Final

DIPLOMA CURRICULUM OF MECHANICAL ENGINEERING (THIRD YEAR) (5th Semester)

(To be implemented from 2026-27)

Prepared by;

National Institute of Technical Teachers' Training & Research Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106

Vetted by:
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State Council for Technical Education & Vocational Training
Near Raj Bhawan, Unit-VIII, Bhubaneswar, Odisha

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PROGRAMME TITLE: MECHANICAL ENGINEERING

SEMESTER - V

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
					L	T	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	Programme Core	MEPC301 TH:1	Metrology and Measurement		3	0	0	70	30	-	-	100	3
2		MEPC303 TH:2	Design of Machine Elements		3	0	0	70	30	-	-	100	3
3		MEPC305 PR:1	Metrology and Measurement Lab		0	0	4	-	-	15	35	50	2
4		MEPC307 PR:2	Computer Aided Machine Design Lab		0	0	4	-	-	15	35	50	2
5		MEPC309 PR:3	Manufacturing Engineering Lab-II		0	0	4	-	-	15	35	50	2
6	Programme Elective	MEPE301 (Any one) TH:3	(a). Industrial Engineering and Management (b). Production and Operation management (c) Industrial Robotics & Automation		3	0	0	70	30	-	-	100	3
7		MEPE303 (Any one) TH:4	(a) Power Plant Engineering (b). Advanced Manufacturing Processes (c). Aeronautical Engineering		3	0	0	70	30	-	-	100	3
8	Open Elective	Open Elective – I OE301 (Any one) TH:5	a. Universal Human Values b. Leadership and Management Skills c. Professional Skills		3	0	0	70	30	-	-	100	3
9	Summer Internship	SI301	SUMMER INTERNSHIP II*		0	0	0	-	-	15	35	50	2
10	Major Project	PR301 PR:4	MAJOR PROJECT		0	0	4	-	-	15	35	50	2
TOTAL					**15**	**0**	**16**	**350**	**150**	**75**	**175**	**750**	**25**

6-week internship after 4th Semester

Assessment to be done, credit to be carried over

SEMESTER-V

TH:1- METROLOGY AND MEASUREMENT

L	T	P		
3	0	0		**Course Code: MEPC301**
Total Contact Hours				**Theory Assessment**
Theory		: 45Hrs		End Term Exam 70
			Total Marks: 100	Progressive Assessment 30
Pre Requisite		**:**		
Credit		**3**		Category of Course : PC

RATIONALE: This subject focuses on the principles of measurement, accuracy, precision, and quality control in engineering. It covers topics like measurement systems, errors, calibration, limits, fits, tolerances, and the use of instruments like vernier calipers, micrometers, gauges, and CMM. This subject is essential for ensuring accuracy in manufacturing and engineering processes.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
- Distinguish between various types of errors.
- Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
- Appreciate the concept of calibration of an instrument.
- Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

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DETAILED COURSE CONTENTS

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	Introduction to measurements: Definition of measurement; Significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error. Measuring instruments: Introduction; Thread measurements: Thread gauge micrometer; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester; Co-ordinate measuring machine.	10
II	Transducers and Strain gauges: Introduction; Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements. Measurement of force, torque, and pressure: Introduction; Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: Mcloed gauge.	10

III	Applied mechanical measurements: Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotometers, Turbine meter; Temperature measure ment: Resistance thermometers, Optical Pyrometer. Miscellaneous measurements: Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmo monometer	8
IV	Unit-IV: Limits, Fits & Tolerances: Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole and Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919-1993 (Limits, Fits & Tolerances, Gauges} IS 3477-1973; concept of multi gauging and inspection. Angular Measurement: Concept; Instruments for Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges (With Numerical on Setting of Angle Gauges). Screw thread Measurements: ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minordiameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floating carriage dial micrometer	10
V	Gear Measurement and Testing: Analytical and functional inspection; Rolling test; Measurement of tooth thickness (constant chord method); Gear tooth vernier; Errors in gears such as backlash, runout, composite. Machine tool testing: Parallelism; Straightness; Squareness; Coaxiallity; roundness; run out; alignment testing of machine tools as per IS standard procedure.	7

REFERENCES:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor,Vinay kulakarni, Tata McGraw Hill, New Delhi, 2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Principles of Engineering metrology – Rega Rajendra, Jaico publishers, 2008
5. Dimensional Metrology – Connie Dotson, DELMAR, cenage learning, 2007
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. chaudary, second edition, Tata cgraw Hill, 2005.
7. A text book of Engineering metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
8. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS
9. Engineering Metrology – K. J. Hume, Kalyani publishers

TH:2- DESIGN OF MACHINE ELEMENTS

L	T	P		Course Code: MEPC303	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE: This course builds the ability to design and analyze machine elements based on functional requirements and failure theories. It enables students to evaluate loads, select materials, and create detailed drawings using standard design practices and tools.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Analyze various modes of failure of machine components under different loading conditions.
- Design and prepare detailed part and assembly drawings of mechanical components.
- Use design data books and relevant design codes effectively in component design.
- Select appropriate standard components and specifications from manufacturer catalogs.
- Create component and assembly drawings using CAD software.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Introduction to Design**: Machine Design philosophy and Procedures; General Considerations in Machine Design; Fundamentals: Types of loads, concepts of stress, Strain, Stress – Strain Diagram for Ductile and Brittle Materials, Types of Stresses; Bearing pressure Intensity; Crushing; Bending and Torsion; Principal Stresses; Simple Numericals; Creep strain and Creep Curve; Fatigue; S-N curve; Endurance Limit; Factor of Safety, Stress Concentration Properties of Engineering materials; Designation of materials as per IS and introduction to International standards & advantages of standardization; Use of design data book; Use of standards in design and preferred numbers series Theories of Elastic Failures; Principal normal stress theory; Maximum shear stress theory & Maximum distortion energy theory.	12

II	**Design of simple machine parts:** Cotter Joint; Knuckle Joint; Turnbuckle; Design of Levers: Hand/Foot Lever & Bell Crank Lever; Design of C–Clamp; Off-set links; Overhang Crank; Arm of Pulley. Antifriction Bearings: Classification of Bearings; Sliding contact & Rolling contact; Terminology of Ball bearings: Life Load relationship, Basic static load rating and Basic dynamic load rating, limiting speed; Selection of ball bearings using manufacturer's catalogue.	8
III	**Design of Shafts, Keys, Couplings and Spur Gears:** Types of Shafts; Shaft materials; Standard Sizes; Design of Shafts (Hollow and Solid) using strength and rigidity criteria; ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley; Design of Sunk Keys; Effect of Key-ways on strength of shaft Design of Couplings – Muff Coupling, Protected type Flange Coupling, Bush-pin type flexible coupling; Spur gear design considerations; Lewis equation for static beam strength of spur gear teeth; Power transmission capacity of spur gears in bending.	8
IV	**Design of Power Screws:** Thread Profiles used for power Screws - Relative merits and demerits of each; Torque required to overcome thread friction; Self-locking and overhauling property; Efficiency of power screws; Types of stresses induced; Design of Screw Jack; Toggle Jack. **Design of springs:** Classification and Applications of Springs; Spring terminology; Materials and Specifications; Stresses in springs; Wahl's correction factor; Deflection of springs; Energy stored in springs; Design of Helical, Tension and Compression springs subjected to uniform applied loads like I.C. engine valves, Weighing balance, Railway buffers and Governor springs; Leaf springs: Construction and Application.	10
V	**Design of Fasteners:** Stresses in Screwed fasteners; Bolts of Uniform Strength; Design of Bolted Joints subjected to eccentric loading; Design of Parallel and Transverse fillet welds; Axially loaded symmetrical section; Merits and demerits of screwed and welded joints. **Ergonomics & Aesthetic consideration in design:** Ergonomics of Design: Man–Machine relationship; Design of Equipment for control, environment & safety; Aesthetic considerations regarding shape, size, color & surface finish.	7

REFERENCES:

1. Machine Design – Sadhu Singh, Khanna Book Publishing Co., Delhi
2. Machine Design Data Book – Sadhu Singh, Revised Edition, Khanna Book Publishing Co., Delhi
3. Introduction to Machine Design – V.B.Bhandari, Tata Mc- Graw Hill, New Delhi.
4. Mechanical Engineering Design – Joseph Edward Shigley, Tata Mc- Graw Hill, New Delhi.
5. Machine design – Pandya & Shah, Dhanpat Rai & Son, New Delhi.
6. Machine design – R.K.Jain, Khanna Publication, New Delhi.
7. Design Data Book – PSG Coimbtore, PSG Coimbtore.
8. Hand Book of Properties of Engineering Materials & Design Data for Machine Elements – Abdulla Shariff, Dhanpat Rai & Sons, New Delhi.

PR:1- METROLOGY AND MEASUREMENT LAB

L	T	P		Course Code: MEPC305	
0	0	4			
Total Contact Hours				**Theory Assessment**	
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam	35
				Progressive Assessment	15
Pre Requisite		**: Nil**			
Credit		**2**		Category of Course : PC	

RATIONALE: Metrology and Measurement Lab helps students understand precision measurement techniques and quality control in manufacturing. It provides hands-on experience with instruments like micrometers, vernier calipers, dial gauges, and coordinate measuring machines (CMM) for accurate dimensional analysis.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Measure various component of linear measurement using Vernier calipers and Micrometre.
- Measure various component of angle measurement using sine bar and bevel Protractor
- Measure the geometrical dimensions of V-thread and spur gear

LIST OF EXPERIMENTS

1. Measure the diameter of a wire using micrometre and compare the result with digital micrometre
2. Measure the angle of the machined surface using sine bar with slip gauges.
3. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
4. Measure the dimensions of ground MS flat/cylindrical bush using Vernier Caliper compare with Digital/Dial Vernier Caliper.
5. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
6. Measure the thickness of ground MS plates using slip gauges

REFERENCES

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Hand book of Industrial Metrology – ASME

PR:2- COMPUTER AIDED MACHINE DESIGN LAB

L	T	P		**Course Code: MEPC307**	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Theory		: 60Hrs	**Total Marks: 50**	End Term Exam	15
				Progressive Assessment	: 35
Pre Requisite		**: Nil**			
Credit		**2**		Category of Course : PC	

RATIONALE: This course develops the ability to create and interpret machine drawings using computer-aided tools. It enhances visualization, modeling, and technical drawing skills essential for engineering communication and design.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Explain the representation of materials used in machine drawing
- Draw the development of surfaces for sheet metal working applications.
- Draw the machine elements including keys, couplings, cotters, riveted, bolted and welded
- joints.
- Construct an assembly drawing using part drawings of machine components
- Represent tolerances and the levels of surface finish of machine elements.

DETAILED COURSE CONTENTS

Sl. No	List of Experiments
1.	**Introduction to CAD software:** Interface overview, File management, Templates and layers, Model space and layout space, Absolute and relative coordinates, Units and limits
2.	**Drawing aids and editing tools:** Grid and snap settings, Ortho and polar tracking, Object snaps (OSNAP), Selection methods, Modify commands (move, copy, mirror, offset, trim, extend, rotate, scale, array)
3.	**Annotation, hatching and blocks:** Dimensioning (linear, aligned, angular, radius), Dimension styles and settings, Text styles and leaders, Hatching patterns, Creating and inserting blocks, Creating W-blocks
4.	**Isometric drawing, printing and plotting:** Creating isometric drawings using isoplane, Setting up viewports, Plotting to scale, Using paper space and model space, Plot styles and layout setup
5.	**Machine drawing practice and assembly:** Sectional and plain elevation drawings, Standard drawing conventions (BIS/ISO), Generating part lists and bill of materials (BoM), Creating exploded views, Practice on 12 machine parts (Sleeve & Cotter Joint, Spigot & Cotter Joint, Knuckle Joint, Stuffing Box, Screw Jack, Foot Step Bearing, Universal Coupling, Plummer Block, Simple Eccentric, Machine Vice, Connecting Rod, Protected Type Flanged Coupling)

6.	**3D Drawing Basics and Modeling:** Introduction to 3D workspace, UCS and view controls, Creating 3D primitives (box, cylinder, cone, sphere), Extrude, revolve, sweep, loft, Union and subtract operations, Creating isometric views from 3D models, Generating 2D orthographic views from 3D models

REFERENCES:

1. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 2003.
2. Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill Book Com pany, New Delhi, 2000.
3. Kannaih, P., Production Drawing, New Age International, 2009
4. Brian C. Benton, George Omura, Mastering Auto CAD 2021 & Auto CAD LT 2021, Sybex
5. P.N. Rao, CAD/CAM: Principles and Applications, McGraw Hill Education
6. T. Jones, Machine Drawing, Tata McGraw-Hill
7. R.K. Dhawan, Machine Drawing, S. Chand Publishing
8. K. L. Narayana, P. Kannaiah & K. Venkata Reddy, Machine Drawing, New Age International Publishers
9. Ibrahim Zeid, Mastering CAD/CAM, McGraw Hill Education
10. Sham Tickoo, AutoCAD 2023 for Engineers and Designers, Basic and Intermediate, BPB Publications

PR:3- Manufacturing Engineering Lab-II

L	T	P		Course Code: MEPC309	
0	0	4			
Total Contact Hours				**Practical Assessment**	
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam	15
				Progressive Assessment	: 35
Pre Requisite		**: Nil**			
Credit		**2**		Category of Course : PC	

RATIONALE: This lab provides hands-on experience in operating various machining equipment such as drilling, shaping, milling, and grinding machines. It enhances students' ability to use measuring instruments and perform different machining operations to produce precise components.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Dismantle and assemble the components on drilling, shaping, milling and grinding machines.
- Perform operations on drilling, shaping, milling and grinding machines.
- Produce articles of industrial application such as Spur gear, square headed bolt, V- block
- Make use of various measuring instruments for taking dimensions

DETAILED COURSE CONTENTS

Sl. No.	List of Experiments
1.	Drilling Exercise: Drill three different sized holes in various materials, maintaining uniform distance between them.
2.	Milling: Create a square and hexagon from round bars with and without indexing.
3.	Generation of Spur Gear Teeth on a Round Bar.
4.	Simple Planning Exercise: Cut 'T' slots (one model).
5.	Shaping a Hexagon on a Round Bar, Keyways, Grooves, and Splines.
6.	Shaping Step Block: Cut dovetail at angles of 60°, 90°, and 120°.
7.	Cylindrical Grinding: Grind external and internal surfaces using a universal grinding machine.
8.	Grinding Cutting Tools to Required Angles.
9.	Grinding Milling Cutters on a Tool and Cutter Grinder.
10.	Grinding Flat Surface on a Surface Grinder Using Magnetic Chuck and Clamping Devices.
11.	Dismantling and Servicing of Drilling Machine Components and Reassembly.

12.	Dismantling and Servicing of Shaper Head Components and Reassembly.
13.	Dismantling and Servicing of Milling Machine Components and Reassembly.
14.	Servicing of Universal Grinding Machine.

REFERENCES:

1. Elements of Workshop Technology (Volume I & II) – Hajra Chowdry & Bhattacharaya, Media Promoters, 11th Edition, 2007
2. Introduction of Basic Manufacturing Processes and Workshop Technology- Rajendersingh, New age International (P) Ltd. NewDelhi, 2006
3. Production Technology – HMT, 18th edition, Tata McGraw Hill, New Delhi
4. Manufacturing process – Myro N Begman, 5 th edition, Tata McGraw Hill, New Delhi

TH:3(a)- INDUSTRIAL ENGINEERING AND MANAGEMENT

L	T	P		Course Code: MEPE301(a)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE:

This course focuses on optimizing resource utilization and improving productivity through effective management of people, materials, and processes. It empowers students to analyze and eliminate waste, implement efficient methods, and make data-driven decisions to enhance overall organizational performance.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Explain the different types of lay out and plant maintenance with safety.
- List and explain the need for method study and work measurements.
- Describe production planning and quality control, and its functions.
- Define the principles of personnel management and organizational behavior.
- List and explain the different financial and material management.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Plant Engineering:** Plant; Selection of site of industry; Plant layout; Principles of a good layout; Types; Process; Product and Fixed position; Techniques to improve Layout; Principles of Material handling equipment; Plant maintenance; Importance; Break down maintenance; Preventive maintenance and Scheduled maintenance. **Plant Safety:** Importance; Accident: Causes and Cost of an Accident, Accident Proneness, Prevention of Accidents; Industrial disputes; Settlement of Industrial disputes; Collective bargaining; Conciliation; Mediation; Arbitration; Indian Factories Act 1948 and its provisions related to health, welfare and safety.	8

II	**Work Study:** Productivity; Standard of living; Method of improving Productivity; Objectives; Importance of good working conditions. **Method Study:** Definition; Objectives; Selection of a job for method study; Basic procedure for conduct of Method study; Tools used; Operation process chart; Flow process chart; Two handed process chart; Man Machine chart; String diagram and flow diagram. **Work Measurement:** Definition; Basic procedure in making a time study; Employees rating factor; Application of time allowances: Rest, Personal, Process, Special and Policy allowances; Calculation of standard time; Numerical Problems; Basic concept of production study; Techniques of Work Measurement; Ratio delay study; Synthesis from standard data; Analytical estimating and Predetermined Motion Time System (PMTS).	10
III	**Production Planning and Control:** Introduction; Major functions of Production Planning and Control; Preplanning; Methods of forecasting; Routing and Scheduling; Dispatching and Controlling; Concept of Critical Path Method (CPM); Types of Production: Mass Production, Batch Production and Job Order Production; Characteristics; Economic Batch Quantity (EBQ); Principles of Product and Process Planning; Make or Buy decision; Numerical problems. **Quality Control:** Definition; Objectives; Types of Inspection: First piece, Floor and Centralized Inspection; Advantages and Disadvantages; Statistical Quality Control; Types of Measurements; Method of Variables; Method of Attributes; Uses of X, R, p and c charts; Operating Characteristics curve (O.C curve); Sampling Inspection; Single and Double Sampling plan; Concept of ISO 9001:2008 Quality Management System Registration/Certification procedure; Benefits of ISO to the organization.	11
IV	**Principles of Management:** Definition of Management; Administration; Organization; F.W. Taylor's and Henry Fayol's Principles of Management; Functions of Manager; Types of Organization: Line, Staff, Taylor's Pure functional types; Line and staff and committee type; Directing; Leadership; Styles of Leadership; Qualities of a good leader; Motivation; Positive and Negative Motivation; Modern Management Techniques; Just In Time; Total Quality Management (TQM); Quality circle; Zero defect concept; 5S Concept; Management Information Systems. **Personnel Management:** Responsibility of Human Resource Management; Selection Procedure; Training of Workers; Apprentice Training; On the Job training and Vestibule School Training; Job Evaluation and Merit Rating; Objectives and Importance; Wages and Salary Administration; Components of Wages; Wage Fixation; Type of Wage Payment: Halsey's 50% Plan, Rowan's Plan and Emerson's efficiency plan; Numerical Problems.	9

V	**Financial Management:** Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Type of debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit; Numerical Problems; Depreciation; Causes; Methods: Straight line, sinking fund and percentage on Diminishing Value Method; Numerical Problems. **Material Management:** Objectives of good stock control system; ABC analysis of Inventory; Procurement and Consumption cycle; Minimum Stock, Lead Time, Reorder Level-Economic Order Quantity problems; Supply Chain.	7

REFERENCES:

1. Industrial Engineering & Management, S.C. Sharma, Khanan Book Publishing Co (P) Ltd., New Delhi
2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.
3. Management, A global perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition 1994.
4. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
5. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

TH:3(b)- Production and Operation management

L	T	P		Course Code: MEPE301(b)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course: PE	

RATIONALE: This course focuses on the critical role of production and operations management in business success, integrating concepts from statistics, economics, finance, and strategy. It equips students with knowledge on location strategy, quality management, and Total Quality Management (TQM) tools to optimize operations and improve decision-making.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Define operations management and explain its relationship to productivity, including tools and techniques.
- Describe the importance of forecasting and explain the effective application of different forecasting approaches and methods.
- Explain layout strategy and how operations managers determine facility arrangements and size.
- Describe how operations managers achieve a reasonable work environment and set expectations related to employee productivity.
- Discuss make-or-buy decisions, the selection and integration of suppliers, and how much and when to order.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Process Planning and Process Engineering**: Process Planning: Introduction, Function, Pre-requisites and steps in process planning, Factors affecting process planning, Make or buy decision, plant capacity and machine capacity. Process Engineering: Preliminary Part Print Analysis: Introduction, Establishing the General Characteristics of work piece, determining the principal Process, Functional surfaces of the work piece, Nature of the work to be Performed, Finishing and identifying operations. Dimensional Analysis: Introduction, types of dimensions, measuring the Geometry of form, Baselines, Direction of specific dimensions. Tolerance Analysis: Causes of work piece variation, Terms used in work piece dimensions, Tolerance stacks. Work piece Control: Introduction, Equilibrium Theories, Concept of location, Geometric Control, Dimensional control, Mechanical control.	14

II	**Production Forecasting:** Introduction of production forecasting, The strategic role of forecasting in supply chain, Time frame, Demand behavior, Forecasting methods- Qualitative and Quantitative, Forecast accuracy. **Scheduling:** Introduction, Objectives in scheduling, Loading, Sequencing, Monitoring, Advanced Planning and Scheduling Systems, Theory of Constraints, Employee scheduling.	8
III	**Break-Even Analysis:** Introduction, Break-even analysis charts, Break-even analysis for process, plant and equipment selection. Aggregate Operations Planning: Aggregate production planning, Adjusting capacity to meet the demand, Demand management, Hierarchical and collaborative planning, Aggregate planning for services.	8
IV	**Assembly Line Balancing:** Assembly lines, Assembly line balancing, Splitting tasks, Flexible and U-shaped line layouts, Mixed model line balancing, Current thoughts on assembly lines, Computerized assembly line balancing.	8
V	**Material Management:** Introduction, Importance and objectives, Purchasing and Stores: policies and procedures, Vendor development, selection, analysis and rating.	7

REFERENCES:

1. Production and Operations Management – K.Aswathappa, K.Shridhara Bhat, Himalaya Publishing House, 2014.
2. Production and Operations Management – Shailendra Kale, McGraw Hill Educations(India) Private Limited,2013.
3. Production and Operations Management – R.Paneerselvam, PHI Learning Private Limited, 2013

TH:3(c)- Industrial Robotics & Automation

L	T	P	Total Marks: 100	Course Code: MEPE301(c)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs		End Term Exam	70
				Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course: PE	

RATIONALE:

This course introduces the fundamental concepts of robotics, covering types, components, drive systems, and sensors, while emphasizing the programming and selection of robots for various applications. It also explores the integration and justification of robots in industrial automation, highlighting their impact on efficiency and productivity across different industries.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Describe the robot anatomy, classification, characteristics, and assess the advantages and disadvantages.
- Discuss the various robotic actuators, including those in hydraulic, pneumatic, and electrical systems.
- Explore different types of sensors and the concepts behind robot vision systems and their programming.
- Illustrate the concepts of robot programming languages and the various methods used in robot programming.
- Identify and evaluate the diverse applications of robots across industries.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Fundamentals of Robotics:** Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.	8

II	**Robotic Drive System and Controller:** Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.	8
III	**Robotic Drive System and Controller**: Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.	8
IV	**Sensors:** Requirements of a sensor; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing. **Introduction to Machine Vision:** Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videocon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.	8
V	**Robot kinematics and Robot Programming:** Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple programs	8
VI	**Automation:** Basic elements of automated system, advanced automation functions, levels of automation. **Industrial Applications:** Application of robots in machining; welding; assembly and material handling.	5

REFERENCES:

1. Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku, Pearson Education Inc. New Delhi 2006.
2. Industrial Robotics: Technology, Programming and Applications – M.P. Groover, Tata McGraw Hill Co, 2001.
3. Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.
4. Robotics for Engineers – Yoram Koren, McGraw Hill Book Co, 1992.
5. A Text book on Industrial Robotics – Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.
6. Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.
7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

TH:4(a)- Power Plant Engineering

L	T	P		Course Code: MEPE303(a)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE:

This course covers the various types of power plants, including thermal, hydro, diesel, gas, and nuclear, focusing on their working principles and classifications. It also emphasizes the power scenario in India, safety precautions, and understanding load terminologies to provide a comprehensive view of the power industry.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Explain the present and future power scenario in India.
- List the various load terminologies used in power plants.
- Describe the working and classifications of hydro power plants.
- Explore the working principles of Diesel, Gas, and Nuclear power plants.
- Comprehend the issues and importance of safety concepts in power plants.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Introduction to Power plant:** Introduction to power plant; Indian Energy scenario in India; Location of power plant; Choice of Power plant; Classification of power plants, layout of thermal power plant	6
II	**Economics of power plant:** Terminology used in power plant: Peak load, Base load, Load factor, Load curve; Various factor affecting the operation of power plant; Methods of meeting the fluctuating load in power plant; Load sharing- cost of power-tariff methods; Performance and operating characteristics of power plant.	8
III	**Hydro power plant:** Introduction to Hydroelectric power plant; Rainfall, Runoff and its measurement, Hydrograph, flow duration curve; Selection of sites for hydroelectric power plant; General layout of Hydroelectric power plant and its working; Classification of the Plant-Run off river plant, storage river plant, pumped storage plant; Advantages and disadvantages of hydroelectric power plant.	8

IV	**Diesel and Gas turbine plant:** The layout of diesel power plant; Components and the working of diesel power plant; Advantages and disadvantages of diesel power plant; Gas turbine power Plant-Schematic diagram, components and its working; Combined cycle power generation-Combined gas and steam turbine power plant operation (only flow diagram). **Nuclear power plant:** Introduction; Nuclear Power-Radio activity-Radioactive charge- types of reactions; Working of a nuclear power plant; Thermal fission Reactors- PWR, BWR and gas cooled reactors; Advantages and Disadvantages of Nuclear power plant.	12
V	**Environmental impact of Power plant:** Social and Economical issues of power plant; Green house effect; Acid precipitation-Acid rain, Acid snow, Dry deposition, Acid fog; Air, water, Thermal pollution from power plants; Radiations from nuclear power plant effluents. **Power plant safety:** Plant safety concept; Safety policy to be observed in power plants; Safety practices to be observed in boiler operation; Safety in oil handling system; Safety in Chemical handling system; Statutory provision related to boiler operation.	11

REFERENCES:

1. Power plant Engineering-P.K. Nag 4th edition, Tata McGraw Hill Education, 2014.
2. Power plant Engineering – Frederick T. Morse, Litton Educational Publishing Inc. 1953.
3. A Course in Power Plant Engineering – Subhash C. Arora, S. Domakundwar, Dhanpat Rai, 1984.
4. Power Plant Engineering – P.C. Sharma, S.K.Kataria & sons, 2009.
5. Power System Engineering – R.K. Rajput, Firewell Media,2006.

TH:4(b)- Advanced Manufacturing Processes

L	T	P		Course Code: MEPE303(b)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE: To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Identify various classifications of manufacturing processes.
- Explain the working principles of mechanical energy-based processes.
- Describe the functioning of electrical energy-based manufacturing processes.
- Explore the principles behind chemical and electro-chemical energy-based processes.
- Discuss the working of thermal energy-based manufacturing processes.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Introduction:** Unconventional machining Process – Need – classification – Brief overview . **Additive Manufacturing Process:** Introduction, Need for Additive Manufacturing, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM	5
II	**Mechanical Energy Based Processes:** Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.	8
III	**Electrical Energy Based Processes:** Electric Discharge Machining (EDM)- working Principle – equipment – Process Parameters – Surface Finish and MRR- electrode / Tool – Power and control Circuits – Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.	8
IV	**Chemical and Electro-Chemical Energy Based Processes:** Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM equipment-Surface Roughness and MRR Electrical Circuit-Process Parameters ECG and ECH – Applications.	12

V	**Thermal Energy Based Processes:** Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications. Introduction to manufacturing; Fundamental properties of materials including metals, polymers, ceramics and composites.	12

REFERENCES:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007.
3. Benedict. G.F. "Non-Traditional Manufacturing Processes", Marcel Dekker Inc., New York, 1987.
4. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.
5. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001

TH:4(c)- Aeronautical Engineering

L	T	P		Course Code: MEPE303(c)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PE	

RATIONALE:

This course provides foundational knowledge in aeronautical engineering, introducing key principles of aircraft design, propulsion, aerodynamics, and flight control systems. It equips students with the necessary skills to understand the operations, materials, and technologies used in the aerospace industry, fostering their potential to contribute to the evolving field of aviation.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Explain the fundamental concepts of aeronautical engineering and its applications.
- Describe the principles of aerodynamics and analyze the forces acting on an aircraft during flight.
- Identify and discuss the materials and structures used in aircraft design and their functions.
- Illustrate the working principles of various aircraft propulsion systems.
- Demonstrate knowledge of flight control systems, aircraft maintenance practices, and aviation safety standards.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Fundamentals of Aeronautical Engineering:** History and evolution of aviation, branches of aeronautical engineering, basic components of an aircraft, types of aircraft – fixed-wing, rotary-wing, UAVs	8
II	**Basics of Aerodynamics:** Fundamental forces of flight – lift, weight, thrust, drag, Bernoulli's principle, airflow over airfoil, angle of attack, stall, types of drag, methods of drag reduction, lift-to-drag ratio, Mach number, shock waves (basic idea)	8
III	**Aircraft Structures and Materials:** Primary and secondary structures, fuselage, wings, empennage, landing gear,aluminum alloys, composites, titanium, structural integrity, fatigue, stress and strain basics, importance of lightweight materials	8
IV	**Propulsion Systems**: Basics of propulsion, types of engines – piston, jet, turboprop, turbofan, working principle of jet engines, compressor, combustor, turbine, nozzle, thrust equation, basic fuel systems, engine cooling methods	8

V	**Flight Control and Aircraft Systems:** Primary control surfaces – ailerons, elevators, rudders, secondary control surfaces – flaps, trim tabs, avionics basics, cockpit instruments, hydraulic systems, electrical systems, fly-by-wire, auto-pilot systems (intro level)	8
VI	**Introduction to Aircraft Maintenance and Safety**: Basics of aircraft maintenance, pre- flight checks, ground handling, maintenance schedules, aviation safety norms, emergency procedures, safety equipment, introduction to DGCA & FAA regulations	5

REFERENCES:

1. John D. Anderson – Introduction to Flight, McGraw-Hill Education
2. John D. Anderson – Fundamentals of Aerodynamics, McGraw-Hill Education
3. T.H.G. Megson – Aircraft Structures for Engineering Students, Butterworth-Heinemann
4. Ajoy Kumar Kundu – Introduction to Aerospace Engineering: Basic Principles of Flight, Wiley India
5. Michael Kroes & William Watkins – Aircraft Maintenance and Repair, McGraw-Hill Education
6. G Lakshmi Narasaiah – Aircraft Structures, BS Publications

TH:5(a)- UNIVERSAL HUMAN VALUES

L	T	P		Course Code: OE 301(a)	
3	0	0			
Total Contact Hours					
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre-Requisite		**: Nil**			
Credit		**3**		Category of Course: OE	

RATIONALE:

The Universal Human Values (UHV) course aims to help diploma students develop a strong ethical foundation, nurturing responsible individuals who contribute positively to society. In an era driven by rapid technological advancements, it is crucial for students not only to gain technical expertise but also to cultivate values that promote harmony, respect, and sustainability.

LEARNING OUTCOMES:

After completion of the course, the students will be able to:

- Identify fundamental human aspirations such as happiness and prosperity.
- Differentiate between the self and the body and understand their respective needs.
- Practice self-reflection to improve decision-making, emotional balance, and personal growth.
- Develop respectful and trustworthy relationships within family, friends, and society.
- Explain the role of values like trust, respect, and love in building strong social bonds.
- Promote cooperation and harmony within communities through ethical practices.

DETAILED COURSE CONTENT:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Introduction to Value Education and Human Values -** Concept and Need for Value Education - Understanding the importance of value education in personal and professional life, Differentiating between values and skills. Basic Human Aspirations - Exploring fundamental human aspirations: happiness and prosperity, Methods to achieve these aspirations through right understanding and relationships.	8
II	**Harmony in the Human Being -** Understanding the Self - Differentiating between the 'Self' (I) and the Body, Understanding the needs of the Self and the Body, Harmony of the Self with the Body - Ensuring the harmony of 'I' with the Body, Practices for mental and physical well-being.	8
III	**Harmony in the Family and Society -** Family as the Basic Unit of Society - Understanding values in human relationships, Trust and respect as the foundational values in relationships, Harmony in Society - The concept of an	8

	undivided society, Universal human order and world family.	

IV	**Harmony in Nature and Existence -** Interconnectedness in Nature - Understanding the four orders of nature: material, plant, animal, and human, Mutual fulfillment among these orders, Co-existence in Existence - Holistic perception of harmony in existence, Role of human beings in maintaining environmental balance.	8
V	**Professional Ethics -** Ethical Human Conduct - Integrating values into professional life, Concept of professional ethics and accountability, Case Studies in Professional Ethics - Analyzing real-life scenarios to understand ethical dilemmas, Developing solutions based on universal human values.	8
VI	**Personal Development and Social Responsibility -** Self-Reflection and Self- Exploration - Techniques for self-assessment and personal growth, Setting personal goals aligned with universal values, Social Responsibility - Understanding one's role in society, Participating in community service and social initiatives.	5

REFERENCES:

1.	R. R. Gaur, R. Asthana, G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
2.	R. R. Gaur, R. Asthana, G. P. Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
3.	A. Nagraj, JeevanVidya: EkParichaya, Amarkantak, 1999.
4.	A. N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
5.	Moral Thinking: An Introduction To Values And Ethics, Vineet Sahu, IIT Kanpur: https://onlinecourses.nptel.ac.in/noc23_hs89/preview

TH:5(b)- LEADERSHIP AND MANAGEMENT SKILLS

L	T	P		Course Code: OE301(b)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : OE	

RATIONALE:

This course/subject on Leadership and Management Skills for students undergoing Diploma programmes is an exploration in leading and managing people, majorly in education based on sound and acceptable principles and theories for effective leadership. The leadership skills will enable them to take initiative, guide team efforts, motivate peers, and ensure effective collaboration. They'll learn how to delegate tasks, resolve conflicts, and foster a positive team environment. The management skills will help them in organizing tasks, setting timelines, and ensuring efficient workflow within a team.
It is expected that the students will be able to handle projects with better project outcomes and a earn a more productive learning experience. This will benefit their academic journey, future careers, and overall professional development:

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Explain the principles of management
- Collaborate across cultures for effective team work
- Communicate with people for a positive work culture
- Demonstrate personal dispositions, skills & abilities of a leader
- Undertake the process of change management
- Design training for staff development
- Adapt suitable leadership style for improved work efficiency.

DETAILED COURSE CONTENT:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Leadership & Management, concept, principles.** • Definition of leadership, management • Leadership theories • Leadership characteristics • Principles of management • Managerial functions • Leader v/s Manager, Leader/Manager traits and character • Leadership Styles	10

II	**Human Resource Management in Organizations** • Human Resource Management: Meaning, Nature, Objectives, Scope • Job & Job analysis. • Staff Development: Need and Objectives of Staff Development, Approaches • Training & development • Organizational Development: Components of OD process. • Learning organization	10
III	**Personal disposition, skills & abilities of leaders** • Self-awareness • Leadership characteristics, traits • Leadership skills & abilities • Emotional intelligence & its components, importance in leadership • Communication skills for effective leadership, barriers to effective communication, Active Listening, Mindful listening. • Leading & Mentorship – Influencing & mentoring	09
IV	**Leader's role in Motivating, Inspiring and Transformative leadership, nurturing team-work** • Goal setting & leadership • Transformative Leadership, vision & envisioning • Motivational role of leader in people management • Group & team • Team dynamics • Conflict management, strategies in managing conflicts	08
V	**Change Management & Leadership** • Models of change • Forces driving change • Change Management – process, goal, importance • The process of change happening in an organization • Key aspects of leadership in change management – responsibilities of a change leader.	08

SUGGESTED ACTIVITIES:

- Group/individual presentation on the basic principles of leadership and management, Discussion on readings - Individual or group presentation of assigned topics in class on leadership and management principles and theories.
- Activities on Envisioning, Goal setting
- ACTION PLAN to be prepared

REFERENCES:

1.	Theories of Educational Leadership and Management (3rd ed.), by Bush, Tony (2003). SAGE Publications, Ltd.
2.	The inspiring leader: unlocking the secrets of how extraordinary leaders motivate. By Zenger, John, Joseph Folkman, and Scott Edinger (2009). New York: McGraw Hill Press.
3.	Knowing yourself. On becoming a leader: the leadership classic. By Bennis, Warren (2009). New York: Basic Books.
4.	Leading Change. By P. Kotter, Harvard Business, 2012.
5.	The Fifth Discipline. By Peter M. Senge, Crwon Currency, 2006.
6.	The Leadership Sutra: An Indian Approach to Power. By Devdutt Pattanaik, – Penguin Random House, 2017.
7.	Leadership and Management. By Dr. A. Chandra Mohan. Himalaya Publishing House, 2010.

TH:5(c)- PROFESSIONAL SKILLS

L	T	P		Course Code: OE301(c)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs	**Total Marks: 100**	End Term Exam	70
				Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : OE	

RATIONALE:

The term, "Professional skills" carries significant weight in the job market and career development. This open elective course explores various types of professional skills, their significance, and how they can be cultivated and harnessed for career progression. By understanding the landscape of professional skills, student can better position himself or herself for success in the competitive job market. It is crucial to continuously update and adapt the professional skills to stay ahead in a rapidly changing work environment. By investing in professional development, one can enhance employability and open doors to new opportunities.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Demonstrate Self-competency and Confidence
- Practice Emotional Competency
- Work in a team work or in collaboration
- Demonstrate problem solving and decision-making skills
- Apply time management strategies and techniques effectively
- Apply professional ethics and integrity in professional and personal life

UNIT NO.	CONTENT	ALLOTTED TIME (HOURS)
I Communication Skills:	• Active listening • Verbal and non-verbal communication • Written communication • Presentation skills • Conflict resolution	08
II Teamwork and Collaboration:	• Building trust within a team • Effective collaboration strategies • Role delegation and responsibility sharing • Conflict resolution within a team	08
III Problem-Solving:	• Identifying root causes of issues • Generating solutions and evaluating options	08

	• Decision-making under pressure • Critical thinking skills • Triple constraint issues	
IV Time Management : 	• Prioritization and task management • Setting realistic deadlines • Effective time planning and organization	06
V Emotional Intelligence : 	• Self-awareness and emotional regulation • Empathy and understanding others' emotions • Managing interpersonal relationships • Motivation • Social skills • Emotional Intelligence (EQ) • Stress management	08
VI Professional Ethics and Integrity:	• Workplace ethics and code of conduct • Confidentiality and data privacy • Professional accountability- • Important Considerations:	05

REFERENCES:

1. Dr. Vitthal Gore: Professional Skills for 21st Century: A Key to Success: Blue Rose- ACADEMIC
2. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success: PEARSON

3. The essence of Leadership: S. Manikutty: Bloomsbury

SUMMER INTERNSHIP II

L	T	P		
0	0	0		**Course Code: SI301**
Total Contact Hours				**Practical Assessment**
Practical		: 0Hrs	**Total Marks: 50**	End Term Exam 15
				Progressive Assessment 35
Pre Requisite		**: Nil**		
Credit		**2**		Category of Course : **Internship**

RATIONALE:

An internship is a professional learning experience that offers meaningful, practical work related to a student's field of study or career interest. An internship gives a student the opportunity for career exploration and development, and to learn new skills. It offers the employer the opportunity to bring new ideas and energy into the workplace, develop talent and potentially build a pipeline for future full- time employees.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Opportunity for "hands-on" experience
- Opportunity to sample various career options
- Preparation for job searches
- Provides a clear job/project description for the work experience.
- Orients the student to the organization, its culture and proposed work assignment(s).
- Helps the student develop and achieve learning goals.
- Offers regular feedback to the student intern.

DETAILED COURSE CONTENTS

Internship of 4-6 Weeks shall be performed during summer break after semester IV and will be assessed as part of Semester III. During the summer vacations, after the 2nd Semester, students are required to be involved in Inter/ Intra Institution Activities viz.; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institution; contribution at incubation/ innovation /entrepreneurship cell of the Institution; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute's Innovations Council for e.g.: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

After completion of Mini-project or Internship the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period or while working on mini-project. The student may contact the Industrial Supervisor/ Faculty Mentor/TPO to assign special topics and problems and should prepare the final report on the assigned topics. Student's Diary and Internship

Report should be submitted by the students along with attendance record and an evolution sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawing, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

PR:4- MAJOR PROJECT (Dissertation – I)

L	T	P		
0	0	4		**Course Code: PR301**
Total Contact Hours				**Practical Assessment**
Practical	: 60Hrs		**Total Marks: 50**	End Term Exam 15
				Progressive Assessment 35
Pre Requisite	**: Nil**			
Credit	**4**			Category of Course : **Project**

RATIONALE:

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of MECHATRONICS and practices in real life situations, so as to participate and manage a large organization and projects, in future.
Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as Project Dissertation-I and the balance portion to be covered in 6th Semester shall be named as Project Dissertation-II.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Expose to self-learning various topics.
- Survey the literature such as books, national/international referred journals and contact resource persons for the selected topic of research.
- Learn to write technical reports.
- Develop oral and written communication skills to present and defend their work in front of a technically qualified audience.
- Develop professional values and ethical standards.
- Handle real life challenges by making effective decisions to complete project work.
- Show skills in developing real world applications

STUDENT'S ACTIVITY

Students will do their project work as guidance from their guide (faculty member).

Guidelines:
The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the students. For this purpose, students should be asked to identify the type of project work they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is

also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be an individual assignment or a group assignment.
Preferably there should not be more than 5 students if the project work is given to a group.
The project work identified in collaboration with industry/organization should be preferred.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance

The teachers are free to evolve other criteria of assessment, depending upon the type of project work. It is proposed that the institute should organize an annual exhibition of the project work done by the students and invite leading Industrial organizations of area of subject to such an exhibition.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters (5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th semester under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Requirements specification and Preliminary work of the system have to be completed in Phase-I. Project Milestones are to be set so that progress can be tracked. In Phase-II Detailed work, Documentation has to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alterations in the components of Task and schedule.

At the end of Project Phase-I in the 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

Final

DIPLOMA CURRICULUM OF MECHANICAL ENGINEERING (THIRD YEAR) (6th Semester)

(To be implemented from 2026-27)

Prepared by;

National Institute of Technical Teachers' Training & Research Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106

Vetted by:
Domain experts from Polytechnics of Odisha

State Council for Technical Education & Vocational Training
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Table of Contents

PROGRAMME TITLE: MECHANICAL ENGINEERING

SEMESTER - VI

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
					L	T	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	**Programme core**	MEPC30 2 TH:1	Automobile Engineering and Hybrid Vehicles		3	0	0	70	30	-	-	100	3
2		MEPC30 4 PR:1	Automobile Engineering and Hybrid Vehicles Lab		0	0	4	-	-	15	35	50	2
3	**Humanities and Social Science**	HS302 TH:2	Entrepreneurship and start ups		4	0	0	70	30	-	-	100	4
4	**Open Elective**	OE302 (Any one) TH:3	a. Project Management b. Disaster Management c. Artificial Intelligence d. Soft Computing Techniques		3	0	0	70	30	-	-	100	3
5		OE304 (Any one) TH:4	a. Engg. Economics & Accountancy b. IoT c. Sustainable Development d. Robotics		3	0	0	70	30	-	-	100	3
6	**Mandatory**	AU302 TH:5	INDIAN CONSTITUTION		2	0	0	0	0	0	0	0	0
7	**Major Project**	PR302 PR:2	MAJOR PROJECT		0	0	6	-	-	100	100	200	3
8	**Seminar**	SE302	SEMINAR		0	0	2	-	-	20	70	100	1
TOTAL					**15**	**0**	**12**	**280**	**120**	**135**	**205**	**750**	**19**

All Audit (mandatory) courses will have assessment, but will have no credit.

SEMESTER-VI

TH:1- Automobile Engineering and Hybrid Vehicles

L	T	P		Course Code: MEPC302	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45Hrs		End Term Exam	70
			Total Marks: 100	Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**3**		Category of Course : PC	

RATIONALE: The course provides foundational knowledge of automobile engineering, focusing on engine components, vehicle systems, and hybrid technologies. It aims to equip students with the skills to understand, design, and maintain modern automotive systems, including emerging hybrid vehicle technologies.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Describe basic automobile components and their functions.
- Learn about cooling, lubrication, fuel, and ignition systems.
- Explore transmission, steering, suspension, and braking systems.
- Explain hybrid vehicle technology and energy systems.
- Discuss future trends in vehicles, including electric and autonomous cars.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	**Fundamentals of Automobiles:** Overview and classification of automobiles, Layout of an automobile and basic structure, IC engine components: Cylinder, piston, crankshaft, camshaft, connecting rod, valves, flywheel, Engine types and configurations (inline, V- type, etc.), Working principles: 4-stroke and 2-stroke petrol/diesel engines, Recent trends in engine design and light weighting	7
II	**Automobile Subsystems** (Cooling, Lubrication, Fuel & Ignition Systems): Cooling Systems: Necessity, types (air and water cooling). Thermo siphon and pump circulation, Lubrication Systems: Purpose, types (petrol and high-pressure), SAE rating of oils, Fuel Supply System: Fuel types, carburetors, fuel injection (SPFI, MPFI), pumps and filters, Ignition System: Battery ignition, magneto ignition, electronic ignition, Starting and Charging Systems: Battery types, starter motor, alternator, lighting system	8
III	**Transmission and Control Systems:** Clutch: Single plate, multi-plate, centrifugal clutches, Gearboxes: Sliding mesh, constant mesh, synchromesh, automatic transmission, Drive Systems: Propeller shaft, universal joints, differential, rear axle types, Steering System: Requirements, caster, camber, kingpin, Rack and pinion, power steering, Braking Systems: Disc and drum brakes, ABS (introductory), regenerative braking	8

IV	**Suspension, Special Vehicles and Vehicle Body:** Suspension: Leaf spring, coil spring, torsion bar, shock absorbers, independent suspension, Vehicle Types: Passenger cars, commercial vehicles, off-road vehicles, Special Purpose Vehicles: Tractors, dumpers, excavators, graders, Vehicle Body and Safety: Chassis types, crash worthiness, airbags, crumple zones (basic intro)	6
V	**Introduction to Hybrid and Electric Vehicles**: Overview of Electric Vehicles (EVs): History, need, advantages, EV architecture, Hybrid Vehicles: Series, parallel, series- parallel hybrids, comparison with IC engine vehicles, Energy Storage Systems: Battery types (Lead Acid, Li-ion), battery management basics, Motors and Controllers: BLDC, induction motors, motor control fundamentals, Charging Infrastructure: On-board/off- board chargers, levels of charging, safety aspects, Modern Mobility Trends: Digital technologies, IoT in vehicles, SCADA in EVs	8
VI	**Policy, Sustainability and Future Trends**: Government Initiatives and Policies: FAME, Bharat EV policy overview, Environmental Impact: Emissions, sustainability, carbon footprint, Smart and Connected Vehicles: ADAS, IoT in mobility, connected vehicle concepts, Digital Twin, AI and Data analytic in Mobility Systems, Introduction to Autonomous Vehicles (brief overview)	8

REFERENCES:

1. Kirpal Singh – Automobile Engineering Vol I & II, Standard Publishers
2. R.B. Gupta – Automobile Engineering, Satya Prakashan
3. James E. Duffy – Modern Automotive Technology, Goodheart-Willcox Pub
4. Iqbal Husain – Electric and Hybrid Vehicles: Design Fundamentals, CRC Press
5. James Larminie and John Lowry – Electric Vehicle Technology Explained, Wiley
6. M.L. Mathur & R.P. Sharma – Internal Combustion Engines, Dhanpat Rai Publications
7. https://archive.nptel.ac.in/courses/107/106/107106088/

PR:1- Automobile Engineering and Hybrid Vehicles Lab

L	T	P		
0	0	4		**Course Code: MEPC304**
Total Contact Hours				**Practical Assessment**
Practical		: 60Hrs	**Total Marks: 50**	End Term Exam 15
				Progressive Assessment 35
Pre Requisite		**: Nil**		
Credit		**2**		Category of Course : PC

RATIONALE: This laboratory course introduces students to fundamental concepts in automobile engineering, with a specific focus on hybrid vehicle technologies. It provides hands-on experience in understanding the components, systems, and operations of both conventional and hybrid vehicles, promoting practical learning and industry relevance.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Identify key components in both conventional and hybrid vehicle power trains.
- Demonstrate the working principles of cooling, lubrication, and fuel systems in automobiles.
- Compare different ignition, clutch, and braking systems.
- Apply basic testing and maintenance procedures to hybrid vehicle battery and power train systems.
- Explain the working principle of integration of electric and combustion systems in hybrid vehicles.

DETAILED COURSE CONTENTS

Sl. No.	List of Experiments
1.	Study and identification of various engine components (Cylinder block, Piston, Crankshaft, etc.).
2.	Study of the working and components of the cooling system (Air and Water cooling systems).
3.	Study of different types of lubrication systems and their functioning.
4.	Study and testing of fuel feed systems (Carburetors, Fuel Injection Systems).
5.	Study of ignition systems (Battery ignition, Magneto ignition, Electronic Ignition).
6.	Study of the working of various types of clutches (e.g. Single Plate, Multi-Plate, Centrifugal).
7.	Study and analysis of different types of gearboxes (e.g. Sliding Mesh, Constant Mesh).
8.	Study of the steering and suspension systems (e.g. Rack and Pinion, Power Steering, Shock Absorbers).
9.	Study of braking systems (e.g. Internal Expanding Brake, Disc Brakes).
10.	Study of hybrid vehicle systems and components (e.g. Battery Management Systems, Regenerative Braking).
11.	Performance testing of a conventional and hybrid vehicle.
12.	Study of electric vehicle drive systems (e.g. electric motors, controllers, battery packs).
13.	Study of the working and testing of a hybrid powertrain system.
14.	Testing and calibration of emission control systems in automobiles.

REFERENCES:

1. Kirpal Singh – Automobile Engineering Vol I & II, Standard Publishers
2. R.B. Gupta – Automobile Engineering, Satya Prakashan
3. James E. Duffy – Modern Automotive Technology, Goodheart-Willcox Pub
4. Iqbal Husain – Electric and Hybrid Vehicles: Design Fundamentals, CRC Press
5. James Larminie and John Lowry – Electric Vehicle Technology Explained, Wiley
6. M.L. Mathur & R.P. Sharma – Internal Combustion Engines, Dhanpat Rai Publications
7. https://archive.nptel.ac.in/courses/107/106/107106088/

TH:2-Entrepreneurship and start ups

L	T	P		Course Code: HS302	
4	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 60Hrs		End Term Exam	70
			Total Marks: 100	Progressive Assessment	30
Pre Requisite		**: Nil**			
Credit		**4**		Category of Course : HSS	

RATIONALE:

Entrepreneurship and Startups are introduced in curriculum to develop the entrepreneurship traits among the students before they enter into the professional life exposing themselves to and interacting with entrepreneurship and startup eco-system, student will develop and entrepreneurial mind set. It is important because they can help the students to develop the skills and knowledge needed to start and grow businesses and understand how to turn their ideas into successful ventures.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Develop Entrepreneurial spirit and resourcefulness.
- Familiar with various uses of human resources for earning dignified means of living.
- Explain the concept and process of entrepreneurship - its contribution and role in the growth and development of individuals and the nation.
- Define entrepreneurial quality, competency, and motivation.
- Learn the process and skills of creation and management of entrepreneurial ventures.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	Introduction to Entrepreneurship and Start- Ups: Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation; Types of Business Structures, Similarities/differences between entrepreneurs and managers.	12
II	Business Ideas and their implementation: Discovering ideas and visualizing the business, Activity map, Business Plan.	08
III	Idea to Start-up: Market Analysis- Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis.	10
IV	Management: Company's Organization Structure, Recruitment and management of talent, financial organization and management.	12
V	Financing and Protection of Ideas: Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses	10

VI	Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy.	8
Total		60

REFERENCES:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, Steve Blank and Bob Dorf K & S Ranch, ISBN – 978-0984999392.

2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Penguin UK, ISBN – 978-0670921607.

3. Demand: Creating What People Love Before They Know They Want It, Adrian J. Slywotzky with Karl Weber, Headline Book Publishing, ISBN – 978-0755388974.

4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business, Clayton M. Christensen, Harvard business ISBN: 978-142219602.

Websites:

1. https://www.fundable.com/learn/resources/guides/startup

2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate-structure/

3. https://www.finder.com/small-business-finance-tips

4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

TH:3(a)- PROJECT MANAGEMENT

L	T	P		Course Code: OE302(a)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE

The aim of this course is to develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how to achieve the goals. The students will develop an understanding of key project management skills and strategies.

LEARNING OUTCOMES

On successful completion of the course, students will be able to:

5. List out the importance of projects and its phases.
6. Define projects from marketing, operational and financial perspectives.
7. Analyze projects based on discount and non-discount methods.
8. Construct network diagrams for planning and execution of a given project.
9. Apply crashing procedures for time and cost optimization.

DETAILED COURSE CONTENT

UNIT	TOPIC/SUB-TOPIC	HRS.
I.	**CONCEPT OF A PROJECT**: Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time) project priority matrix- work break down structure.	**9**
II.	**CAPITAL BUDGETING PROCESS:** Planning- Analysis-Selection-Financing-Implementation-Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis	**9**
III.	**FINANCIAL ESTIMATES AND PROJECTIONS:** Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability projected cash flow statement and balance sheet. Break-even analysis.	**9**

IV.	**BASIC TECHNIQUES IN CAPITAL BUDGETING**: Non discounting and discounting methods- payback period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return. Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects**.**	**9**
V.	**PROJECT ADMINISTRATION**: Progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off. Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management soft wares.	**9**

REFERENCES:

- Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill
- Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson - McGraw Hill
- Project management - David I Cleland - Mcgraw Hill International Edition, 1999
- Project Management – Gopala krishnan – Mcmillan India Ltd.
- Project Management-Harry-Maylor-Peason Publication

TH:3(b)- DISASTER MANAGEMENT

L	T	P		Course Code: OE302(b)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE

Disasters can be caused by both natural and man-made factors. They cannot be anticipated, and once they do, they must be handled with maturity, subtlety, and responsibility. Numerous immediate decisions must be made, and relief efforts must be planned and managed. Thus this course provides to the civil engineers, a proper knowledge regarding the disasters along with how they affect the environment and living things.

LEARNING OUTCOMES

After completion of the course, the students will be able to

- Use of basic information on various types of disasters to control the disaster
- Take the precautions during various disasters
- Decide first action to be taken under various disasters
- Communicate with others in India which are dealing with disasters
- Select IT tools to help in disaster management

DETAILED COURSE CONTENT

UNIT NO.	CONTENT	TIME ALLOTTED (HOURS)
UNIT-I	**Understanding Disaster** • Understanding the Concepts and definitions of Disaster, Hazard, • Vulnerability, Risk, Capacity • Disaster and Development, and disaster management	**05**
UNIT-II	**Types, Trends, Causes, Consequences and Control of Disasters** • Geological Disasters (earthquakes, landslides, tsunami, • mining); Hydro-Meteorological Disasters (floods, • cyclones, lightning, thunder-storms, hail storms, • Avalanches, droughts, cold and heat waves) Biological (3rd yr)/First Draft/May, 2023. Disasters (epidemics, pest attacks, forest fire); • Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.	**10**

UNIT-III	**Disaster Management Cycle and Framework** • Disaster Management Cycle – Paradigm Shift in Disaster Management. • Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness. • During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – • Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Frame-work of Action	**10**
UNIT-VI	**Disaster Management in India** • Disaster Profile of India – Mega Disasters of India and Lessons Learnt. • Disaster Management Act 2005 – Institutional and Financial Mechanism, • National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies	**10**
UNIT-V	**Applications of Science and Technology for Disaster Management** • Geo-informatics in Disaster Management (RS, GIS, GPS and RS). • Disaster Communication System (Early Warning and Its Dissemination). • Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters • Institutions for Disaster Management in India	**10**
	TOTAL	**45**

REFERENCES:

- Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
- Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR, New Delhi
- Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
- 4. Alexander, David, Natural Disasters, Kluwer Academic London
- Ghosh, G. K., Disaster Management, A P H Publishing Corporation
- Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

TH:3(c)- ARTIFICIAL INTELLIGENCE

L	T	P		Course Code: OE302(c)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE:

Artificial Intelligence (AI) empowers machines to mimic human intelligence, enabling tasks such as decision-making, problem-solving, and learning. It drives innovation across industries, from healthcare to robotics, by automating complex processes and uncovering insights from data. Learning AI equips students with cutting-edge skills to build intelligent systems and shape the future of technology.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Explain key concepts in Artificial Intelligence such as intelligent agents, search algorithms (uninformed, informed, local), and neural network architectures.
- Explain the principles of decision-making models, including Markov Decision Processes and reinforcement learning, and their applications in AI.
- Implement search algorithms, logic-based agents, and neural network architectures (feed forward, CNN, RNN) to solve AI-related problems.
- Analyze the performance of different neural network architectures and optimization techniques (e.g., gradient descent, Adam) to improve model accuracy and efficiency.
- Develop intelligent agents and neural network models for real-world applications, applying advanced learning techniques and optimization methods.

DETAILED COURSE CONTENT:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Fundamentals of Artificial Intelligence:** Introduction: History and foundations of AI Intelligent Agents, Uninformed Search; informed Search; Local Search; Adversarial Search, Constraint Satisfaction Problems	6
II	**AI:** Logic, Planning, and Knowledge Representation, Logical Agents, First Order Logic and its Inference, Classical Planning, Knowledge Representation	6
III	**Bayesian Network:** Introduction to Probability, Conditional Probability, Conditional Independence, Bayesian Network, Representation Approximate Inference in Bayesian Networks, Learning in Bayesian Network.	6
IV	**Decision Making:** Decision Theory, Markov Decision Processes, Reinforcement Learning	6
V	**Neural Networks:** Neural Networks: Biological neurons vs. artificial neurons; History and development of neural networks, Neurons, weights, biases, Activation functions (Sigmoid, ReLU, Tanh, Softmax).	7

VI	**Neural Network Architectures:** Feedforward Neural Networks (Single-layer and multilayer architectures), Convolutional Neural Networks (CNNs, Filters, pooling, and feature maps), Recurrent Neural Networks (RNNs, Long Short-Term Memory (LSTM)), Learning and Training - Perceptron and its limitations; Multilayer perceptron (MLP) and Backpropagation; Overfitting and regularization	7
VII	**Optimization Techniques:** Gradient Descent and its Variants (Stochastic Gradient Descent (SGD), Momentum-based optimization, Adam optimizer), Learning Rate and Convergence - Impact of learning rate on training.	7

REFERENCES:

1.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson/Prentice Hall, New Jersey, 2003.
2.	M.C. Trivedi, A Classical Approach to Artificial Intelligence, 1st Edition, Khanna Publishing House, New Delhi, 2018.
3.	V.K. Jain, Machine Learning, 1st Edition, Khanna Publishing House, New Delhi, 2018.
4.	Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, MIT Press, Cambridge, 2014.
5.	Vinod Chandra S.S. and Anand Hareendran S., Artificial Intelligence and Machine Learning, PHI Learning, New Delhi, 2014.

TH:3(d)- SOFT COMPUTING TECHNIQUES

L	T	P		Course Code: OE301/302/304	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE:

The Soft Computing Techniques course is designed to equip with the knowledge and skills required to solve complex real-world problems using intelligent, flexible, and approximate reasoning methods. In contrast to traditional "hard computing" approaches that demand exact solutions, soft computing embraces uncertainty, imprecision, and partial truth-making it ideal for solving practical problems in engineering, data science, and decision-making.

LEARNING OUTCOMES:

After completion of the course, the students will be able to

- Explain the Core Concepts of soft computing, including its need, scope, and its difference from traditional hard computing.
- Design Basic Neural Networks for classification, prediction, and pattern recognition tasks.
- Design Fuzzy Inference Systems using fuzzy sets, membership functions, and fuzzy rules.
- Apply Defuzzification Methods to convert fuzzy outputs into actionable results.
- Apply Genetic Operators like selection, crossover, and mutation to solve optimization and search problems.
- Apply Hybrid Models in fields like control systems, image processing, and decision-making.

DETAILED COURSE CONTENT:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Introduction to Soft Computing -** Overview of Soft Computing - Definition and importance of soft computing, Comparison between hard computing and soft computing, Applications of soft computing in various engineering fields, Components of Soft Computing - Introduction to Artificial Neural Networks (ANNs), Basics of Fuzzy Logic Systems (FLS), Overview of Genetic Algorithms (GAs).	8
II	**Artificial Neural Networks (ANNs) -** Fundamentals of ANNs, Biological inspiration and neural models, Types of activation functions, Architecture of neural networks: single-layer and multi-layer perceptrons, Learning Processes in ANNs - Supervised, unsupervised, and reinforcement learning, Backpropagation algorithm and its applications, Training, validation, and testing of neural networks, Applications of ANNs - Pattern recognition and classification, Function approximation and prediction, Case studies in engineering applications.	10

III	**Fuzzy Logic Systems (FLS) -** Introduction to Fuzzy Logic, Classical sets vs. fuzzy sets, Membership functions and their types, Fuzzy set operations, Fuzzy Rule-Based Systems - Linguistic variables and hedges, Formation of fuzzy if-then rules, Inference mechanisms and defuzzification techniques, Applications of Fuzzy Logic, Fuzzy control systems, Decision-making in uncertain environments, Engineering case studies utilizing fuzzy logic.	10
IV	**Genetic Algorithms (GAs) -** Basics of Genetic Algorithms - Evolutionary principles and natural selection, Chromosome representation and initialization, Fitness functions and selection mechanisms, Genetic Operators - Crossover techniques and their significance, Mutation operations and rates, Elitism and generational replacement strategies, Applications of Genetic Algorithms**,** Optimization problems in engineering, Scheduling and routing problems, Real-world case studies employing GAs.	10
V	**Hybrid Systems and Applications -** Integration of Soft Computing Techniques**,** Concept of hybrid systems combining ANNs, FLS, and Gas, Neuro-fuzzy systems: architecture and learning, Genetic-fuzzy systems and their applications, Practical Implementations - Designing hybrid models for complex problem-solving, Simulation and analysis of hybrid systems, Case studies demonstrating the effectiveness of hybrid approaches.	7

REFERENCES:

1.	Soft Computing: Fundamentals and Applications by D. K. Pratihar
2.	Soft Computing and Its Applications by Rafik Aziz Aliev and Rashad Rafik Aliev
3.	Soft Computing: Integrating Evolutionary, Neural, and Fuzzy Systems by Tettamanzi Andrea G. B. and Tomassini Marco
4.	Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence by Jyh-Shing Roger Jang et al.
5.	Neural Network, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications by S. Rajasekaran and G. A. Vijayalakshmi Pai

TH:4(a)- ENGINEERING ECONOMICS AND ACCOUNTANCY

L	T	P		**Course Code: OE304(a)**	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE

Engineering Economics and Accountancy plays crucial role in the economic aspects of engineering. This course ensures that the budding engineers to facilitate the process of economic decision making and also to acquaint knowledge on basic financial management aspects. Also, they will be able to develop the skills to analyze financial statements.

LEARNING OUTCOMES

On successful completion of the course, students will be able to:

- Identify various aspects of managerial economics
- Describe the mechanism of demand and supply
- Interpret various concepts of production and cost analysis
- Explain the different components of pricing
- Distinguish the details of financial accounting

DETAILED COURSE CONTENT

UNIT	TOPIC/SUB-TOPIC	ALLOTTED TIME (HRS.)
I.	**INTRODUCTION:** Managerial Economics; Relationship with other disciplines; Firms: Types, objectives and goals; Managerial decisions; Decision analysis.	**8**
II.	**DEMAND & SUPPLY ANALYSIS:** Demand; Types of demand; Determinants of demand; Demand function; Demand elasticity; Demand forecasting; Supply; Determinants of supply; Supply function; Supply elasticity.	**12**
III.	**PRODUCTION AND COST ANALYSIS:** Production function; Returns to scale; Production optimization; Least cost input; Isoquants; Managerial uses of production function; Cost Concepts; Cost function; Types of Cost; Determinants of cost; Short run and Long run cost curves; Cost Output Decision; Estimation of Cost.	**10**

IV.	**PRICING:** Determinants of Price; Pricing under different objectives and different market structures; Price discrimination; Pricing methods in practice; Role of Government in pricing control.	**7**
V.	**FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT):** Balance sheet and related concepts; Profit & Loss Statement and related concepts; Financial Ratio Analysis; Cash flow analysis; Funds flow analysis; Comparative financial statements; Analysis & Interpretation of financial statements; Investments; Risks and return evaluation of investment decision; Average rate of return; Payback Period; Net Present Value; Internal rate of return,	**8**

REFERENCES:

1. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House, New Delhi, 2018
2. McGuigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.
3. Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition, 2005.
4. Samuelson. Paul A and Nordhaus W.D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
5. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.
6. Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson South Western, 4th Edition, 2001.

TH:4(b)- INTERNET OF THINGS

L	T	P		Course Code: OE304(b)	
3	0	0			
Total Contact Hours			**Total Marks: 100**	**Theory Assessment**	
Theory		: 45 Hrs.		End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE:

The Internet of Things (IoT) is revolutionizing the way devices communicate, interact, and function, creating a connected world that bridges physical and digital spaces. With industries embracing smart solutions in areas like healthcare, agriculture, manufacturing, transportation, and home automation, there is a growing demand for skilled professionals who can design, implement, and manage IoT systems.

LEARNING OUTCOMES:

After the completion of this course, the students will be able to

- Explain Core IoT Concepts, including architecture, components, and communication models.
- Identify IoT Ecosystem Elements, such as sensors, actuators, microcontrollers, communication protocols, and cloud platforms.
- Integrate identified Hardware Components like Arduino, Raspberry Pi, sensors, and actuators for IoT projects.
- Analyze Sensor Data from IoT devices.
- Identify Common Security Threats in IoT ecosystems, including data breaches, device hijacking, and network vulnerabilities.

DETAILED COURSE CONTENT:

Unit No.	Topic/Sub-Topic	Allotted Time (Hours)
I	**Introduction to Internet of Things (IoT) -** Overview of IoT - Definition and significance of IoT, Historical evolution and future prospects, Applications across various industries, IoT Architecture and Components, Basic architecture - sensors, actuators, connectivity, and data processing, Hardware components: microcontrollers (e.g., Arduino, Raspberry Pi), Software components: operating systems and middleware.	8
II	**Sensors, Actuators, and Data Acquisition:** Sensors and Actuators, Types of sensors: temperature, humidity, motion, etc., Actuators: motors, relays, and control	10

	mechanisms, Interfacing sensors and actuators with microcontrollers, Data Acquisition and Processing - Analog and digital data acquisition methods, Signal conditioning and filtering techniques, Introduction to data processing and storage.	
III	**Communication Protocols and Networking -** IoT Communication Protocols, Overview of protocols: MQTT, CoAP, HTTP, etc., Wireless communication: Wi-Fi, Bluetooth, Zigbee, LoRaWAN., Wired communication: Ethernet, Serial communication, Networking Fundamentals - IP addressing and subnetting, Network topologies and architectures, Introduction to IPv6 and its relevance to IoT.	10
IV	**IoT Platforms and Cloud Integration -** IoT Platforms, Overview of popular IoT platforms (e.g., AWS IoT, Google Cloud IoT), Data analytics and visualization tools, Edge computing concepts, Cloud Computing for IoT, Introduction to cloud services: IaaS, PaaS, SaaS, Integration of IoT devices with cloud platforms, Data storage, processing, and management in the cloud.	10
V	**IoT Security and Privacy -** Security Challenges in IoT, Common vulnerabilities and threats, Authentication and authorization mechanisms, Data encryption and secure communication, Privacy Considerations - Data privacy laws and regulations, User consent and data ownership, Best practices for ensuring privacy in IoT applications.	7

REFERENCES:

1.	Internet of Things by Jeeva Jose
2.	Internet of Things by Raj Kamal
3.	Internet of Things (IoT) by Dr. Kamlesh Lakhwani, Dr. Hemant Kumar Gainey, Joseph Kofi Wireko, and Kamal Kant Hiran
4.	Internet of Things: From research and innovation to market deployment by Dr. Ovidiu Vermesan and Dr. Peter Friess
5.	The Internet of Things in the Cloud: A Middleware Perspective by Honbo Zhou
6.	Internet of Things: Architectures, Protocols and Standards by Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri
7.	Internet of Things (IoT): Concepts and Applications edited by Dr. Jamil Y. Khan and Dr. Mehmet R. Yuce

TH:4(c)- SUSTAINABLE DEVELOPMENT

L	T	P		Course Code: OE304(c)	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE:

The aim of this course is to develop an action mindset for sustainable development by imparting knowledge on environmental, social and economic dimensions of sustainability and related principles.

LEARNING OUTCOMES:

After Completion of the course, student will be able to

- Explain current challenges to sustainability, including modern world social, environmental, and economic structures and crises.
- Identify the social environmental, and economic dimensions of sustainability in terms of UN Sustainable development goals
- Explain understanding of the social, economic and ecological linkage of Human well-being, production and consumption
- Discuss sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.
- Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.

DETAILED COURSE CONTENT:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
I	**SUSTAINABILITY AND DEVELOPMENT CHALLEGES** Definition of sustainability – environmental, economical and social dimensions of sustainability – sustainable development models – strong and weak sustainability – defining development- millennium development goals – mindsets for sustainability: earthly, analytical, precautionary, action and collaborative– syndromes of global change: utilisation syndromes, development syndromes, and sink syndromes – core problems and cross cutting Issues of the 21 century – global, regional and local environmental issues – social insecurity – resource degradation –climate change – desertification.	**9**
II	**PRINCIPLES AND FRAME WORK** History and emergence of the concept of sustainable development – our common future – Stockholm to Rio plus 20– Rio Principles of sustainable development – Agenda 21 natural step- peoples earth charter – business charter for sustainable	**9**

	development –UN Global Compact – Role of civil society, business and government – United Nations' 2030 Agenda for sustainable development – 17 sustainable development goals and targets, indicators and intervention areas.	
III	**SUSTAINABLE DEVELOPMENT AND WELLBEING** The Unjust World and inequities – Quality of Life – Poverty, Population and Pollution – Combating Poverty – – Demographic dynamics of sustainability – Strategies to end Rural and Urban Poverty and Hunger – Sustainable Livelihood Framework- Health, Education and Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities and Industry for Prevention, Precaution , Preservation and Public participation.	**9**
IV	**SUSTAINABLE SOCIO-ECONOMIC SYSTEMS** Sustainable Development Goals and Linkage to Sustainable Consumption and Production – Investing in Natural Capital- Agriculture, Forests, Fisheries – Food security and nutrition and sustainable agriculture- Water and sanitation – Biodiversity conservation and Ecosystem integrity –Ecotourism – Sustainable Cities – Sustainable Habitats- Green Buildings – Sustainable Transportation — Sustainable Mining – Sustainable Energy– Climate Change –Mitigation and Adaptation – Safeguarding Marine Resources – Financial Resources and Mechanisms	**9**
V	**ASSESSING PROGRESS AND WAY FORWARD** Nature of sustainable development strategies and current practice- Sustainability in global, regional and national context –Approaches to measuring and analysing sustainability– limitations of GDP Ecological Footprint- Human Development Index- Human Development Report – National initiatives for Sustainable Development – Hurdles to Sustainability – Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Inclusive Green Growth and Green Economy – National Sustainable Development Strategy Planning and National Status of Sustainable Development Goals	**9**
		Total : 45

REFERENCE:

- Tom Theis and Jonathan Tomkin, Sustainability: A Comprehensive Foundation, Rice University, Houston, Texas, 2012
- A guide to SDG interactions: from science to implementation, International Council for Science, Paris,2017
- Karel Mulder, Sustainable Development for Engineers – A Handbook and Resource Guide, Rouledge Taylor and Francis, 2017.
- The New Global Frontier – Urbanization, Poverty and Environment in the 21st Century – George Martine, Gordon McGranahan,Mark Montgomery and Rogelio Fernández-Castilla, IIED and UNFPA, Earthscan, UK, 2008
- Nolberto Munier, Introduction to Sustainability: Road to a Better Future, Springer, 2006
- Barry Dalal Clayton and Stephen Bass, Sustainable Development Strategies- a resource book", Earthscan Publications Ltd, London, 2002.

TH:4(d)- ROBOTICS

L	T	P		Course Code: OE301/302/304	
3	0	0			
Total Contact Hours				**Theory Assessment**	
Theory		: 45 Hrs.	**Total Marks: 100**	End Term Exam	: 70
Tutorial		: 0		Progressive Assessment	: 30
Pre Requisite		**: Nil**			
Credit		**: 3**		Category of Course : OE	

RATIONALE:

Robotics boosts skills that are the foundation of success, such as critical-thinking and problem-solving skills. When working on a robot, students are encouraged to use logic, engineering intuition, and critical thinking. Students can come up with problems in their everyday life that they think robots can fix. Allowing students to develop theories that can be tested in robotics projects will strengthen their ability to form hypotheses.

LEARNING OUTCOMES:

After the completion of the course, the students will be able to

- Explain basic concepts, parts of robots and types of robots.
- Describe drive systems for robot, sensors and programming of robots.
- Select the robots according to its usage.
- Apply robots with justification and implementation of project.
- Design automation applications of robots in various industries.

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
I	**Fundamentals of Robotics:** Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, SCARA, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.	**9**
II	**Robotic Drive System and Controller:** Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.	**9**
III	**Sensors:** Requirements of a sensor; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range	**9**

	sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing. Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videocon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving	
IV	**Robot kinematics and Robot Programming:** Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple programs	**9**
V	**Automation:** Basic elements of automated system, advanced automation functions, levels of automation. Industrial Applications: Application of robots in machining; welding; assembly and material handling	**9**

REFERENCES:

- Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku
- Industrial Robotics: Technology, Programming and Applications – M.P. Groover
- Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G,
- Robotics for Engineers – Yoram Koren
- A Text book on Industrial Robotics – Ganesh S. Hedge
- Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb
- Elements of Robotics Process Automation, Mukherjee

TH:5- INDIAN CONSTITUTION

L	T	P		
2	0	0		**Course Code: AU302**
Total Contact Hours				**Theory Assessment**
Theory		: 30Hrs		End Term Exam 0
			Total Marks: 0	Progressive Assessment 0
Pre Requisite		**: Nil**		
Credit		**0**		Category of Course : Mandatory

RATIONALE:

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. In this course, student will make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Explain the emergence and evolution of Indian Constitution.
- Define the structure and composition of Indian Constitution
- Describe and analyze federalism in the Indian context.
- Analyze the Panchayati Raj institutions as a medium of decentralization
- Evaluate the Indian Political scenario amidst the emerging challenges.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
I	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.	08
II	Union Government: Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.	07
III	State Government: Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat.	05
IV	Local Administration: District Administration, Municipal Corporation, Zila Panchayat.	05

V	Election Commission: Role and Functioning, Chief Election Commissioner, State Election Commission	05

REFERENCES:

1. Ethics and Politics of the Indian Constitution, Rajeev Bhargava, Oxford University Press, New Delhi, 2008.
2. The Constitution of India, B.L. Fadia, Sahitya Bhawan; New edition (2017).
3. Introduction to the Constitution of India, DD Basu, Lexis Nexis; Twenty-Third 2018 edition.

Websites:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

PR:2- MAJOR PROJECT

L	T	P		
0	0	6		**Course Code: ARPC301**
Total Contact Hours				**Theory Assessment**
Theory		: 90Hrs	**Total Marks: 100**	End Term Exam : 100
				Progressive Assessment : 100
Pre Requisite		**: Nil**		
Credit		**: 6**		Category of Course : Project

RATIONALE:

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of MECHATRONICS and practices in real life situations, so as to participate and manage a large organization and projects, in future.
Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as Project Decertation-I and the balance portion to be covered in 6th Semester shall be named as Project Decertation-II.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Achieve real life experience in Project design.
- Develop the skill of writing Project Report

STUDENTS' ACTIVITY

Students will do their project work as guidance from their guide (faculty member).

Guidelines:
The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the students. For this purpose, students

should be asked to identify the type of project work they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be an individual assignment or a group assignment. Preferably there should not be more than 5 students if the project work is given to a group. The project work identified in collaboration with industry/organization should be preferred.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters (5th and 6th semester). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th semester under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Requirements specification and Preliminary work of the system have to be completed in Phase-I. Project Milestones are to be set so that progress can be tracked. In Phase-II Detailed work, Documentation has to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alterations in the components of Task and schedule.

At the end of Project Phase-I in the 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.
A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in the table below:

Sl. No.	Performance Criteria	
1.	Selection of project assignment	
2.	Planning and execution of considerations	
3.	Quality of performance	
4.	Providing solution of the problems or production of final product	
5.	Sense of responsibility	
6.	Self-expression/ communication/ Presentation skills	
7.	Interpersonal skills/human relations	
8.	Report writing skills	
9	Viva voce	

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.
It is proposed that the institute should organize an annual exhibition of the project work done by the students and invite leading Industrial organizations of area of subject to such an exhibition.

ORGANIZATION OF PROJECT REPORT
1. Cover page:

It should contain the following (in order)

I. Title of the Project
II. "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"

III. By Name of the Student(s)
IV. Logo of the Institution
V. Branch Name/Depart Name and Institution Name with Address
VI. Academic Year

2. 1st Inner page
Certificate:
It should contain he is following
"This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).
Seal and signature of the Supervisor/Guide with date

3. 2nd Inner Page
Acknowledgement by the Student(s)

4. Contents.

5. Chapter wise arrangement of Reports

6. Last Chapter: Conclusion
It should contain
I. Conclusion
II. Limitations
III. Scope for further Improvement

7. References

SEMINAR

L	T	P		
0	0	2		**Course Code: SE302**
Total Contact Hours				**Practical Assessment**
Practical		: 30Hrs		End Term Exam 30
			Total Marks: 100	Progressive Assessment 70
Pre Requisite		**: Nil**		
Credit		**1**		Category of Course : Seminar

RATIONALE:

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of MECHATRONICS and practices in real life situations, so as to participate and manage a large organization and projects, in future. The work must be presented in front of the examiner's panel consisting of an approved external examiner, an internal examiner and a guide,co-guide etc. as decided by the Head of the Department.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Present and convince their work as a seminar in front of the examiners and engineering community
- Develop presentation skills
- create interaction among listeners
- Display experimental set up/ equipment/test rig
- Conduct experiments/tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them
- Learn to appreciate your peers and give positive feedback.

Guidelines:

It is a continuation of Project work started in semester IV. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in the standard format as provided by the department. The candidate has to prepare a detailed project report consisting of the introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiner's panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head of the Department. The candidate has to be in regular contact with his/her guide.