skills for effective presentations and public speaking.
CLOBJ 2	Develop advanced writing skills for preparing technical reports, proposals, and research papers.
CLOBJ 3	Improve interpersonal communication through active listening, feedback, and conflict resolution techniques
CLOBJ 4	Build proficiency in group discussions, debates, and team collaboration for problem-solving.
CLOBJ 5	Master professional communication through emails, memos, and business correspondence.
CLOBJ 6	Strengthen non-verbal communication skills, including body language and facial expressions, in diverse contexts.

f. Course Learning Outcomes:

CLO 1	Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
CLO 2	Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication.
CLO 3	Develop skills of group presentation and communication in team.
CLO 4	Develop non-verbal communication such as proper use of body language and gestures.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Listening skills Listening Process and Practice: Introduction to recorded lectures, poems, interviews and speeches, listening test. To help students understand the meaning and importance of good. Listening skills, learning the traits of being a good listener	15%	02
2	Listening Skills – Questions With audio aids, students will be able to listen to dialogues, improve in gathering information and to summarize the content. To listen and understand day-to-day conversations and to solve questions based on audio files.	10%	01
3	Building Vocabulary Etymological study of words and construction of words, phrasal verbs, foreign phrases, idioms & phrases, jargon, register related to organizational set up. Word exercise & word games to enhance self-expression & vocabulary of participants.	15%	02
4	Listening to workplace communication Have good Understanding of workplace environment, working conditions and behavioural skills in different scenarios at workplace.	10%	01
5	Introduction to Phonetics Sounds: Consonant, Vowel, Diphthongs, transcription of words (IPA) weak forms, syllable division, word stress, intonation and voice.	15%	02
6	Speaking Skill Building Introduction	05%	01

	To enable students to eliminate stage fright and engage in conversation with others.		
7	Speaking Skill Building Activity Enables students to engage in formal communication as well as to participate in events like debate, extempore etc, and to introduce them to various international Language testing systems.	05%	01
8	Tourism Pitch Classroom activity which helps students to express their feelings and experiences in English. Encouraging students to overcome stage fear.	05%	01
9	Lifeboat Classroom Activity to encourage Communication and Convincing Skills	05%	01
10	Reporter Classroom Activity to encourage Communication and Convincing Skills.	05%	01
11	Paragraph jumble Enhance the skill of writing by completing the paragraph in appropriate and sensible form.	05%	01
12	life skills it enables us to effectively handle issues commonly encountered in daily life.	05%	01
		100%	15

i. Text Book and Reference Book:

1. Technical Communication: Principles And Practice by Sangeetha Sharma, Meenakshi Raman, Oxford University Press.
2. Effective Technical Communication by Dr. Bharti Kukreja, Dr. Anupama Jain, S.K. Kataria & Sons, 1st edition.
3. English Pronouncing Dictionary by Jones D | ELBS London 2003.
4. Better English Pronunciation by J. D. O'Connor | Cambridge University Press, 1980, 2nd, Pub. Year 1980.

Semester 3

(1)

- a. **Course Name:** Entrepreneurship and Start-ups
- b. **Course Code:** 03600201
- c. **Prerequisite:** Zeal to learn Subject
- d. **Rationale:** The main objective of this course is to understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation and learning the process and skills of creation. This subject provides detail information about Acquiring Entrepreneurial spirit and resourcefulness, Familiarization with various uses of human resource for earning dignified means of living, Acquiring entrepreneurial quality, competency, and motivation and management of entrepreneurial venture.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental principles of entrepreneurship and the process of starting a business.
CLOBJ 2	Analyse market opportunities and develop strategies for launching and growing a start-up.
CLOBJ 3	Learn how to create a business plan, including financial projections and resource allocation.
CLOBJ 4	Understand the legal, financial, and regulatory aspects involved in starting a new venture.
CLOBJ 5	Develop skills in managing risk, innovation, and scaling business operations for long-term success.
CLOBJ 6	Foster an entrepreneurial mindset by exploring case studies and real-world start-up challenges.

f. Course Learning Outcomes:

CLO 1	Understanding the dynamic role of entrepreneurship and small businesses.
CLO 2	Organizing and Managing a Small Business.
CLO 3	Financial Planning and Control.
CLO 4	Forms of Ownership for Small Business.
CLO 5	Strategic Marketing Planning.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to Entrepreneurship and Start - Ups Definitions Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers.	15%	08
2	Business Ideas and their implementation Discovering ideas and visualizing the business, Activity map, Business Plan.	15%	08
3	Idea to Start-up Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis.	20%	10
4	Management Company's Organization Structure: Recruitment and management of talent.	20%	08
5	Financing and Protection of Ideas Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses.	20%	07
6	Exit strategies for entrepreneurs Exit strategies for entrepreneurs, bankruptcy, succession and harvesting strategy.	10%	07
		100%	48

i. Text Book and Reference Book:

1. Entrepreneurial Development by Srinivasan. N. P, New Delhi, S.Chand 1999.
2. ENTREPRENEURIAL DEVELOPMENT by Vasant Desai, Himalaya Publication.
3. Entrepreneurial Development by David Holt.

(2)

- a. **Course Name:** Fundamentals of Programming
- b. **Course Code:** 03633207
- c. **Prerequisite:** This course assumes a basic understanding of the principles of programming. Prior knowledge of C is neither expected nor desired.
- d. **Rationale:** The course is intended to provide students with an understanding of the basic elements of the C programming language by analysing several programming techniques. It is an excellent preparation for advanced courses in computing or graduate work in computer science.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic concepts of programming, including variables, data types, and operators.
CLOBJ 2	Develop problem-solving skills by writing algorithms and implementing them in code.
CLOBJ 3	Learn the syntax and structure of a chosen programming language (e.g., C, Python, Java).
CLOBJ 4	Apply control structures such as loops, conditionals, and functions to create functional programs.
CLOBJ 5	Understand the concepts of arrays, strings, and data structures for efficient data manipulation.
CLOBJ 6	Debug and test programs to ensure accuracy, efficiency, and robustness in the code.

- f. **Course Learning Outcomes:**

CLO 1	Use the fundamentals of C programming in trivial problem solving.
CLO 2	Enhance skill on problem solving by constructing algorithms.
CLO 3	Identify solution to a problem and apply control structures and user defined functions for solving the problem.
CLO 4	Demonstrate the use of Strings and string handling functions
CLO 5	Apply skill of identifying appropriate programming constructs for problem solving.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Steps in program development Problem Problem identification, Task analysis, Data analysis inputs and output, Use of flow chart, program coding, testing, debugging and executing.	10%	05
2	Place of C in computer language Data Data Types & Variables: Data Types, Constants, Variables, Variable declaration. Storage class specification: Auto, Static, Extern, Register. Type modifiers: Expressions, Operators & Assignment Statements. Operators: Arithmetic increment, Decrement, Relational, Logical, Conditional, Bit Wise, Precedence of operators. Expressions and type conversion in expressions, Type casting, Assignment statements CONTROL STATEMENTS If – Nested if – The if-else-if ladder, the '?' operator as an alternative to 'if', Loop Control Structure: while – for – do while – Nesting of loops Switch, Break and continue statements, Exit () function, go to. Console I /O, I / O FUNCTIONS.	20%	10
3	Arrays Declaration and initialisation, One-dimensional, Two-dimensional, Array element access and display. Functions: Utility of function, Declaration and prototypes, Function arguments, The return statement, Function call (Call by value, Call by reference), Recursive function, Scope rules of functions.	20%	10

	Pointers: ‘&’ and ‘*’ operators, Pointer expressions, Pointer assignments, Pointer arithmetic Dynamic Allocation Functions: malloc () and calloc (), Pointer versus Array, Arrays of pointers, Pointers to pointers.		
4	Structures, Unions and User Defined Variables BASICS OF STRUCTURE: Declaring a structure, referring structure elements, Array of structure, passing a structure to a function, Structure within structure, Structure pointers. UNION. BASICS: Declaration, referring union elements, Uses of structure and unions, Enumerated data type and type definition. Function returning pointer, File Handling, File pointer FILE ACCESSING FUNCTIONS: fopen (), fclose (), fputc (), fgetc (), feof (), ferror (), fprintf (), fscanf (), fgets (), fputs (), fflush (), fseek (), ftell ().	25%	12
5	Pointers C Standard Library and Header Files HEADER FILES: stdio.h, ctype.h, string.h, math.h, stdlib.h, stdarg.h, conio.h (uses of these files), Standard library functions (names of the categories and utilities), MATHEMATICAL FUNCTIONS: abs (), cos (), sin (), exp (), log (), pow (), sqrt (), tan (). STRING FUNCTIONS: strcat (), strcmp (), strcpy (), strlen (), strstr (), strrev (), strset (), strupr (), strlwr ().	25%	08
		100%	45

i. Text Book and Reference Book:

1. Programming in ‘C’. by Balagurusamy E, Tata McGraw Hill Publishing Co. Ltd.
2. Let Us C by Yeshavant Kanetkar | BPB Publications.
3. C Programming: Test Your Skills by Ashok Kamthane.

j. Experiment List:

Sr. No.	Experiment List
1	Exercise on data type conversion, use of variable of different types.
2	Write simple program using expression, assignment statements and different types of operators.
3	Write simple programs using control statements: if, switch, conditional operator, for, while, do-while, break and continue statements.
4	Familiarity with formatted and unformatted console I / O with simple programs.
5	Write program using 1D and 2D arrays, sorting and matrix manipulation.
6	Write programs on function, using function prototype declaration, function definition, with or without arguments, returning value or no value, call by value and call by reference, recursive functions.
7	Write program using pointer (int, float and character type), using malloc () and calloc () functions, pointer to pointer, pointer to function.
8	Write program using structure, accessing structure elements, array of structure, passing structure to function and using structure pointers, using unions, accessing union elements, using structure and union in same function, to write programs on enunciated data type and familiarity with type definition.
9	Write program using different file function. Write program using different macro definition, file inclusion and conditional compilation.
10	Write program using string function and math function.

(3)

- a. **Course Name:** Material Science and Metallurgy
- b. **Course Code:** 03634201
- c. **Prerequisite:** Zeal to learn the Subject
- d. **Rationale:** Subject is concerned with the changes in structure and properties of matter. Many of the processes which are involved to bring out these changes, forms the basis of engineering activities. The study of basic concepts of material science and metallurgy will help the students understanding engineering subjects where the emphasis is laid on the application of these materials.
- e. **Course Learning Objective:**

CLOBJ 1	Understand material classification, structure, and properties.
CLOBJ 2	Analyse the mechanical properties of metals and alloys.
CLOBJ 3	Learn material selection principles for engineering design.
CLOBJ 4	Study phase diagrams and heat treatment effects
CLOBJ 5	Explore corrosion, fatigue, and wear prevention.
CLOBJ 6	Understand metallurgy, including material extraction and refining.

- f. **Course Learning Outcomes:**

CLO 1	Explain about crystal structures and atomic bonds.
CLO 2	Describe about classification of ferrous metals and their properties.
CLO 3	Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
CLO 4	Describe about the various metallic failures and knowledge in testing of materials.
CLO 5	Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Engineering Materials Types of bonds, construction and characteristics of electrovalent, covalent, coordinate, hydrogen and metallic, Intermolecular force of attraction, Molecular arrangement in solids, liquid and gases, Structure of solids i. Concept of crystalline structure. ii. Structure of metal-unit cell, BCC, FCC and HCP. iii. Examples and properties of metallic structures Physical, chemical, electrical, electromagnetic and thermal properties of material Solidification of metals and digital transducers i. Concept. ii. Crystal, grain, grain boundaries and dendritic solidification. iii. Effect of cooling rate on material properties. iv. Effect of grain size on properties of metal.	10%	05
2	Phase Diagrams Equilibrium diagrams. i. Concept, definition and need. ii. Solid solution-definition, properties and examples. iii. Alloys-major elements, reasons to add and important effect on material properties. iv. Cooling curve concept and method to plot. v. Cooling curve for pure metals and alloys. Time Temperature Transformation curve- (TTT curve). i. Need and application. ii. Steps to construct TTT curve Iron carbon equilibrium diagram. i. Concept, need & characteristics. ii. Definition of the terms used. iii. Plotting fundamentals. iv. Interpretation Heat treatment processes. i. Types of furnaces. ii. Heat treatment processes. (Annealing, normalizing, carburizing, case hardening, hardening, tempering, spherodising, nitriding, tempering, stabilizing, etc.). Methods, parameters and changes in properties. iii. Types of quenching mediums, their properties and applications.	25%	12

3	Metallurgical Microscope Metallographic examination and microstructures need and importance. Principle & working of metallurgical microscope, Preparation of specimen for microscopic examinations.	05%	03
4	Metals And Its Alloys Classification Classification of metals, Flow diagram for the production of iron and steel. Ferrous metals i. Classification. ii. Steels-types, composition, properties, applications. (For Plain carbon steel, alloy steel including stainless steel and cast iron.) iii. Designation and coding methods according to BIS for plain & alloy steel and cast iron. iv. Designation and coding (as per BIS, ASME, EN, DIN, JIS) of plain & alloy steel and cast iron. v. Microstructure of mostly used ferrous materials-low carbon steel, alloy steel, cast iron. Nonferrous metals i Classification. ii. Types, composition, properties and applications. (For Copper, copper alloys, Aluminium and Aluminium alloys.) iii. Designation and coding methods according to BIS. iv. Designation and coding (as per BIS, ASME, EN, DIN, JIS) of mostly used nonferrous materials. microstructure of mostly used nonferrous materials (Copper, Brass, Gunmetal, Aluminium).	25%	12
5	Non-Metallic Materials Introduction and classification of non-metallic materials, Classification of Polymers on basis of Thermal behaviour (Thermoplastics & Thermosetting), Properties and applications of polymers (like Polyethylene, Polypropylene, Polyvinylchloride, Teflon, Polystyrene, Phenol formaldehyde, Acrylonitrile, Epoxy resin.), Surface coating methods, setup, working parameters and applications using polymers, Composites. i. Introduction of composite. ii. Characteristics of composites. iii. Constituents of composite. iv. Types and applications of composites. Other non-metallic materials-types, properties, and applications. (Like rubber, ceramics, refractories, insulators, abrasives, adhesives, etc). Designation and coding of important non-metallic materials as per BIS.	15%	06
6	Electrolysis Introduction Electrolytes and non-electrolytes. i. Types of electrolytes. ii. Construction and working of an electrochemical cell. iii. Standard conditions. iv. Standard hydrogen electrodes. v. Electrochemical series, galvanic series. vi. Faraday's Laws of Electrolysis. vii. Industrial applications of electrolysis. viii. Surface coating through electrolysis-setup and working. Corrosion-types and reasons.	10%	04

7	Fluid And Powder Materials Classification of fluid and powder materials, Oils. i. Types and properties. ii. Designation methods as per BIS. iii. Applications in Mechanical engineering. Paints and varnishes. i. Definition and classifications. ii. Surface preparation and coating methods using paints and varnishes. Powder metallurgy. i. Basic concept of powder metallurgy and its applications, merits, and demerits. ii. Manufacturing process of powder coating-setup, equipment used and working.	10%	05
		100%	47

i. Text Book and Reference Book:

1. Material Science & Metallurgy by O.P. Khanna, Dhanpath Rai and Sons.
2. Material Science & Engineering by R.K. Rajput, S.K. Kataria & Sons.
3. Material Science by R.S. Khurmi, S. Chand & Co. Ltd.

j. Experiment List:

Sr. No.	Experiment List
1	a: State the criteria to identify any five (3 metallic and 2 non-metallic) materials from the selected set of material b: List properties of each above-identified materials. Also, identify main alloying elements and reasons to add them
2	Analyse the content of ferrous/non-ferrous material using a photo spectrometer. (This may be covered during industrial visit).
3	a: Study various heat treatment furnaces. b: Perform hardening process on ferrous material. Measure the hardness before and after hardening.
4	Examine the given specimen by use of Metallurgical Microscope
5	Prepare ferrous micro specimens and examine them. Also prepare report on this. –Four specimens. (One of plain carbon steel, second of alloy steel, third of heat-treated steel and fourth of cast iron.)
6	Prepare non-ferrous micro specimens and examine them. Also prepare report on this. – Three specimens. (One of copper, second of brass and third of aluminium.)
7	Study corrosive materials to identify different types of corrosion of metals
8	Visit one relevant industry which has specifically heat treatment processes facilities and photo spectrometer.
9	PROBLEM BASED LEARNING: Group of 4-5 students will identify and collect five machine / product components which are made from different engineering materials and which are also failed in their applications. Students will measure and sketch the components (free hand-orthographic views) with dimensions. Students in group will also discuss the reasons of failure and will note down the discussion and outcome
10	SCHOOL WITHIN SCHOOL: a. Each student will explain at least one diagram (assigned by teacher-may be part of iron- carbon diagram, TTT curve for specific material, etc) to all batch colleagues. b. Each student will share experiences of the student activities he/she has carried out.

(4)

- a. **Course Name:** Analog and Digital Electronics
- b. **Course Code:** 03634203
- c. **Prerequisite:** Basic Physics and Electronics
- d. **Rationale:** Digital electronics replaces the analog circuits in many fields. Using digital circuits is easier. Diploma holders must have knowledge about the fundamental laws used in digital electronics and the working principle of digital circuits. Operational amplifiers find application in timer circuits. This subject deals with both analog and digital electronic circuits.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic concepts of analog and digital electronics.
CLOBJ 2	Analyse and design analog circuits using components like resistors, capacitors, and transistors.
CLOBJ 3	Study digital logic gates and their applications in circuits
CLOBJ 4	Learn about signal processing, modulation, and amplification in analog systems.
CLOBJ 5	Understand binary arithmetic and its implementation in digital circuits.
CLOBJ 6	Apply the principles of analog-to-digital and digital-to-analog conversion.

f. Course Learning Outcomes:

CLO 1	Study of Pin diagram and Symbol of Operation amplifier.
CLO 2	Study various applications of Inverting, Non-Inverting, and Voltage follower.
CLO 3	Study and understand the feedback topology of the amplifier
CLO 4	Understand the basic linear applications of Op-Amp.
CLO 5	Understand the Boolean Algebra and Combinational Logic.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Fundamentals of Operational Amplifier Introduction to Operational amplifier: block diagram of OP-AMP, a schematic symbol of OP-AMP, Pin Diagram of OP-AMP, Advantages, Disadvantages, and Applications of OP-AMP. Block-diagram of an ideal differential amplifier features of the differential amplifier, the configuration of Op-Amp: inverting and non-inverting, characteristics of the ideal op-amp, equivalent circuit, the concept of negative feedback, concept of virtual short and virtual ground. Open-loop configuration: circuit diagram of inverting, non-inverting and differential amplifier Closed-loop configuration: circuit diagram of inverting, non-inverting and voltage follower Op-amps, Parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, Output offset voltage, thermal drift, input voltage range, supply voltage, supply current, common-mode rejection ratio, supply voltage rejection ratio, output resistance, supply current, transient response, slew rate, bandwidth, gain-bandwidth product	10%	05
2	Op-Amp with Negative Feedback Configuration Types of Different feedback configurations such as voltage-series feedback, voltage-shunt feedback, current-series feedback and current-shunt feedback, Circuit diagram of differential amplifier with one op-amp Basics of Linear Applications of Op-Amp: Concepts of Pre-amplifier, Instrumentation amplifier with three op-amps, summing amplifier, Applications of summing amplifier: scaling and averaging amplifier, Integrator using op-amp, Differentiator using opamp, 555 timer and its applications	25%	12
3	Boolean Algebra Number systems – Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other – Boolean Algebra – Basic laws and Demorgan's Theorems – Logic gates – OR – AND – NOT – NOR – NAND – EX-OR Symbols, Truth table and Boolean expression – Realization of gates using universal gates NAND, and NOR – Problems using 2, 3, and 4 variables – Boolean expression for outputs – Simplification of Boolean expression using Karnaugh map (up to 4 variable)- Construction logic circuits for the Boolean expressions.	05%	03

4	Combinational Logic Arithmetic circuits – Binary addition – Binary Subtraction – 1's complement and 2's complement – Signed binary numbers – Half adder – Full adder – Half subtractor – Full subtractor – Parity Generator and checker – Digital comparator – Arithmetic Logic Unit – Decoder – 3 to 8 decoder – BCD to seven segment decoder – Encoder – Multiplexer – Demultiplexer – Digital Logic families – TTL – CMOS – LS series – Fan in – Fan out – Propagation delay – Noise immunity for the above families.	25%	12
5	Sequential Logic Flip-flops – RS – D – T – JK – Master Slave Flip Flops – Edge triggered FF – Asynchronous Binary Counter – Decade counter – Mod n counter – Up Down Counter – Presentable counter – Ring counter – Johnson counter – Synchronous counter – State diagram – Shift register – 4-bit shift register – Serial in Serial out – Serial in Parallel out – Parallel in serial out.	15%	06
		100%	47

i. Text Book and Reference Book:

1. OPAMP & Linear Integrated Circuits by Ramakant Gaiekwad, PHI.
2. Modern Digital Electronics by R. P. Jain, Tata McGraw-Hill Education.
3. Fundamentals of Digital Electronics by A. Anandkumar, PHI Publication.

j. Experiment List:

Sr. No.	Experiment List
1	Study and verification of Basic Gates (AND, OR & NOT)
2	Study and verification of Universal Gates (NAND & NOR)
3	Implementation of the given Boolean function using logic gates
4	Realization of Half Adder & Full Adder using Basic gates
5	Realization of Half subtractor & Full subtractor using Basic gates
6	Multiplexer and De-multiplexer
7	Introduction to OP-AMP
8	OP-AMP as Inverting Amplifier
9	OP-AMP as Non-inverting Amplifier
10	OP-AMP as Adder
11	OP-AMP as subtractor
12	OP-AMP as Integrator
13	OP-AMP as differentiator.

(5)

- a. **Course Name:** Theory of Machines for Mechatronics
- b. **Course Code:** 03634207
- c. **Prerequisite:** Basic knowledge of physics, mechanics and mathematics.
- d. **Rationale:** It is important for Mechatronics engineers to understand about relative motions amongst various elements of mechanisms of machines responsible to perform the targeted task. This course is essential to provide fundamental study about establishment of relative motions for designing various mechanisms to build various machines.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of kinematics and dynamics of machines.
CLOBJ 2	Analyse the motion of mechanisms and linkages using graphical and analytical methods.
CLOBJ 3	Study the forces and torques acting on machines and their impact on performance.
CLOBJ 4	Learn about the design and operation of cams, gears, and other mechanical components.
CLOBJ 5	Apply principles of vibration analysis to study the behaviour of mechanical systems.
CLOBJ 6	Understand the integration of mechanical systems with sensors, actuators, and control systems in mechatronics.

f. Course Learning Outcomes:

CLO 1	Explain the kinematics and rigid-body dynamics of kinematically driven machine components.
CLO 2	Relate motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
CLO 3	Design some linkage mechanisms and cam systems to generate specified output motion.
CLO 4	Define kinematics of gear trains.
CLO 5	Describe role of friction in function of various friction devices like clutch, bearing, brakes and various power transmission elements.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	INTRODUCTION Basic kinematic concepts, definition and classification of link, kinematic pair, joint, kinematic chain, mechanism and machine, types of constraint motion, Degrees of freedom (mobility) - Kutzbach and Grubler's criterion for degrees of freedom, Grashof's law, Kinematic inversions for different chain, Mechanical advantage	16%	07
2	VELOCITY AND ACCELERATION ANALYSIS Vectors, Displacement of a rigid body, Definition of velocity, angular velocity, graphical velocity analysis using instantaneous centres, Relative velocity method for four bar mechanism, Relative velocity method for slider-crank mechanism, Instantaneous centre. Definition of acceleration, Angular acceleration, Radial and transverse components of acceleration, Coriolis component of acceleration.	22%	10
3	CAM AND FOLLOWERS Classification of cams and followers, Terminology and definitions, Description of follower movement, Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions, specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical cam profile.	18%	08
4	GEARS & GEAR TRAINS Classification of gears, Gear terminology, Involute and cycloidal gear profiles, Law of gearing, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, Epicyclic and regular gear train.	16%	07

5	GOVERNORS & GYROSCOPE Types of governors, Working principle and application of governors and gyroscope, case studies.	06%	03
6	FRICTION DEVICES Bearings: Function and classification of bearings, Working principle and Applications, Lubrications. Power Transmission Elements: Classification of belt and rope drives, working principle, construction of rope drives case studies of application.	22%	10
		100%	45

i. Text Book and Reference Book:

1. Theory of Machine by S S Ratan, Tata McGraw Hill Publishing.
2. Theory of Machines by Dr. Sadhu Singh, Pearson Education.
3. Theory of Machines by Thomas Bevan | CBS Publishers.
4. Kinematics and Dynamics of Machinery by R L Norton, McGraw-Hill.
5. Theory of Machine by R S Khurmi, S.Chand Publication.

j. Experiment List:

Sr. No.	Experiment List
1	Exercise based on basic concepts of kinematics.
2	Exercise on velocity and acceleration analysis of four-bar and slider crank mechanisms by graphical approach.
3	Exercise on velocity and acceleration analysis of slider crank mechanism by Klein's construction.
4	Exercise to design cam and follower mechanism.
5	Exercise on kinematics of simple, compound and reverted gear trains.
6	Performance to determine effect of variation of operating load on epi-cyclic gear train.
7	Performance to determine operating characteristics of Watt governor.
8	Performance to determine operating characteristics of Porter governor.
9	Performance to determine operating characteristics of Proell governor.
10	Performance to determine operating characteristics of Hartnell governor.
11	Performance to determine gyroscopic effect.
12	Exercise to learn about application of friction in design and functional performance of clutch, brake, bearings, belt and rope drives.

(6)

- a. **Course Name:** Measurements & Instrumentation
- b. **Course Code:** 03634209
- c. **Prerequisite:** Knowledge of basic mathematics and Science. Basic Electrical and Electronics Engineering
- d. **Rationale:** Measurements are more important for the quality of the product. In this subject various method of measurements are discussed.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of measurement and the importance of accuracy and precision.
CLOBJ 2	Learn about various types of measuring instruments and their applications in engineering.
CLOBJ 3	Study the calibration, operation, and maintenance of instruments used in industrial settings.
CLOBJ 4	Apply measurement techniques for physical quantities like temperature, pressure, and flow.
CLOBJ 5	Understand the concepts of signal processing and data acquisition systems.
CLOBJ 6	Develop skills in interpreting and analysing measurement data for decision-making in engineering projects.

f. Course Learning Outcomes:

CLO 1	Know the terms of the measurements, and understand the principle of operation of an instrument, choose Suitable measuring instruments for a particular application and apply ethical principles while measuring dimensions.
CLO 2	Appreciate Measurement of strain by using a basic strain gauge and hence verify the stress induced and application of transducers in mechanical engineering applications for sustainable development
CLO 3	Apply the principles of instrumentation for transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress in mechanical engineering applications for sustainable development
CLO 4	Apply the principles of Miscellaneous measurements for humidity, density, level and blood pressure.
CLO 5	Apply the principles of limits, fits, tolerance and Analyse the process alignment testing of machine tools for manufacturing field.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	MEASURING INSTRUMENTS Measurement-definition-methods of measurement-Significance-Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration -Errors in Measurements-Systematic and Random error. Measuring instruments- Factors in selecting the measuring instruments -Thread measurements: -Bench micrometre-Thread gauge micrometre- Angle measurements- Bevel protractor, Sine Bar, Gauges: plain plug gauge, snap gauge, ring gauge-. Surface finish Measurement of surface finish by Tal surf surface roughness tester-Co- ordinating measuring machine.	10%	06
2	TRANSDUCERS AND STRAIN GAUGES Transducers- concept-Characteristics, Transducers selection factors, classifications of Transducer, actuating mechanisms. Voltage and current generating analog transducers Types- Piezoelectric transducer. Strain Measurements: Strain gauge, Classification, Berry type mechanical strain gauge, optical strain gauges, mounting of strain gauges, Strain gauge rosettes-two and three elements, Gauge factor	20%	08
3	MEASUREMENT OF FORCE, TORQUE, AND PRESSURE Force measuring devices- Spring Balance, proving ring, Strain gauge type Load cell- Torque measuring devices- Prony brake, Hydraulic dynamometer-pressure measuring devices- - Diaphragm type pressure gauge- Bourdon tube pressure gauge- Mcloed gauge, Construction, working and applications.	25%	10

4	APPLIED MECHANICAL MEASUREMENTS Speed measurement- Classification of tachometers. Working principle, construction, working of Revolution counters and Eddy current tachometers. Displacement measurement-Working principle, construction, working of Linear variable Differential transformers (LVDT)-Flow measurement-Working principle, construction, working of Rotometers-Temperature measurement. Principle, construction, working of Resistance thermometers and Optical Pyrometer, Thermocouples	25%	10
5	MISCELLANEOUS MEASUREMENTS Humidity measurement-construction, working of hair hygrometer-Density measurement- Measurement of density using hydrometer, Liquid level measurement --Measurement of liquid level by using sight glass, Float Gauge-Biomedical measurement- construction, working of Sphygmometer	20%	08
		100%	42

i. Text Book and Reference Book:

1. Electric and Electronic Measurement and instrumentation by Sawhney, A.K., Dhanpat Rai and Co. Author, nineteenth revised edition 2011 reprint, 2014.
2. Metrology and Measurement by Anand Bewoor & Vinay Kulkarni, McGraw-Hill.
3. Engineering Metrology and Instrumentation by R.K.Rajput.
4. Engineering Metrology and Measurement by N V Raghavendra and Krishnamurthy, Oxford University Press.

j. Experiment List:

Sr. No.	Experiment List
1	Calibration of capacitive transducer for angular displacement
2	Study and calibration of LVDT transducer for displacement measurement.
3	Study of resistance temperature detector for temperature measurement.
4	Calibration of thermistor for temperature measurement.
5	Calibration of thermocouple for temperature measurement.
6	Calibration of hot wire anemometer for temperature measurement.
7	Calibration of Pressure Gauges
8	Calibration of strain gauge for temperature measurement.
9	Study and calibration of photo and magnetic speed pickups for the measurement of speed
10	Study and calibration of a rotameter for flow measurement.

(7)

- a. **Course Name:** Professional Communication and Critical Thinking
- b. **Course Code:** 03693203
- c. **Prerequisite:** Knowledge of English Language.
- d. **Rationale:** Advance level of communication and personality development is crucial for and after placement.
- e. **Course Learning Objective:**

CLOBJ 1	Develop effective verbal and written communication skills for professional settings.
CLOBJ 2	Enhance listening, feedback, and presentation skills to communicate clearly in diverse environments.
CLOBJ 3	Practice critical thinking and problem-solving techniques to analyse complex issues.
CLOBJ 4	Learn to construct logical arguments and support decisions with evidence and reasoning.
CLOBJ 5	Apply communication strategies for teamwork, leadership, and conflict resolution.
CLOBJ 6	Understand ethical considerations and cultural awareness in professional communication.

f. Course Learning Outcomes:

CLO 1	Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
CLO 2	Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication.
CLO 3	Also develop skills of group presentation and communication in team.
CLO 4	Develop non-verbal communication such as proper use of body language and gestures.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Story Mason Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	05%	01
2	Determiners, Articles, and Interrogatives This session will enable students to understand proper usage of Determiners and Articles. It will also enhance their daily speaking conversational/ communication skills. Preparation of verbal section in company's aptitude exam.	10%	06
3	Subject-Verb Agreement This will enable students to understand the formation of sentence with the usage of subject-verb agreement.	10%	03
4	Reading-Skill Building Types of Reading – reading for different purposes An Astrologer's Day-Malgudi Days Enhance reading skills by collecting information, know the importance of reading.	10%	02
5	Reading Comprehension Learn to solve the reading comprehension questions in an easy manner and also in less amount of time Introduction, Factual & Inferential comprehension, Reasons for Poor Comprehension Able to solve reading comprehension in less amount of Time by practicing.	10%	02
6	Mafia the art of Observation and Convincing The interesting activity is targeted toward improving observation and convincing skills. A team activity in which every single Individual is a very important person of his team to win.	05%	01
7	Direct and Indirect Speech	10%	03

	This session will enable students to understand proper usage of narration.		
8	Industry Expectation In this class the students will be made to understand what will be the world after their college life will be, how they should prepare themselves from that competitive world with full of challenges for them.	05%	01
9	Mirror & Water Images Reflection of an object into a mirror and water. It is obtained by inverting an object laterally (mirror) & vertically (water).	10%	03
10	Sentence Correction It will also enhance their daily speaking conversational/communication skills. Preparation of verbal section in company's aptitude exam.	05%	02
11	Play Teacher Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	05%	01
12	Professional Writing Email and report.	05%	03
13	Group Discussion It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members of a group who share some common objectives.	10%	02
		100%	30

i. Text Book and Reference Book:

1. Active English by Juneja & Qureshi | Macmillan.
2. Verbal and Non-verbal reasoning by B.S. Sijvali and Indu Sijvali, Arihant Publication.
3. Competitive English by Azhar Siddiqui, Macmillan.

Semester 4

(1)

- a. **Course Name:** Essence of Indian Knowledge and Tradition
- b. **Course Code:** 03600251
- c. **Prerequisite:** Zeal to learn Subject
- d. **Rationale:** The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature is also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

e. Course Learning Objective:

CLOBJ 1	Understand the historical evolution and core concepts of Indian philosophy and culture.
CLOBJ 2	Explore the significance of ancient Indian texts and their impact on modern knowledge systems.
CLOBJ 3	Learn about the contributions of Indian scholars to science, mathematics, and technology.
CLOBJ 4	Study the principles of Indian spirituality, ethics, and their application in daily life.
CLOBJ 5	Analyse the traditional Indian education system and its relevance in contemporary society.
CLOBJ 6	Understand the role of Indian art, literature, and music in shaping cultural heritage.

f. Course Learning Outcomes:

CLO 1	Understanding the role of Modern Science.
CLO 2	Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	0	20	20	-	-	-	40

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basic Structure of Indian Knowledge System i) Vedas, (ii) Unveda (Ayurveda, Dhanurveda, Gandhveda, Sthanya etc.) (iii) Vedanga (Education, Kalna, Nanrut, Grammar, Jyotish verses), (iv) Upaayaga (Dharma level, Vivamsa, Purana, Takma level)	60%	15
2	Modern Science and Indian Knowledge System	15%	05
3	Yoga and Holistic Health care	15%	05
4	Case Studies	10%	05
		100%	30

(2)

- a. **Course Name:** Control Engineering
- b. **Course Code:** 03633255
- c. **Prerequisite:** Knowledge of basic mathematics and Science. Basic Electrical and Electronics Engineering
- d. **Rationale:** Measurements are more important for the quality of the product. In this subject various method of measurements are discussed.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of control systems and their components.
CLOBJ 2	Analyse and model dynamic systems using mathematical techniques.
CLOBJ 3	Study feedback control mechanisms and their applications in engineering systems.
CLOBJ 4	Learn about stability, performance analysis, and design of control systems.
CLOBJ 5	Apply transfer functions, state-space models, and controllers to solve practical problems.
CLOBJ 6	Develop skills in using control system software for simulation and real-time applications.

f. Course Learning Outcomes:

CLO 1	Understand the fundamental principles of control systems, including feedback and stability.
CLO 2	Design and implement PID controllers for real-time system regulation.
CLO 3	Analyse system behaviour using time-domain and frequency-domain techniques.
CLO 4	Model and simulate dynamic systems for control system design and optimization.
CLO 5	Apply control engineering concepts to automate and optimize mechatronic systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, basic elements of a servo mechanism, Examples of automatic control systems, use of equivalent systems for system analysis, linear systems, non-linear systems, control system examples from chemical systems, mechanical systems, electrical systems, introduction to laplace transform	15%	08
2	Transfer Function Transfer function analysis of ac and dc servomotors synchronous, stepper motor, amplidyne. ac position control system, magnetic amplifier.	15%	06
3	Control system representation Transfer function, block diagram, reduction of block diagram, problems on block diagram, Mason's formula signal flow graph	20%	10
4	Time Response Analysis Standard test signals, time response of first and second-order system, time constant, time response of second order system, time response specifications, steady-state errors and error constants, problems in first and second order system.	25%	12
5	Stability Routh Hurwitz Criterion, Root Locus, Bode Plotting using semi log graph paper	25%	12
		100%	48

i. Text Book and Reference Book:

1. Modern Control System by Richard C. Dorf and Robert H. Bishop | Pearson Int.
2. Modern Control Engineering by Katsuhiko Ogata | Prentice Hall of India.
3. Control Systems Engineering by Nagrath and Gopal | New Age Publication.
4. Automatic Control Systems by Benjamin C. Kuo | John Wiley & Sons.
5. Feedback and Control Systems by Joseph J. Distefano | TMH.

j. Experiment List:

Sr. No.	Experiment List
1	Introduction to MATLAB Software.
2	To obtain a transfer function from given poles and zeroes using MATLAB.
3	To Perform Block Diagram Reduction rules in MATLAB.
4	Generating standard test signals i.e. step, ramp, and unit impulse on a simulator.
5	To obtain the transfer function from the state model and state space from transfer function.
6	Simulation of DC motor Working using state space model in MATLAB.
7	To obtain the time response of a given second order system with its damping frequency.
8	Simulation of Transfer Function of RC Circuit in MATLAB Software.
9	Plotting root loci of a given transfer function using a simulator.
10	Plotting phase magnitude plot of a given transfer function with a simulator.
11	To control the closed loop system using PID controller.

(3)

- a. **Course Name:** Manufacturing Process
- b. **Course Code:** 03634251
- c. **Prerequisite:** Knowledge of basic production techniques and Science.
- d. **Rationale:** In this subject various method of production are discussed.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of various manufacturing processes such as casting, welding, and machining.
CLOBJ 2	Analyse the material properties and their influence on the selection of manufacturing methods.
CLOBJ 3	Learn about the working principles of machines and tools used in the production process.
CLOBJ 4	Study the design considerations for cost-effective and efficient manufacturing operations.
CLOBJ 5	Understand quality control methods and the importance of precision in manufacturing.
CLOBJ 6	Explore modern manufacturing technologies, including additive manufacturing and automation.

f. Course Learning Outcomes:

CLO 1	Understand different manufacturing processes like casting, machining, welding, and additive manufacturing.
CLO 2	Select appropriate manufacturing techniques based on material properties and design requirements.
CLO 3	Analyse the efficiency and cost-effectiveness of various manufacturing methods.
CLO 4	Apply principles of automation and robotics to enhance manufacturing productivity.
CLO 5	Integrate CAD/CAM systems for optimizing the design-to-production process.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction 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.	16%	06
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.	22%	08
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.	12%	05
4	Boring Machine Purpose and field of application, Horizontal boring machines, Precision boring machines.	06%	03
5	Milling Machines Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling	22%	08

	cutters, attachments extending the processing capabilities of general-purpose milling machines, Indexing, Helical milling operation and its set up, Alignment tests of milling machine.		
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.	12%	05
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.	06%	03
8	Grinding Machines and Abrasives Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, centre less grinders, Types of grinding wheels, wheel characteristics and wheel selection.	12%	04
		100%	42

i. Text Book and Reference Book:

1. Manufacturing Technology by P.N.Rao, Tata McGraw Hill publication.
2. Production Technology by H M T Publication, Tata McGraw Hill, 1980.
3. Elements of Workshop Technology (Vol I & Vol II) by Hajra Choudhary | Media Promoters and Publishers Pvt ltd.
4. Workshop Technology (Vol I & Vol II) by B.S Raghuwanshi | Dhanpatrai.
5. Production Technology by R.K. Jain | Khanna Pub.

j. Experiment List:

Sr. No.	Experiment List
1	To get an overview of various machine tools.
2	To Study single point cutting tool geometry.
3	To study Various Parts, mechanism, attachments and operations of lathe.
4	To understand drilling m/c, classification and operation.
5	To study a Boring m/c, classification and operations performed.
6	To understand Milling Machines, its construction and operation.
7	To understand the principle, construction and operation of shaping and slotting m/c.
8	To understand Sawing and Broaching machine.
9	To understand construction and working of Grinding machine.
10	To understand different alignment test on lathe, shaper, drilling and milling machine.

(4)

- a. **Course Name:** Microprocessor and Microcontroller
- b. **Course Code:** 03634257
- c. **Prerequisite:** Knowledge of basic mathematics and electronics.
- d. **Rationale:** In this subject construction and working of microprocessors and microcontrollers are discussed.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the architecture and functioning of microprocessors and microcontrollers.
CLOBJ 2	Learn to program microprocessors and microcontrollers using assembly and high-level languages.
CLOBJ 3	Study input/output interfacing techniques for microcontroller-based systems.
CLOBJ 4	Develop skills in troubleshooting and debugging microprocessor and microcontroller systems.
CLOBJ 5	Analyse memory organization, addressing modes, and data transfer techniques in microcontrollers.
CLOBJ 6	Apply microcontrollers in real-world embedded systems and automation applications.

f. Course Learning Outcomes:

CLO 1	Understand the architecture and working principles of microprocessors and microcontrollers.
CLO 2	Program microcontrollers using assembly language and high-level programming languages.
CLO 3	Interface microcontrollers with external devices such as sensors, motors, and displays.
CLO 4	Design and implement embedded systems for real-time applications.
CLO 5	Troubleshoot and optimize microprocessor-based systems for efficiency and performance.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction To 8085 Microprocessor CPU, I/O devices, clock, memory, bussed architecture, address bus, data bus and control bus; 8085 Microprocessor architecture, buses, register, flags; 8085 pin configuration & function. Addressing modes of 8085.	10%	05
2	Introduction to 8051 Microcontrollers and embedded processors, Overview of 8051 family Architecture of 8051, 8051 Memory organization, Registers, Special Function Registers (SFRs), PSW, Program counter & ROM space in 8051.	15%	07
3	8051 Programming Introduction to 8051 Assembly language programming, Instruction Set: Arithmetic, Logical, Loop, jump and Call instructions, Addressing Modes, 8051 data types and Directives, time delay for various 8051 chips., Accessing memory using various addressing modes.	20%	07
4	Programming Tools and Technique Introduction to Assembly and Embedded C Language, Introduction to KEIL IDE/SDCC, Basics of Embedded C --Data types, Looping, Functions, Array in C, Arithmetic & Logical Operations in C.	15%	10
5	Internal and External Peripheral Interfacing Assembly and C Programming of Internal Peripherals Like: Ports, Timers and Counters in different Modes, UART in different modes, Different types of Interrupts and its priority. LCD interfacing, Matrix keyboard interfacing, parallel and	40%	16

	serial ADC, DAC Interfacing, Stepper and DC motor, Sensor Interfacing.		
		100%	45

i. Text Book and Reference Book:

1. "8051 Microcontroller & Embedded system using assembly & C" by Muhmmad Mazidi.
2. "8051 microcontroller & Embedded system using assembly & C" by K J Ayala.
3. "Programming and Customizing the 8051 Microcontroller" by Myke Predko. "The 8051 Microcontrollers, Architecture and programming and Applications" by K.Uma Rao, Andhe Pallavi.

j. Experiment List:

Sr. No.	Experiment List
1	Programming 8051 Micro controller using ASM and C, and implementation in flash 8051 microcontroller.
2	Programming with Arithmetic logic instructions [Assembly].
3	Program using constructs (Sorting an array) [Assembly].
4	Programming using Ports [Assembly and C].
5	Delay generation using Timer [Assembly and C].
6	Programming Interrupts [Assembly and C].
7	Implementation of standard UART communication (using hyper terminal) [Assembly and C].
8	Interfacing LCD Display. [Assembly and C].
9	Interfacing with Keypad [Assembly and C].
10	Programming ADC/DAC [Assembly and C].
11	Interfacing with stepper motor. [Assembly and C].
12	Pulse Width Modulation. [Assembly and C] Programming ARM Micro controller using ASM and C using simulator.
13	Programming with Arithmetic logic instructions [Assembly].

(5)

- a. **Course Name:** Power Electronics
- b. **Course Code:** 03634259
- c. **Prerequisite:** Knowledge of basic electrical and electronics.
- d. **Rationale:** In this subject construction and working of electrical and electronic devices are discussed.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts and components of power electronics systems.
CLOBJ 2	Learn the operation and application of power semiconductor devices such as diodes, transistors, and thyristors.
CLOBJ 3	Analyse and design power conversion circuits including rectifiers, inverters, and choppers.
CLOBJ 4	Study the principles of controlling power flow and voltage regulation in electronic systems.
CLOBJ 5	Understand the operation of power supplies and energy-efficient systems for industrial applications
CLOBJ 6	Develop skills in the design and analysis of power electronic systems for renewable energy and automation.

f. Course Learning Outcomes:

CLO 1	Understand the principles of power conversion and control in electronic systems.
CLO 2	Analyse and design power electronic circuits, including rectifiers, inverters, and converters.
CLO 3	Select appropriate semiconductor devices for power regulation and switching applications.
CLO 4	Apply power electronics in the control of motors, energy systems, and mechatronic devices.
CLO 5	Evaluate the efficiency, thermal management, and protection in power electronic systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Thyristor Devices Types of Thyristors: SCR, LASCR, SCS, GTO, UJT, PUT, DIAC and TRIAC, Thyristor family devices: symbol, construction, operating principle and V-I characteristics, SCR, construction, two transistor analogy, types, working and characteristics, Protection circuits: over- voltage, over-current, Snubber, Crowbar.	20%	08
2	Power semi-conductor Devices Power electronic devices, Power transistor: construction, working principle, V-I characteristics and uses, IGBT and MOSFET: Construction, working principle, V-I characteristics and uses.	25%	10
3	Commutation of SCR SCR Turn-On methods, SCR Turn-Off methods, Class A- Series resonant commutation circuit, Class B-Shunt Resonant commutation circuit, Class C-Complimentary Symmetry commutation circuit, Class D $\pm$ Auxiliary commutation, Class E- External pulse commutation, Class F- Line or natural commutation.	25%	10
4	Phase Controlled Rectifiers Phase control: firing angle, conduction angle, Single phase half controlled, full controlled and midpoint-controlled rectifier with R, RL load: Circuit diagram, working, input- output waveforms, equations for DC output and effect of freewheeling diode, Different configurations of bridge-controlled rectifiers: Full bridge, half bridge with common anode, common cathode, SCRs in one arm and diodes in another arm.	15%	07

5	Industrial Control Circuits Explain the working principle of Chopper and its applications, explain basic working principle of inverter and its applications, Explain the working principle of cyclo-converter and its applications	15%	07
		100%	42

i. Text Book and Reference Book:

1. Power Electronics by Dr P.S. Bhimbra.
2. Power electronics by M D Singh and K B Khanchandani.
3. Power Electronics - Circuits, Devices and Applications by Muhammad H. Rashid.
4. An Introduction to Thyristors and Their Applications by Ramamoorthy.
5. Power Electronics: Devices, Converters, Applications" By V. Subrahmanyam.
6. Modern Power Electronics by P. C. Sen.
7. Modern Power Electronics and AC Drives by Bimal. K. Bose.

j. Experiment List:

Sr. No.	Experiment List
1	To study, Perform & plot characteristics of Thyristor.
2	To study, Perform & plot characteristics of DIAC.
3	To study, Perform & plot characteristics of TRIAC.
4	To perform Resistance and RC triggered circuits of SCRs.
5	To study, Perform & plot UJT as a relaxation oscillator.
6	To perform the operation of single-phase half wave-controlled rectifier using RC phase shift triggering.
7	To study, Perform & observe the waveform of single-phase half converter with Resistive load.
8	To study, Perform & observe the waveform of single-phase full converter with resistive load.
9	To study, Perform & observe the waveform of step-up choppers.
10	To study, Perform & observe the waveform of step-down choppers.
11	To study, Perform & observer the wave forms of series inverters.
12	To study, Perform & observer the wave forms of parallel inverters.
13	To Perform operation of voltage commutated thyristor-based DC Chopper.
14	To simulate operation of Buck Converter.
15	To simulate operation of Boost Converter.

(6)

- a. **Course Name:** Design of Machine Elements
- b. **Course Code:** 03634263
- c. **Prerequisite:** Knowledge of mechanics and mathematics.
- d. **Rationale:** In this subject design of various machine parts are discussed.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of machine element design and material selection.
CLOBJ 2	Learn to design key mechanical components such as shafts, bearings, gears, and springs.
CLOBJ 3	Apply stress, strain, and fatigue analysis to ensure safe and efficient designs.
CLOBJ 4	Study the principles of failure theories and factor of safety in machine element design.
CLOBJ 5	Understand the role of tolerances and fits in the design and assembly of machine components.
CLOBJ 6	Develop skills in creating detailed drawings and CAD models for machine element design.

- f. **Course Learning Outcomes:**

CLO 1	Apply principles of mechanics to design machine elements.
CLO 2	Select materials and components based on mechanical properties and design requirements.
CLO 3	Perform stress and strain analysis for machine element durability and safety.
CLO 4	Use CAD tools to create and validate machine element designs for real-world applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction General consideration and factors influencing the design of machine elements and design process. Various materials used in manufacturing of machine elements and their properties. Types of loads, types of stresses, concept of stress concentration and factor of safety. Standardization and preferred numbers, numeric examples on preferred numbers.	18%	08
2	Design of machine elements subjected to direct stresses Illustration of simple machine elements subjected to direct stresses independently and identification of resisting areas (simple numeric examples). Design of simple machine elements subjected to uni-axial direct stresses independently. Design procedure (with numeric examples), steps, identification of resisting areas and design of: i. Knuckle joint. ii. Cotter joint. iii. Riveted joints. iv. Welded joint-fillet & lap joint	22%	09
3	Design of Machine element subject to bending Principle of bending and its fundamental equation. Modulus of various sections, example of pure bending like levers, beams, axle, etc. Types of levers. Design procedure (with numeric example) of levers including cross section of arms, bosses and pins. Design procedure (with numeric example) of leaf spring.	12%	05
4	Design of machine elements subjected to direct and twisting moments Fundamental equation of twisting moment with design procedure. Types of shafts with important features of each. Design of shafts (with numeric examples). Types of keys, applications of each and design procedure (with numeric examples). Types of couplings and applications. Design of muff and flange couplings (with numeric examples). Types of spring, terminology related to helical spring and	18%	08

	applications of helical spring.		
5	Design of machine elements subjected to direct and bending stresses Eccentric loading. Concept. ii. Illustrations like frame, C-clamp, Bracket, Foundation bolt, Bolts in flange, etc. iii. Design of machine element like C-Clamp, bracket, foundation bolt and bolts in flange. (with numeric examples).	10%	04
6	Design of pressure vessels Types and applications of pressure vessels used in industries. State Range of pressure also. Design of thick and thin cylinders (with numeric examples). Design of thin spherical shell (with numeric examples).	10%	04
7	Selection procedure for bearings Classification of bearings. Bearing designation as per IS. Antifriction bearings: types, advantages, applications. Selection procedure of anti-friction bearings. Calculation for anti-friction bearings: basic dynamic load, load rating, equivalent load, bearing life.	10%	04
		100%	42

i. Text Book and Reference Book:

1. "Machine Design (Textbook)" by Sadhu Singh.
2. "Machine Design an Introduction" by R L Norton.
3. "Design of Machine Elements" by V B Bhandari.
4. "Machine Design Vol - II & III by F. Haideri.

j. Experiment List:

Sr. No.	Experiment List
1	Exercise based on design considerations and material selection.
2	Exercise to design helical spring and leaf spring.
3	Exercise to design belt drive and chain drive.
4	Exercise to design pulley and wire rope.
5	Exercise to design roller bearings.
6	Exercise to design journal bearing.
7	Exercise to design thin and thick pressure vessels.
8	Prepare drawing or model of designed pressure vessel.

(7)

- a. **Course Name:** Minor Project
- b. **Course Code:** 03634268
- c. **Prerequisite:** The students are required to identify their problem and they are required to follow all the rules and instructions issued by department, for safety and other requirements.
- d. **Rationale:** To understand the basic theory, study of the particular Systems/Services/Processes in the context of the abstract problem area/s. After understanding the student will analyse the information, prepare list of probable requirements, the questions if any, the probable forecasting of hurdles which might be observed in future and finding the way outs.
- e. **Course Learning Objective:**

CLOBJ 1	Identify and define a specific problem or project related to the field of study.
CLOBJ 2	Conduct research and gather relevant data to support project development.
CLOBJ 3	Apply theoretical knowledge to design, implement, and test a working solution.
CLOBJ 4	Develop problem-solving and analytical skills through hands-on project experience.
CLOBJ 5	Enhance communication skills by preparing a detailed project report and presentation.
CLOBJ6	Learn project management techniques such as time management and teamwork during execution.

f. Course Learning Outcomes:

CLO 1	Demonstrate a holistic understanding of mechatronics principles through the design and integration of mechanical components with electronic systems in a practical project.
CLO 2	Showcase practical competence in mechatronics by selecting, interfacing, and programming sensors and actuators for seamless integration into a mechatronic system.
CLO 3	Attain proficiency in real-time control of mechatronic systems, mastering microcontroller programming, and implementing feedback control algorithms along with dynamic response analysis.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

Semester 5

(1)

- a. **Course Name:** Hydraulic and Pneumatic Systems
- b. **Course Code:** 03634301
- c. **Prerequisite:** Basic knowledge of Physics.
- d. **Rationale:** This course gives the basic knowledge of components and functions of hydraulic and pneumatic systems. Also provides different theories and applications of hydraulic and pneumatic power/control systems.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of fluid power systems, including hydraulics and pneumatics.
CLOBJ 2	Learn about the components of hydraulic and pneumatic systems, such as pumps, valves, actuators, and cylinders.
CLOBJ 3	Analyse and design basic hydraulic and pneumatic circuits for industrial applications.
CLOBJ 4	Study fluid dynamics and the behaviour of fluids under pressure in various system configurations
CLOBJ 5	Understand the maintenance, troubleshooting, and safety aspects of hydraulic and pneumatic systems.
CLOBJ 6	Apply control techniques to optimize the performance and efficiency of fluid power systems.

f. Course Learning Outcomes:

CLO 1	Understand the knowledge about hydraulic and pneumatic systems.
CLO 2	Control motions through hydraulic and pneumatic systems.
CLO 3	Understand behaviour of working media in hydraulic and pneumatic systems.
CLO 4	Do automation by integrating electrical and mechanical components in hydraulic and pneumatic systems.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	INTRODUCTION Basics of Hydraulics & Pneumatic Systems, advantages and disadvantages, Comparison between mechanical, electrical, hydraulic and pneumatic power transmission, Principles of Hydraulic Fluid power (Pascal law, application of Pascal law, continuity equation, flow rate).	05%	02
2	Hydraulic System and its Components Hydraulic Pumps & Motors: Classification of hydraulic pumps, Gear Pumps, Vane Pumps, Radial piston Pumps, Axial piston Pumps, Hydraulic motors, Selection of Hydraulic Pumps. Actuators: Linear and Rotary Actuators, Hydrostatic Transmission Systems. Hydraulic Valves: Direction control valves, Pressure control valves, Flow control valves, non-return valves, Electro-Hydraulic Servo valves. Hydraulic system Accessories: Reservoirs, Accumulators, Heating & cooling devices Fluid Properties: Types, Properties, physical characteristics & functions of hydraulic Oils, Classification Mineral based, Fire resistant & Biodegradable Oils Filters & location of filter.	40%	18
3	Design of Hydraulic Circuits Symbols, Control of single acting and double acting cylinder, meter in and meter out circuits, regenerative circuits, counter valve application, automatic cylinder reciprocating, fail safe circuit, pump unloading circuits, Power losses in flow control circuits.	10%	05
4	Pneumatic System and its components Basic Requirements for Pneumatic System, Applications, Types & Selection criteria for Air Compressors, Air receiver, FRL unit, Air filter, Pressure regulator and Lubricator.	25%	12

	Pneumatic Actuators, Motors and Valves: Types of Pneumatic Cylinders & Air motors, Cushion assembly, mounting Arrangements, Pneumatic Direction control valves, Quick exhaust, Time delay Shuttle and Twin pressure valves.		
5	Design of Pneumatic Circuits Symbols, control of single acting & double acting cylinder by various methods, impulse operation, speed control of a cylinder, sequencing of motions, automatic cylinder reciprocating, time delay circuits, logic operation circuits, circuits by cascade systems.	10%	05
6	Electro Hydraulics and Electro-Pneumatic Overview and applications, System components, Development of single and multiple Actuator Circuits.	10%	03
		100%	45

i. Text Book and Reference Book:

1. Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.
2. Hydraulics & Pneumatics by Andrew Parr, Jaico Publications.
3. Pneumatic and Hydraulic components and instrumentation in automatic controls by Leskiewics H.J. and Zarhmba M.

j. Experiment List:

Sr. No.	Experiment List
1	Graphical Symbol as per DIN-ISO: 1219.
2	To understand working and construction of hydraulic components and basic circuits.
3	To understand working and construction of Pneumatic components and basic circuits.
4	Circuit design for Speed control of hydraulic cylinders. (Meter-In, Meter-Out and Bypass circuits).
5	Electro hydraulic circuit-Speed control of double acting hydraulic cylinder.
6	Electro Hydraulic circuit-Sequential operation through Limit Switches.
7	To control Double acting pneumatic cylinder through 5/2 D.C. Valve & by 3/2 push button valves and Shuttle Valve.
8	To understand the logic system for pneumatic system.
9	To understand use of Quick exhaust, Flow control and Time Delay valve.
10	Control of Double acting pneumatic cylinder.
11	To control double acting pneumatic cylinder through 5/2 solenoid operated DCV.

(2)

- a. **Course Name:** Programmable Logic Controllers
- b. **Course Code:** 03634303
- c. **Prerequisite:** Basic knowledge of Electrical and Electronics engineering.
- d. **Rationale:** This course aims to teach students various teaching learning experiences: for maintain Industrial Automation Systems.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic principles and components of a programmable logic controller (PLC) system.
CLOBJ 2	Learn the programming languages used for PLCs, including ladder logic and function block diagrams.
CLOBJ 3	Design and implement control systems using PLCs for industrial automation applications.
CLOBJ 4	Study the interfacing of PLCs with sensors, actuators, and other industrial devices.
CLOBJ 5	Develop skills in troubleshooting and maintaining PLC-based control systems.
CLOBJ 6	Apply PLCs to real-world projects, enhancing automation, efficiency, and control in industries.

f. Course Learning Outcomes:

CLO 1	Identify different types of automation systems.
CLO 2	Interface I/O devices with the PLC modules.
CLO 3	Develop PLC ladder programs for various applications.
CLO 4	Prepare simple SCADA applications.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to Industrial Automation Automation: Need and benefits. Types of automation system: Fixed, Programmable, Flexible, Different systems used for Industrial automation: PLC, HMI, and SCADA	05%	02
2	PLC Fundamentals Evolution of PLC, Basic Components and Their Symbols, Fuses, Switches – Pushbutton, Mushroom head switches, Selector Switches, Limit Switches, Indicator Lamps, Relays, Time Delay Relays - Delay-On Timer (TON) Relay, Delay-Off Timer (TOF) Relay. Building blocks of PLC: CPU, Memory organization, Input- output modules (discrete and analog), Specialty I/O Modules, Power supply. Fixed and Modular PLC and their types, Redundancy in PLC module I/O module selection criteria Interfacing different I/O devices with appropriate I/O modules.	40%	18
3	PLC Programming and Applications Fundamentals of Ladder diagrams – Basic diagram framework, wiring and reference designators. Boolean logic and relay logic - AND, OR, AND OR and OR AND. PLC I/O addressing PLC programming Instructions: Relay type instructions, The Latch (with sealing/latching contacts), Timer instructions: On delay, off delay, retentive, Counter instructions: Up, Down, High speed, Logical instructions, Comparison Instructions, Data handling Instructions, Arithmetic instructions. PLC programming language: Functional Block Diagram (FBD), Instruction List. Structured text, Sequential Function Chart (SFC), Ladder Programming. Simple Programming examples using ladder logic: Language based on relay, timer counter, logical, comparison, arithmetic and data handling instructions. PLC Based Applications: Interfacing of different sensors, Motor sequence control, Traffic light control, Elevator control, Tank Level control, Conveyor system, Stepper motor control with PLC.	10%	05
4	HMI And SCADA In Automation Introduction to HMI Definition of HMI, History of HMI, Application of HMI, Difference between HMI and SCADA. Introduction to SCADA: Definition of SCADA, History of SCADA, Application area of SCADA, Advantages and disadvantages of SCADA.	25%	12
		100%	45

i. Text Book and Reference Book:

1. Introduction to Programmable Logic Controllers by Gray Dunning, Delmar Thompson Learning.
2. Programmable Logic Controllers by Frank D. Petruzella, McGraw-Hill Book Company.
3. Programmable Logic Controllers by John R. Hackworth, Frederick D. Hackworth, Pearson Education Inc.
4. SCADA-Supervisory Control and Data Acquisition by Stuart A. Boyer, Instrument Society of America Publications, USA | 4, Pub. Year 2004

j. Experiment List:

Sr. No.	Experiment List
1	Identify and connect various switches – pushbutton, mushroom head switches, selector switches, limit switches, indicator lamps, relays, time delay relays - delay-on timer (TON) relay, delay-off timer (TOF) relay.
2	Identify and connect various parts of the given PLC and front panel status indicators with different sensors i.e., Proximity, RTD, Thermocouple, IR, Ultrasonic sensor, level, pressure, flow, for real time interfacing with PLC.
3	Use PLC to test the START STOP logic using two inputs and one output.
4	Develop/Execute a ladder program for the given application using following: - timer, counter, comparison, logical, arithmetic instructions.
5	To perform an automation module - star delta connection of AC motor.
6	Measure the temperature of the given liquid using an automation module - water level control.
7	Develop and test ladder program to automation module - conveyor control.
8	Develop and test the ladder program for mobile dynamic automation module - DC motor with external encoder.
9	Develop ladder program for automation module - 4-way traffic signal control
10	Develop and test ladder program for AC motor speed control with VFD.
11	Develop and test ladder program for automation module - lift control.
12	Develop and test ladder program for servo motor control.
13	Develop and test ladder program and configure advance PLC and HMI.

(3)

- a. **Course Name:** Project-I
- b. **Course Code:** 03634306
- c. **Prerequisite:** The students are required to identify their problem and they are required to follow all the rules and instructions issued by department, for safety and other requirements.
- d. **Rationale:** To understand the basic theory, study of the particular Systems/Services/Processes in the context of the abstract problem area/s. After understanding the student will analyse the information, prepare list of probable requirements, the questions if any, the probable forecasting of hurdles which might be observed in future and finding the way outs.
- e. **Course Learning Objective:**

CLOBJ 1	Understand how mechanical, electronic, and computer engineering work together.
CLOBJ 2	Get hands-on experience in choosing and using sensors and actuators for practical applications.
CLOBJ 3	Gain skills in creating and implementing control systems that are stable, responsive, and reliable.
CLOBJ 4	Develop the ability to program microcontrollers and embedded systems for seamless integration in mechatronic projects.
CLOBJ 5	Improve teamwork and project management skills by actively participating in planning, executing, and evaluating mechatronics projects with others.

f. Course Learning Outcomes:

CLO 1	Will expose technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
CLO 2	Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
CLO 3	Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
CLO 4	Expose students to the engineer's responsibilities and ethics.
CLO 5	Expose the students to future employers.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	8	4	-	-	60	-	40	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

(4)

- a. **Course Name:** Summer Internship
- b. **Course Code:** 03634308
- c. **Prerequisite:** Current technological developments relevant to the subject area of training.
- d. **Rationale:** The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The Internship program not only helps fresh pass-outs in gaining professional know-how but also benefits, corporate on fresh perspectives on business issues and even discovering future business leaders.
- e. **Course Learning Objective:**

CLOBJ 1	Learn to use mechatronics tools to solve real-world engineering problems.
CLOBJ 2	Work well with others in diverse teams on mechatronics projects to improve teamwork skills.
CLOBJ 3	Understand how mechatronic systems work by being involved in their development from start to finish.
CLOBJ 4	Solve practical problems in mechatronics using what you've learned in your studies.
CLOBJ 5	Build connections with professionals in mechatronics through networking and hands-on project collaboration.

- f. **Course Learning Outcomes:**

CLO 1	Will expose technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
CLO 2	Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
CLO 3	Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
CLO 4	Expose students to the engineer's responsibilities and ethics.
CLO 5	Expose the students to future employers.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	-	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

(5)

- a. **Course Name:** Computer Aided Design
- b. **Course Code:** 03634331
- c. **Prerequisite:** Mechanics of Solids, Matrix Methods of Structural Analysis and Structural Analysis.
- d. **Rationale:** CAD for mechatronics give students greater depth of technical knowledge in the areas of design using modelling and analysis software's. To learn detailed engineering of 3D models and application of computer system to a solution of design problem.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and applications of CAD software in engineering design.
CLOBJ 2	Learn to create 2D and 3D drawings, models, and assemblies using CAD tools.
CLOBJ 3	Develop skills in drafting, dimensioning, and detailing for accurate technical drawings.
CLOBJ 4	Apply design modifications and simulations to optimize engineering solutions.
CLOBJ 5	Explore CAD software features for modelling, visualization, and rendering of designs.
CLOBJ 6	Understand the integration of CAD with other engineering tools for product development and manufacturing.

- f. **Course Learning Outcomes:**

CLO 1	Use CAD software to create 2D and 3D models of mechanical components and assemblies.
CLO 2	Apply design principles to develop efficient and manufacturable product designs.
CLO 3	Perform geometric modelling and simulation of mechanical systems.
CLO 4	Generate technical drawings and detailed documentation for manufacturing.
CLO 5	Integrate CAD models with other mechatronic system components for simulation and testing.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Fundamentals of CAD Computer graphics & its terminology, CAD definition, concept & need, CAD process, Functional areas of CAD, Coordinate systems Geometric transformation - concept and types, 2 dimensional (2D) geometric transformation- translation, scaling, rotation and mirror with numeric examples.	20%	09
2	CAD Hardware CAD Workstation-types, functions and configuration, Input and output devices (including voice, gesture, 3-dimensional (3D) printer, etc)-types, configuration and applications.	20%	09
3	Geometric modelling Difference between 2D & 3D models, Geometric modelling 'concept, types, features and applications. Solid modelling methods like Constructive Solid Geometry, Pure primitives & Boundary Representation Feature base modelling-concept, illustrative examples. Parametric & non parametric modelling-concept, differences and illustration.	20%	09
4	3D Modelling using AutoCAD Introduction to AutoCAD-3D features and 2D commands overview. 3D primitives- types and defining parameters. User coordinate system (UCS) and its options 3D draw commands, 3D modify and editing commands, 3D viewing & views generation Surface modelling commands.	20%	09
5	3D parametric modelling Introduction to parametric modelling software. (Anyone from Creo, Unigraphics, CATIA, Solid Edge, Inventor etc), Sketching	20%	09

	interfacing overview, 3D working plane introductions, 3D modelling, Assembly modelling, Views generation.		
		100%	45

i. Text Book and Reference Book:

1. AutoCAD 2016 For Beginners by CAD Folks, CreateSpace Independent Publishing Platform.
2. Machine Drawing including AutoCAD (Textbook) by Ajeet Singh, McGraw hill.
3. Production Drawing by K L Narayan, New Age Publication.
4. Machine Drawing by N.D. Bhatt, Charotar publishing house.
5. CAD/CAM & Automation by Farzad Haidari, Nirali Publication.

j. Experiment List:

Sr. No.	Experiment List
1	Preparatory Activity: Prepare a 2D drawing using AutoCAD and 2D parametric sketcher environment.
2	3D Solid Modeling: Prepare 3D solid models using AutoCAD (Four components).
3	3D Surface Model: Prepare simple surface model using AutoCAD (Four components).
4	Mini Project and Presentation Using AutoCAD: Prepare solid models of dismantled parts of an assembly, Assemble the parts, Present the project.

(6)

- a. **Course Name:** Advanced Microcontrollers
- b. **Course Code:** 03634337
- c. **Prerequisite:** Knowledge of Microprocessor & Microcontroller
- d. **Rationale:** This course will provide an opportunity to the students to learn ATMEGA architecture, instruction set and programming. Arduino is very popular for portable applications because of its high performance with low power consumption. Students will learn architecture, assembly language and C programming for Arduino microcontroller in this course.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the architecture and advanced features of modern microcontrollers.
CLOBJ 2	Learn advanced programming techniques for microcontrollers using C, Assembly, and other languages.
CLOBJ 3	Study the interfacing of microcontrollers with sensors, actuators, and communication devices.
CLOBJ 4	Explore real-time operating systems (RTOS) and their use in microcontroller-based applications.
CLOBJ 5	Analyse and design embedded systems for specific applications like automation, robotics, and IoT.
CLOBJ 6	Develop skills in troubleshooting, debugging, and optimizing microcontroller-based systems.

- f. **Course Learning Outcomes:**

CLO 1	Understand the architecture and features of advanced microcontrollers.
CLO 2	Program microcontrollers for complex mechatronic system tasks.
CLO 3	Interface sensors, actuators, and communication modules with microcontrollers.
CLO 4	Implement real-time control systems using microcontroller-based platforms.
CLO 5	Optimize microcontroller performance for energy efficiency and processing speed.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	INTRODUCTION Embedded System Characteristics, Examples: Washing Machine, Chocolate Vending Machine, Room Temperature Controller, Operating System (OS): Types of OS, Types of Mobile OS, Characteristics of Real Time Operating System, Microcontroller Types: PIC, AVR, ARM: features and applications, AVR microcontroller: Types, Architecture	15%	06
2	Embedded C basics operators for Arduino Familiarizing with the Arduino IDE, Sketch designing for Arduino Communication interface using serial port Basic understanding of the code with Boolean operations, pointer access operations, bitwise operations, compounded operations	25%	12
3	Embedded C control structure blocks Decision making statement, Looping mechanism – for, do and while. The branching operations based on conditions expression	10%	05
4	Introduction to Arduino UNO Arduino UNO specifications including power ratings, digital and analog peripherals, Difference between the C language and Embedded C language Arduino UNO Ports, Pins, Digital and Analog Peripherals	25%	10
5	Communication with Arduino Different communication modules available with their real-life application Communication interface: Initialization for serial port and code for it, Interfacing DC motor and its Code, Interfacing 16x2 LCD and its code, Interfacing Accelerometer with Arduino, Interfacing of Relay Driver ULN2803 with	25%	12

	Arduino, Interfacing of USB-UART, Interface LM35 temperature sensor, Interfacing of Seven segment, Interfacing keypad and Code for it.		
		100%	45

i. Text Book and Reference Book:

1. Arduino Cookbook by Michael Margolis, Shroff/O'Reilly.
2. An Embedded Software Primer by David Simon | Addison Wesley, Pub. Year 2000.
3. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc.
4. Advanced PIC Microcontroller Projects in C by Dogan Ibrahim | Newnes, Pub. Year 2011.

j. Experiment List:

Sr. No.	Experiment List
1	Install Arduino IDE and its development tool.
2	Develop a program to Blink LED for 1second.
3	Develop a program to interface Input Switches and output LEDs with development board (Arduino).
4	Interface 16x2 LCD and Display "HELLO WORLD".
5	Interface 7 seg display with development board (Arduino) and write a program to count and display 0 to 9 on it.
6	Interfacing keypad with Arduino Board.
7	Interface LM35 temperature sensor with Arduino and monitor temp. on serial monitor.
8	Interface DC motor using L293D Motor Driver.
9	Build Digital thermometer using LM35 and LCD 16x2.
10	Interfacing of Relay Driver ULN2803 with Arduino.
11	Controlling multiple LEDs with a loop and an array.

Semester 6

(1)

- a. **Course Name:** Indian Constitution
- b. **Course Code:** 03600351
- c. **Prerequisite:** Zeal to learn Subject
- d. **Rationale:** The course aims to give brief knowledge of Indian Constitution and administration of different bodies of India. To make governance better an engineer must conduce to E-governance through computers and knowledge of cyber laws. An engineer must know the limits of state action and regulations by acquainting himself with the laws that applied by the bureaucrats. Since an engineer works at different places and sights, he must have the basic knowledge of centre – state relations with reference to policy of financing the key projects. The knowledge of Constitution is necessary for him in order to ensure that the rules and regulations under which public and private sector works, do not violate the provisions of the Constitution. Knowledge of corporate culture is necessary for him. He must understand the compulsions of the public private partnership and philosophy of state ownership of key industries.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the historical background and significance of the Indian Constitution.
CLOBJ 2	Study the structure and key components of the Indian Constitution, including the Preamble, Fundamental Rights, and Directive Principles.
CLOBJ 3	Learn about the roles and powers of the President, Parliament, and Judiciary in the Indian political system.
CLOBJ 4	Analyse the federal structure and the relationship between the central and state governments.
CLOBJ 5	Understand the process of constitutional amendments and their impact on Indian democracy.
CLOBJ 6	Explore the constitutional provisions for social justice, equality, and fundamental freedoms in India.

f. Course Learning Outcomes:

CLO 1	Understanding the Constitution.
CLO 2	Ability to understand, Union Government State Government, Local Administration and Election Commission.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	4	20	20	-	-	-	40

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	The Constitution – Introduction The History of the Making of the Indian Constitution Preamble and the Basic Structure, and its interpretation Fundamental Rights and Duties and their interpretation, State Policy Principles.	25%	09
2	Union Government Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.	20%	06
3	State Government Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat.	20%	05
4	Local Administration District Administration, Municipal Corporation, Zila Panchayat.	15%	05
5	Election Commission Role and Functioning, Chief Election Commissioner, State Election Commission	20%	05
		100%	30

i. Text Book and Reference Book:

1. An Introduction to the Constitution of India by D.D. Basu, Prentice Hall, New Delhi.
2. An Introduction to the Constitution of India by M. V. Pylee | Vikas New Delhi.

(2)

- a. **Course Name:** Internet of Things
- b. **Course Code:** 03633357
- c. **Prerequisite:** Fundamentals of Embedded system, Wireless Communication, internet technology. Basic knowledge of electronic components and programming skills.
- d. **Rationale:** This course will make students understand Hardware and software component for IoT. This course is also covering components of the networking and how to connect devices with internet.
- e. **Course Learning Objective:**

CLOBJ 1	Learn the basics of IoT, including sensors, communication, and data analysis.
CLOBJ 2	Develop skills to create and set up IoT solutions with sensors, actuators, and communication tools.
CLOBJ 3	Understand and implement security measures to protect IoT devices and data.
CLOBJ 4	Use advanced data analysis to extract useful information from IoT-generated data.
CLOBJ 5	Design and optimize IoT systems for different purposes, considering scalability and compatibility.

f. Course Learning Outcomes:

CLO 1	Define the term “Internet of Things”.
CLO 2	State the technological trends which have led to “Internet of Things”
CLO 3	Describe the impact of “Internet of Things” on society.
CLO4	Describe the interactions of Things with the physical world.
CLO 5	Describe the interaction between software and hardware in an “Internet of Things” device.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to IoT The Internet of Things Today, Internet of Things Vision, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technology- Embedded System, Wireless Sensor Networks, Communication Protocols, IoT Devices, IoT Devices vs. Computers, Societal Benefits of IoT	15%	06
2	IoT and M2M (Machine-to-Machine) Introduction, Machine-to-Machine communication, Difference between IoT and M2M, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.	15%	07
3	IoT Architecture Introduction, Architecture, Reference Model, IoT Design Methodology- Purpose and Requirement Specification, Process Specification, Domain Model Specification, Functional View, Information View, Deployment and Operational View, Device and Component Integration, Other Relevant architectural views, Application Development, Protocol of IoT.	15%	07
4	Hardware and Software: Arduino Board: Arduino Platform, Arduino IDE, Compiling Code, Arduino Shields, Arduino Basic Setup & Interface. Raspberry Pi: About the board, Raspberry Pi Interfaces, Serial SPI, Programming Raspberry Pi, Controlling LED with Raspberry pi.	20%	09
5	IoT Applications: Introduction, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications, Opinions on IoT Application and Value for Industry, Home Automation, Environment, Energy, Health and Lifestyle, Retail & Logistics, Agriculture, Case Studies: Smart Cities.	20%	08
6	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT Data Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities.	15%	08
		100%	45

i. Text Book and Reference Book:

1. "Internet of Things (A Hands-on-Approach)", (Textbook) by Vijay Madi Setti and Arshdeep Bahga, | VPT.
2. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", (Textbook) by Francis DaCosta, | A press Publications.
3. Gaston C. Hillar, Internet of Things with Python, PACKT. (Textbook).
4. Arduino Cookbook (Textbook) by Michael Margolis | O Really Publication.

j. Experiment List:

Sr. No.	Experiment List
1	Study basic Architecture of Internet of Things.
2	Demonstrations of Different IoT devices.
3	Introduction to Arduino board (NODE MCU).
4	Interfacing of Arduino board with LED and Switches.
5	Interfacing of Arduino with Sensor like IR sensor.
6	Interfacing of Arduino with Temperature sensor & Humidity sensor (DHT 22).
7	Interfacing of Arduino with Motors.
8	Connect Raspberry Pi with your existing system components.
9	Introduction and working of Raspberry Pi.
10	Interfacing Raspberry Pi board with LED.
11	Interfacing Raspberry Pi board with Light sensor (LDR).
12	Interfacing Raspberry Pi board with Switch and other Devices.
13	Interfacing of Raspberry Pi board with Temperature Sensor, Ultrasonic Sensor.
14	Case Study of IoT Applications.
15	Open Ended Problem

(3)

- a. **Course Name:** Robotics Engineering
- b. **Course Code:** 03634351
- c. **Prerequisite:** Zeal to learn the subject.
- d. **Rationale:** This course introduces the concepts of Robotic system, its components and instrumentation and control related to robotics.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts and components of robotics systems.
CLOBJ 2	Learn about the design, kinematics, and control of robotic arms and mobile robots.
CLOBJ 3	Study sensors and actuators used in robots for perception and movement.
CLOBJ 4	Develop skills in programming robots for automation, navigation, and task execution.
CLOBJ 5	Explore various types of robots, including industrial, service, and autonomous robots.
CLOBJ6	Understand the application of artificial intelligence and machine learning in robot decision-making.

f. Course Learning Outcomes:

CLO 1	Explain the fundamentals of robotics and its components.
CLO 2	Illustrate the kinematics and dynamics of robotics.
CLO 3	Elucidate the need and implementation of related instrumentation and control in robotics.
CLO4	Illustrate the movement of robotic joints with computers/microcontrollers.
CLO 5	Explain sensors and instrumentation in robotics.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction Automation and robotics, Robot-definition, need, brief history, social justification, Robot terminology Robot anatomy, Resolution, Accuracy and repeatability, and Classification and Structure of robots, point to point and continuous path systems.	20%	09
2	Basic Concepts Basic concepts, and key features, Basic structure of robots Classification of robot according to: types of system, control loop, structure of manipulator (Cartesian, cylindrical, spherical, and articulated), and Degree of freedom: concept measuring and importance.	20%	09
3	Robotic System and Control Systems Components of robotic system, Hydraulic systems, D.C. servo motors, Basic control systems concepts and models, Control system analysis, Robot activation and feedback components, Positional and velocity sensors, actuators. Power transmission systems	20%	09
4	Sensors and Instrumentation in Robotics Tactile sensors, proximity and range sensors, Force and torque sensors, Uses of sensors in robotics. Vision equipment, Image processing, Concept of low level and high-level vision	25%	11
5	Computer based Robotics Method of robots programming, GUI based robotic arm control, Interfacing with computer, communication and data processing, Introduction to Artificial Intelligence.	15%	07
		100%	45

i. Text Book and Reference Book:

1. Introduction to Robotics: Analysis, Systems, Applications by A. B. Niku, Prentice Hall.
2. Introduction to Robotics, Mechanics and control by John J. Craig, Addison, Wesley.
3. Fundamentals of Robotics, Analysis & Control by Schilling by Robert J., Prentice Hall of India.
4. Introduction to Robotics by S. K. Saha, Mc Graw Hill publication.
5. Robotics for Engineers by Koren Yoram, McGraw - Hill Education

j. Experiment List:

Sr. No.	Experiment List
1	Study different drivers for robotic arms.
2	To simulate simple robotic system using MATLAB/ MSc Adam software.
3	To study image processing system for robotics system.
4	MATLAB program for simple and inverse kinematics of simple robot configuration.
5	To simulate joint torque control of manipulator.
6	To model the robot dynamics using Euler-Lagrange method and to simulate the same.
7	To study feedback control of robot manipulator.
8	To study adaptive control of robot manipulator.
9	To study different methods of speed control of dc Motor.
10	To study speed control of stepper motor using microcontroller.
11	To study robotic programming language like AL and AML.

(4)

- a. **Course Name:** Project-II
- b. **Course Code:** 03634356
- c. **Prerequisite:** The students are required to identify their problem and they are required to follow all the rules and instructions issued by department, for safety and other requirements.
- d. **Rationale:** To understand the basic theory, study of the particular Systems/Services/Processes in the context of the abstract problem area/s. After understanding the student will analyse the information, prepare list of probable requirements, the questions if any, the probable forecasting of hurdles which might be observed in future and finding the way outs.
- e. **Course Learning Objective:**

CLOBJ 1	Learn how to design and model mechatronic systems using computer programs.
CLOBJ 2	Use advanced control methods to make mechatronic devices work better in different situations.
CLOBJ 3	Combine sensors and actuators to create strong and responsive mechatronic systems.
CLOBJ 4	Figure out and fix problems in complicated mechatronic projects using a step-by-step approach.
CLOBJ 5	Work well in a team to plan, do, and show a complete mechatronics project, using skills from different areas.

f. Course Learning Outcomes:

CLO 1	Understand how to use computer programs for designing mechatronic systems.
CLO 2	Improve mechatronic devices by applying advanced control methods.
CLO 3	Build responsive systems by combining sensors and actuators.
CLO 4	Solve problems step by step in complex mechatronic projects.
CLO 5	Collaborate effectively in a team to plan, execute, and showcase mechatronics projects using diverse skills.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	4	-	-	100	-	100	200

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

(5)

- a. **Course Name:** Quality and Reliability Engineering
- b. **Course Code:** 03634357
- c. **Prerequisite:** Zeal to learn the subject.
- d. **Rationale:** The course provides an introduction to the fundamental concepts of statistical process control, strategic total quality management, Six Sigma, and the application of these concepts, philosophies, and strategies to issues arising in government and industry.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of quality management and the importance of quality in engineering.
CLOBJ 2	Learn about the tools and techniques used for quality control, including statistical process control (SPC) and Six Sigma.
CLOBJ 3	Study the concepts of reliability engineering and methods to ensure product durability and performance.
CLOBJ 4	Apply failure analysis and reliability testing to evaluate product lifespan and reduce defects
CLOBJ 5	Understand the role of maintenance and risk management in improving system reliability.
CLOBJ6	Develop skills in using quality and reliability metrics to monitor and enhance engineering processes.

- f. **Course Learning Outcomes:**

CLO 1	To understand the fundamental concepts of statistical process control and strategic total quality management.
CLO 2	To evaluate Failure Mode and Effect Analysis and the application of these concepts, philosophies, and strategies to issues arising in government and industry.
CLO 3	To understand the complexities of statistical analysis and control-chart interpretation and their workplace application.
CLO4	Provide skills in diagnosing and analysing problems causing variation in manufacturing and service industry processes.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	1	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction Different Definitions and Dimensions of Quality, Historical Perspective of the importance of quality in the industry, Contribution of Renowned Quality Gurus (Their Philosophies and Impact on Quality).	20%	05
2	Quality Engineering and Management Tools Introduction to Quality Management Standards, 7 QC tools, 7 New Quality Management Tools, 5S Technique, Kaizen, Cost of Quality Technique, Total Quality Management: Basic Philosophy, Approach, Implementation Requirements & Barriers.	20%	09
3	Designing for Quality Introduction to Concurrent Engineering, Quality Function Deployment (QFD), and Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application (with case studies).	10%	05
4	Introduction to Design of Experiments Introduction, Methods, Taguchi approach, Achieving robust design, Steps in experimental design.	25%	09
5	Trends in Quality Engineering & Management Lean Manufacturing, Total Productive Maintenance (TPM), Bench Marking, Business Process Re-engineering (BPR), Six Sigma - Basic Concept, Principle, Methodology, Implementation, Scope, Advantages and Limitations of all as applicable.	15%	08
6	Reliability Concepts Reliability engineering fundamentals, Failure data analysis and examples, Failure rate, Failure density, Probability of	10%	06

	failure, Mortality rate, Mean time to failure, Reliability in terms of Hazard rate and Failure Density, examples.		
		100%	42

i. Text Book and Reference Book:

1. Quality Management by Kanishka Bedi.
2. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India.
3. Statistical Quality Control by M. Mahajan | Dhanpat Rai & Co.

(6)

- a. **Course Name:** Mechatronics Software Lab
- b. **Course Code:** 03634358
- c. **Prerequisite:** Basic knowledge of engineering drawing & design is required
- d. **Rationale:** To introduce the students to the basic applications of software in design & analysis of mechanical & electronics components used in automation.
- e. **Course Learning Objective:**

CLOBJ 1	Develop practical skills in programming and simulating mechatronic systems using specialized software.
CLOBJ 2	Learn to interface sensors, actuators, and controllers through software to design automation systems.
CLOBJ 3	Gain experience in using software for modelling and simulation of mechanical, electrical, and control systems.
CLOBJ 4	Apply software tools to analyse and optimize the performance of mechatronic components and systems.
CLOBJ 5	Understand the integration of hardware and software in the development of mechatronic projects.
CLOBJ 6	Develop problem-solving and debugging skills in a hands-on mechatronics software environment.

f. Course Learning Outcomes:

CLO 1	Develop software for controlling mechatronic systems using programming languages.
CLO 2	Use simulation tools to model and test mechatronic systems.
CLO 3	Interface sensors and actuators with microcontrollers through software.
CLO 4	Implement algorithms for control, automation, and robotics in mechatronic applications.
CLO 5	Debug, test, and optimize software for real-time performance in mechatronic systems

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	4	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List:

Sr. No.	Experiment List
1	Introduction to Modelling Software.
2	To prepare different solid models by using basic tools in software.
3	To prepare different solid models by using advance tools in software.
4	To prepare different solid models by using Engineering & Editing tools using software.
5	To prepare Assembly model by using software.
6	To prepare drawing sheet by using Software.
7	To prepare different Surface models by using Software.
8	To utilize other drawing options in Software.
9	To generate different sheet metal component by using Software.
10	Student Project (Prepare solid model of industrial parts and its assembly using parametric modelling software).

(7)

- a. **Course Name:** Computer Integrated Manufacturing
- b. **Course Code:** 03634381
- c. **Prerequisite:** Basic Knowledge of Manufacturing Processes
- d. **Rationale:** To expose the students to the basics of NC, CNC, DNC machines. To make them understand the concept of writing the manual part program on CNC milling and lathe machines. To introduce the students to the different components of Computer Integrated Manufacturing systems.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the concepts and components of Computer Integrated Manufacturing (CIM) systems.
CLOBJ 2	Learn about the role of CAD, CAM, and CNC in automating the manufacturing process.
CLOBJ 3	Study the integration of computer systems for design, production, and quality control in manufacturing.
CLOBJ 4	Understand the principles of flexible manufacturing systems (FMS) and their applications in industry.
CLOBJ 5	Explore the role of robotics and automation in improving manufacturing efficiency and accuracy.
CLOBJ6	Develop skills in using CIM software tools for process planning, scheduling, and optimization.

f. Course Learning Outcomes:

CLO 1	To describe basic concepts of CAM application and understand CAM wheel.
CLO 2	To prepare CNC programs for manufacturing of different geometries on milling and lathe machines.
CLO 3	To classify different components using different techniques of group technology.
CLO4	To prepare Process planning for different components.
CLO 5	To identify applications of JIT, MRP-I, MRP-II, and Expert system to CAM.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Computer Aided Manufacturing CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions.	10%	05
2	NC/CNC Machine Tools NC and CNC Technology: Types, Classification, Specification and components, Construction Details, Controllers, Sensors and Actuators, CNC hardware: Re circulating ball screw, anti-friction slides, step/servo motors. Axis designation, NC/CNC tooling. Fundamentals of Part programming, Types of formats, Part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric sub routines. Introduction of APT Language.	45%	20
3	Group Technology and CAPP Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and benefits.	13%	06
4	Flexible Manufacturing System Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages. Automated material handling system: Types and Application, Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing, Tool Management, Tool supply system, Tool Monitoring System, Flexible Fixturing, Flexible Assembly Systems.	16%	07

5	Integrated Production Management System Introduction, MRP-I, MRP-II. Just in Time philosophy: JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System.	16%	07
		100%	45

i. Text Book and Reference Book:

1. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education.
2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover, Prentice Hall of India, New Delhi, 2003.
3. Flexible Manufacturing Cells and System by William. W. Luggen Hall, England Cliffs.
4. Computer Numerical Control by P. Radhakrishnan, New Central Book Agency.
5. CAD/CAM, Principles and Applications by P N Rao, McGraw Hill.
6. Computer Aided Manufacturing by Rao, Tewari, Kundra, McGraw Hill.

j. Experiment List:

Sr. No.	Experiment List
1	Study of Computer Integrated System.
2	CNC part Programming: Milling.
3	CNC part Programming: Milling Canned Cycle.
4	CNC part Programming: Lathe.
5	CNC part Programming: Lathe Canned Cycle.
6	Problems on GT and Industrial case problems on coding.
7	Problems on CAPP and Industrial case problems.
8	Study of Flexible Manufacturing system.
9	Study about MRP-I, MRP-II.
10	Study of Expert System in Manufacturing and MIS.