Faculty of Engineering and Technology

Radha Govind University

Chandausi, Sambhal (U.P.)

Evaluation Scheme & Syllabus for

Department of Mechanical Engg.

DIPLOMA –MECHANICAL ENGINEERING

III Year (5^{th} & 6^{th} Semester)

(Effective from session _____)

DIPLOMA - MECHANICAL ENGG. STUDY AND EVALUATION SCHEME

3rd Year, 5th Semester

SUBJEC CODE	SUBJECT SNAME	STUDY SCHEM E Periods /Wee k			Credits	MARKSINEVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMEN T			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DME 501	Theory of Machines & Mechanisms	4	0	0	4	30	-	30	70	-	70	100
DME 502	Design of Machine Elements	4	0	0	4	30	-	30	70	-	70	100
DME 503	Advanced Manufacturing Process	3	0	3	4	30	-	30	70	-	70	100
DME 504	Open Elective –ii a) Computer Aided Design & Manufacturing b) Reverse Engineering c) Artificial Intelligence	2	0	0	2	30	-	30	70	-	70	100
DME 505	Minor Project	0	0	8	4	-	50	50	-	50	50	100
DME 506	Advanced Manufacturing Process	0	0	4	2	-	25	25	-	25	25	50
DME 507	Summer Internship (4-6 Weeks)	-	-	-	2	-	-	-	-	50	50	50
Total					22	150	75	225	350	75	425	600

For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.

Note: -1 Students will present a seminar/viva on their summer internship along with certificate, project and report.

2. Students will submit the certificate.

DIPLOMA - MECHANICAL ENGG. STUDY AND EVALUATION SCHEME

3rd Year, 6th Semester

SUBJEC CODE	SUBJECT SNAME	STUDY SCHEM E Periods /Wee k			Credits	MARKSINEVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMEN T			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DME 601	PROGRAM ELECTIVE-I	3	0	0	3	30	-	30	70	-	70	100
DME 602	Entrepreneurship And Start- Up*	2	0	0	2	30	-	30	70	-	70	100
DME 603	PROGRAM ELECTIVE-II	3	0	0	3	30	-	30	70	-	70	100
DME 604	PROJECT WORK	0	0	24	12	-	240	240	-	160	160	400
Total					20	90	240	330	210	160	370	700

For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.

DME 601 Program Elective-I	DME 603 Program Elective-II
1. Advanced Engg. Mathematics 2. Additive Manufacturing 3. Project Management 4. Finance Fundamentals	1. Green Energy & Engg. 2. Maintenance of Machine Tools 3. Non- Destructive Testing 4. Product Design & Development

Note: "Entrepreneurship and Start-up" course is also mandatory in Industrial internship/training mode.

DME 501 L-4 T-0 P-0

THEORY OF MACHINES & MECHANISMS

RATIONALE

A diploma holder in this course is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Explain the fundamentals and kinematics of mechanisms, links, pairs, and chains.

CO2: Explain cams and followers, their motions, displacement diagrams, and draw cam profiles.

CO3: Analyze and select power transmission systems including belts, chains, gears, and ropes.

CO4: Analyze the concepts, applications, and analysis of flywheels and governors.

CO5: Explain the construction, working, and applications of brakes, clutches, and bearings.

CO6: Analyze balancing of rotating masses and understand causes, effects, and remedies of vibrations.

DETAILED CONTENT

UNIT I: Introduction to Mechanisms and Machines: Introduction of Mechanism and Machine, Basic elements- Link, Pairs, Chains, Inversions, different types of mechanisms, Displacement, velocity and acceleration of plane mechanisms.

Cams and Followers: Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; Drawing of profile of radial cam with knife-edge and roller follower.

UNIT II: Power Transmission: Basics of Power Transmission

Belt Drives: Flat belt, V– belt & its applications; Material for flat and V-belt; Angle of lap, Belt length, Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numerical).

Chain Drives: Advantages & Disadvantages; Selection of Chain& Sprocket wheels; Methods of lubrication.

Gear Drives: Gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for simple and compound, gear train, law of gearing; Rope Drives – Types, applications, advantages & limitations of Steel ropes.

UNIT III: Flywheel and Governors: Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine; Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance. Governor Types and explanation with neat sketches (Centrifugal-Watt and Porter); Concept, function and applications & Terminology of Governors; Comparison between Flywheel and Governor.

UNIT IV: Brakes, Dynamometers, Clutches & Bearings: Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake; Concept of Self Locking & Self energizing brakes.

Clutches: Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of Single plate, Multiplate, Centrifugal and Cone clutch.

Bearings i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot.

UNIT V: Balancing & Vibrations: Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane. Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.

INSTRUCTIONAL STRATEGY

• Use teaching aids for classroom teaching

• Give assignments for solving numerical problems

• Arrange industry visits to augment explaining use of various machine components like belt,

• rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, Fly wheels, cams and gear drives

• Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

MEANS OF ASSESSMENT

1. Assignments and quiz/class tests

2. Sessional test

3. Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.

2. Theory of machines – R.K.Bansal ,Laxmi publications

3. Theory of machines – R.S. Khurmi &J.K.Gupta , S.Chand publications.

4. Dynamics of Machines – J B K Das, Sapna Publications.

DME 502 L-4 T-0 P-0

Design of Machine Elements

RATIONALE

The subject "Design of Machine Elements" is crucial for mechanical engineering diploma students as it equips them with the knowledge and skills needed to create and improve machine components. This subject focuses on the principles of designing various machine elements such as bearings, gears, springs, and fasteners. Understanding these principles helps students to analyse and solve real-world engineering problems, ensuring the reliability and efficiency of mechanical systems. By learning to design machine elements, students can prevent failures, optimize performance, and contribute to the development of innovative and cost-effective mechanical solutions.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Explain the fundamentals of machine design.

CO2: Design simple machine elements such as cotter joints, knuckle joints, levers, C clamps, and overhang cranks.

CO3: Design bearings and springs based on load and deflection requirements.

CO4: Design shafts, keys, and couplings for strength, rigidity, and standardization.

CO5: Design spur gears, including tooth profile and module selection.

CO6: Design power screws and fasteners, including screw jacks, bolts, riveted and welded joints, considering efficiency and load requirements.

DETAILED CONTENT:

UNIT-I: Introduction to Design: Procedure of Design, General considerations in Machine Design, Use of standards in design and preferred numbers series; Stresses; Bearing pressure Intensity; Crushing; Creep Curve; Fatigue; S-N curve; Endurance Limit; Factor of Safety and Factors governing selection of factor of Safety; Stress Concentration: Causes & Remedies; selection criteria of materials; Introduction to Theories of Failures; Ergonomics & Aesthetic consideration in design.

UNIT-II: Design of simple machine parts: Cotter Joint; Knuckle Joint; Design of Levers: Hand/Foot Lever & Bell Crank Lever; Design of C–Clamp; Overhang Crank;.

Bearings: Introduction, Types of bearing and terminology of bearings, Life Load relationship, Selection of bearings using manufacturer's catalogue.

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.

UNIT-III: Design of Shafts, Keys, Couplings: Types of Shafts; Shaft materials; Standard Sizes; Design of Shafts (Hollow and Solid) using strength and rigidity criteria; determination of shaft diameter (Hollow and Solid), ASME code of design for shafts. Design of Sunk Keys; Effect of Keyways on strength of shaft. Introduction and function of keys, types, material and failure of keys. Design of keys (Sunk key only), Necessity, advantages and types of Couplings, Design of couplings – Muff Coupling and Flange Coupling (Protected and unprotected);

UNIT-IV: Design of Spur Gear: Mechanical drive, classification of gears, selection of gear, involute and cyloidal profile of teeth, terminology of spur gear, standard system of gear teeth, Spur gear design considerations; Lewis equation for static beam strength of spur gear teeth; design procedure of spur gear (module determination). Power transmission capacity of spur gears in bending.

UNIT-V: Design of Power screws and Fasteners: Introduction of power screw, terms used in screw threads, Thread Profiles used for power Screws; Torque required to overcome thread friction; Self-locking and overhauling property; Efficiency of power screws; Design of Screw Jack. Introduction of Fasteners, Types of Fasteners, Bolts of uniform strength, design of bolted joints, design of parallel and transverse welded, design riveted joints, failure and efficiency of riveted joints, leak proofing of riveted joints- caulking and fullering.

INSTRUCTIONAL STRATEGY

• Combine interactive lectures with hands-on projects and the use of CAD software.

• Incorporate real-world examples, disassembly exercises, and simulation tools.

• case studies and problem-solving sessions.

• Guest lectures and industry visits can provide practical insights.

• Utilizing online resources and hosting design competitions can further engage students and foster innovation.

MEANS OF ASSESSMENT

• Assignments and quiz/class tests

• Sessional test

• Small projects

• Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

1. Machine Design – Sadhu Singh, Khanna Book Publishing Co., Delhi (ISBN: 978- 9382609-575)

2. Machine Design Data Book – Sadhu Singh, Revised Edition, Khanna Book Publishing Co., Delhi (ISBN: 978-9382609-513)

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.

DME 503 L-3 T-0 P-3

ADVANCED MANUFACTURING PROCESSES

RATIONALE

In today's competitive industrial environment, the demand for high precision, productivity, quality, and cost-effectiveness in manufacturing has led to the development and adoption of advanced manufacturing processes. Traditional machining methods, though still vital, are often inadequate for processing modern engineering materials or for meeting the desired specifications. Hence, knowledge of advanced manufacturing processes has become essential for diploma engineering students.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Explain the geometry, materials, performance, and maintenance of cutting tools, and analyze the effects of machining parameters.

CO2: Describe and compare plastic processing techniques and powder metallurgy processes.

CO3: Analyze the principles, process parameters, capabilities, and applications of modern, non-traditional, and hybrid machining processes.

CO4: Interpret CNC machine configurations and develop basic CNC part programs using Gcodes and M-codes.

CO5: Explain the concepts of automation, PLCs, and industrial robotics, and evaluate their applications.

DETAILED CONTENT

UNIT-I: Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect , multipoint cutting tools, reamer, drill, milling cutter, throw-away inserts, chip breaker, tool and cutter maintenance, regrinding and lapping of tools.

Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.

UNIT-II: Plastic Processing: Processing of plastics; Moulding processes: Injection moulding, Compression moulding, Transfer moulding; Extruding; Casting; Calendaring; Fabrication methods-Sheet forming, Blow moulding, Laminating plastics (sheets, rods & tubes), Reinforcing; Applications of Plastics.

Powder Metallurgy: Introduction, Powder Fabrication: Mechanical & Chemical fabrication, Powder Characterization: Particle size measurement, BET surface area, Interparticle friction, Powder packing, mixing and blending, Shaping and Compaction, Slurry techniques and Sintering.

Unit-III: Modern Machining Processes: Introduction – comparison with traditional machining; Ultrasonic Machining: principle, Description of equipment, applications; Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications; Wire cut EDM: Principle, Description of equipment, Controlling parameters; applications; Abrasive Jet Machining: principle, description of equipment, application; Laser Beam Machining: principle, description of equipment, application; Electro Chemical Machining: description of equipment, application.

Hybrid Machining Processes: Concept; Classification of Hybrid Machining Processes; Major Elements of Hybrid Machining Technology; Benefits of Hybrid Machining Technology.

Unit-IV: CNC Machining and Operations: Vertical and horizontal machining center: Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine. CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming including subroutines and canned cycles. Principles of computer aided part programming.

UNIT-V: Automation and Robotics: Introduction and Need; (A) Single spindle automates, transfer lines. (B) Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system, Introduction to PLC, Block diagram of PLC.

Robotics: Definition, Classification of Robots - Geometric classification and Control classification, Laws of Robotics, Robot Components, Coordinate Systems, Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Limitation of usage of robots in processing operation.

INSTRUCTIONAL STRATEGY

1. Lay greater emphasis on practical aspects of maintenance.

2. Make use of transparencies, video films and CD's.

3. Expose the students to real life situation.

4. Promote continued learning through properly planned assignments.

5. Demonstrate sample of all types of gear and bearings.

MEANS OF ASSESSMENT

− Assignments and quiz/class tests

− Mid-term and end-term written tests

− Model/prototype making

Reference Books:

1. Production Technology – HMT, Banglore, Tata Mc-Graw Hill

2. CNC machines – Pabla B. S. & M. Adithan, New Age international limited.

3. Non conventional Machining – P. K. Mistra, Narvasa Publishining House

4. Manufacturing Processes – Begman & Amsted, John Willey and Sons.

5. Advanced manufacturing technology – David L. Goetsch 6. Exploring Advanced Manufacturing Technologies – Stephen F. Krar & Arthur Gil, Industrial Press

Websites for Reference: http://swayam.gov.in

ADVANCED MANUFACTURING PROCESSES LAB

LIST OF PRACTICALS:

1. Study the constructional details of EDM Machine.

2. Study the constructional details of CNC lathe.

3. Study the constructional details of CNC milling machine.

4. Develop a part programme for lathe operations and make a job on CNC lathe and CNC turning centre.

5. Develop a part programme for milling operations and make a job on CNC milling.

6. Prepare a specimen of composite material with two or more materials.

7. Observe the microstructure of composite material specimen.

8. Find the mechanical strength of composite material specimen.

DME 504 L-3 T-0 P-3

Open Elective-II

(Computer Aided Design & Manufacturing)

RATIONALE

Manufacturing of this century belongs to computerized equipment & machine tools to manufacture a variety of components with high quality, high precision & low cost at a faster rate. Commuter Aided Designing, Computer Aided Manufacturing, & Flexible Manufacturing Systems-all are the part of Computer Integrated Manufacturing which help to achieve the desired goals in manufacturing. After studying the subject, the students will be able to know about these integrated techniques which help a manufacturer to achieve his goal with in stipulated time.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Explain the fundamentals of CAD, CAM, CNC, product cycle, CNC programming (Gcodes, M-codes, APT) and rapid prototyping technologies.

CO2: Create and modify 2D and 3D surface and solid models using parametric CAD tools, solid primitives, Boolean operations, transformations, and dimensioning techniques.

CO3: Analyze the concepts, components, flexibility types, advantages, and limitations of Flexible Manufacturing Systems (FMS) for modern manufacturing environments.

DETAILED CONTENTS

Unit I: Introduction

Introduction to CAD,CAM & CIM, Advantages of CAD&CAM,Product Cycle, Reasons for implementation of CAD & CAM,Steps involved in CAM operation, Intoduction of CNC , CNC programming (G-codes, M-codes,APT programming).

Rapid Prototyping : 3D printing, Fused deposition modeling, Laminated object manufacturing, Selective laser Sintering , Stereo lithography , Ball 3 to 2 particle manufacturing

Unit II: Surface / Solid Modelling Using CAD/CAM:

Introduction to parametric and non-parametric surfaces, Creation of simple surfaces using revolved surface, ruled surface and 3D surfaces commands, Designing Software used in creation of solid models, Concept of solid models, Solid Primitives- Box, cylinder, Cone, Sphere, Wedge and torus, Construction of solid using Region, Extrude and Revolved feature, Creation of

Composite solid using Boolean function e.g. Union, Subtraction and Intersection. Sectioning of Solids and modification of solid Edges and faces using solid editing commands. Shell, Separate commands. Performing 3D operations like 3D array, mirror and rotate, Creation of fillets and chamfers, Dimensioning of solids, 2D and 3D transformation: Translation, Scaling, rotation, mirror, zooming, panning and clipping.

Unit III : Flexible Manufacturing System

Introduction to FMS, Principles of flexibility, changes in manufacturing system – external changes and internal changes job flexibility, machine flexibility, Features of FMS – production equipment, support system, material handling system, computer control system, Advantages & limitations of FMS.

REFERENCE BOOKS/ ONLINE RESOURCES

1. CAD/CAM by Mikell Groover and Zimmers; Prentice Hall of India Pvt. Ltd., Delhi.

2. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata McGraw Hill, NewDelhi.

3. Introduction to Robotics by John J. Craig; Pearson Education Asia, Singapore.

4. Industrial Robot by Groover; Prentice Hall of India Pvt. Ltd., Delhi.

5. Robotics by Yorem Korem; McGraw Hill International. Book Co., New Delhi.

6. CAD/CAM – Theory and Practice by Zeid; Tata McGraw Hill Publishers, New Delhi.

7. CAD/CAM/CIM by S. Radha Krishan.

8. CNC Machines by Dr. B.S. Pabla – New Age Publications.

9. e-books/e-tools/relevant software to be used as recommended by

AICTE/BTE/NITTTR,

Chandigarh.

10. http://swayam.gov.in

(Open Elective- II)

Reverse Engineering

RATIONALE:

To meet out Globalization, technological advances and to sustain, we have to explore the knowledge about machine tools covering the various operations and Maintenance skill sets required for the development of a nation and its people.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Explain the principles, processes, phases, and tools of reverse engineering including dimensional measurement, surface/solid model reconstruction, and material characterization.

CO2: Analyze material characteristics, alloy structures, mechanical properties, and failure mechanisms to assess part durability and life limitations.

CO3: Apply reverse engineering techniques to solve industrial problems in automotive and aerospace sectors.

DETAILED CONTENTS

Unit I INTRODUCTION

Definition–Uses–the Generic Process–Phases–Computer Aided Reverse Engineering Surface and Solid Model Reconstruction–Dimensional Measurement Prototyping. Material Specification, Composition Determination, Microstructure Analysis, Manufacturing Process Verification.

UNIT II: MATERIAL CHARACTERISTICS,PART DURABILITY AND LIFE LIMITATION

Alloy Structure Equivalency–Phase Formation and Identification–Mechanical Strength– Hardness–Part Failure Analysis–Fatigue–Creep and Stress Rupture Environmentally Induced Failure

Unit III: INDUSTRIAL APPLICATIONS

Reverse Engineering in the Automotive Industry; Aerospace Industry. Case studies and Solving Industrial projects in Reverse Engineering. Legality:Patent–Copyrights–Trade Secret–Third-Party Materials.

Text and Reference Books:

1. Reverse Engineering: An Industrial Perspective by V. Raja andK. Fernandes, Springer Verlag.Wego

2. Kevin Otto , "Product Design : Techniques in Reverse Engineering and New Product Development", ISBN-13: 9788177588217, Dorling Kindersley

3. Robert Messler, "Reverse Engineering: Mechanisms, Structures, Systems & Materials", McGraw Hill Education, ISBN: 9780071825160

4. Reverse Engineering by K. A. Ingle, McGraw-Hill. 5. Raja, Vinesh, Fernandes, Kiran J. , "Reverse Engineering An Industrial Perspective" ISBN 978-1-84628-856-2, Springe

(Open Elective- II)

Artificial Intelligence

RATIONALE:

Introducing AI at the diploma level enables students to understand the fundamentals of intelligent systems, machine learning, decision-making algorithms, and data-driven technologies. The subject provides insights into how machines can simulate human intelligence to perform tasks like speech recognition, vision processing, problem-solving, and autonomous control.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Explain the definition, goals, history, and applications of Artificial Intelligence in solving real-world problems.

CO2: Analyze intelligent agents, environment properties, and apply brute-force, heuristic, and local search algorithms to problem-solving tasks.

CO3: Apply fuzzy logic systems and neural network models, including perception and Back propagation algorithms, to develop basic intelligent systems.

DETAILED CONTENTS

Unit 1 – Introduction to Artificial Intelligence

• Artificial Intelligence (AI) definition

• Goals of AI

• History of AI

• Applications of AI

Unit 2-Agents ,Environments & Algorithms Terminology

• Agent Terminology, Types of Agents – Simple Reflex Agents, Model Based Reflex Agents, Goal Based Agents

• Nature of Environments, Properties of Environments

• Brute Force Search Strategies – Breadth First Search, Depth First Search.

• Heuristic Search Strategies, Local Search Algorithms.

Unit 3 – Fuzzy Logic Systems & Neural Networks

Introduction to Fuzzy Logic and Fuzzy systems,

• Membership functions,

• Fuzzification / Defuzzification

•Basic structure of Neural Networks

• Perceptron

• Back-propagation

Text and Reference Books:

1. Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases Denis Rothman Packt Publishing ISBN – 978-1788990547

2. Artificial Intelligence by E. Balagurusamy

3. Artificial Intelligence: A Simplified Approach by Sinha, P.Royston

4. Introduction to Artificial Intelligence by Dan W. Patterson.

DME 505 **L-0 T-0 P-8**

MINOR PROJECT

RATIONALE

Minor projects for mechanical engineering diploma students are essential because it provides them advantage like apply theoretical knowledge to real-world problems, develop critical skills like problem-solving and teamwork, provide hands-on experience with tools and technologies, encourage innovation and creativity, prepare students for their careers by demonstrating initiative and independence, Familiarize students with industry standards.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

• Use effectively oral, written and visual communication

• Demonstrate skill and knowledge of current technological tools and techniques specific to the professional field of study.

• Identify, analyse and solve problems creatively through sustained critical investigation.

• Develop leadership abilities.

• Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

Minor projects are crucial for mechanical engineering diploma students for several

reasons:

1. Application of Knowledge: They allow students to apply theoretical concepts learned in class to practical, real-world problems, reinforcing their understanding.

2. Skill Development: Projects help in developing essential skills such as problem-solving, critical thinking, teamwork, and project management, which are highly valued in the engineering industry.

3. Hands-On Experience: Students gain hands-on experience with tools, materials, and technologies used in mechanical engineering, which is invaluable for their future careers.

4. Innovation and Creativity: Working on projects encourages students to think creatively and come up with innovative solutions to engineering challenges.

5. Career Preparation: Completing projects demonstrates a student's ability to take initiative, work independently, and successfully complete tasks, making them more attractive to potential employers.

6. Industry Standards: Projects familiarize students with industry standards and practices, preparing them for professional work environments.

7. Networking: Collaborating on projects provides opportunities to build networks with peers, faculty, and industry professionals, which can be beneficial for future career prospects.

Note: The teachers may guide /help students to identify their minor project work and check out their plan of action well in advance.

Suggested list of minor projects Following are some project ideas for mechanical engineering diploma students:

1. Solar-Powered Water Pump: Design and build a water pump that operates using solar energy. This project can help in understanding renewable energy applications and fluid mechanics.

2. Automatic Pneumatic Bumper System: Create a system that deploys a bumper automatically to prevent vehicle damage during collisions. This involves knowledge of pneumatics and safety systems.

3. Fabrication of Seed Sowing Machine: Develop a machine that can sow seeds at specific intervals and depths. This project combines agricultural engineering with mechanical design.

4. Electricity Generation from Speed Breakers: Design a mechanism to generate electricity when vehicles pass over speed breakers. This project explores energy conversion and mechanical design.

5. Hydraulic Scissor Lift: Build a scissor lift powered by hydraulics. This project helps in understanding hydraulic systems and mechanical linkages.

6. Solar-Powered Air Conditioning System: Develop an air conditioning system that runs on solar power. This project involves thermodynamics and renewable energy.

7. Automatic Side Stand Retrieving System for Two-Wheelers: Create a system that automatically retracts the side stand of a motorcycle when the vehicle starts moving. This project focuses on safety mechanisms and automation.

8. Fabrication of a Mini Wind Turbine: Design and construct a small wind turbine to generate electricity. This project involves aerodynamics and renewable energy.

9. Design and Fabrication of a Go-Kart: Build a small, lightweight vehicle for recreational purposes. This project covers vehicle dynamics, design, and fabrication.

10. Water Purification System Using Solar Energy: Develop a system that purifies water using solar energy. This project combines environmental engineering

with mechanical design. These projects not only provide hands-on experience but also help in understanding various mechanical engineering concepts.

As a minor project activity each student is supposed to study the operations at site

and prepare a detail project report of the observations/processes/activities by

him/her. The students should be guided by the respective subject teachers. Each

teacher may guide a group of 4 to 5 students.

The teachers along with field supervisors/engineers will conduct performance

assessment of students.

Criteria for assessment will be as follows:

S.NO. CRITERIA MARKS

1. Attendance and Punctuality

2. State of the Art through Synopsis

PPT

DME 507 SUMMER INTERSHIP

(INDUSTRIAL TRAINING)

L	T	P
0	0	0

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th semester examinations.

The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details. The teacher along with field supervisors will conduct performance assessment of students. The

components of evaluation will include the following:

Punctuality and regularity 15%

Initiative in learning new things 15%

Presentation and VIVA 15%

Industrial training report 55%

6^{TH} SEMESTER

DME 601 L-3 T-0 P-0

Program Elective-i

(Advanced Engineering Mathematics)

RATIONALE:

Mathematics is essential for engineering students to understand core engineering subjects. It provides the framework for engineers to solve problems in engineering domains. This course is designed to bridge the gap between diploma mathematics and B.E/ B.Tech. mathematics in matrix algebra, differential calculus, vector calculus, differential equations, and Laplace transforms.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Compute eigenvalues and eigenvectors of matrices and apply Cayley–Hamilton theorem to solve engineering problems.

CO2: Apply partial differentiation techniques, Jacobians, and optimization methods to functions of several variables.

CO3: Analyze scalar and vector fields using gradient, divergence, and curl in engineering applications.

CO4: Formulate and solve ordinary differential equations of first and second order arising in engineering systems.

CO5: Apply Laplace transform techniques to solve differential equations and analyze dynamic systems.

DETAILED CONTENT

Unit I: EIGEN VALUES AND EIGEN VECTORS

Characteristic equation – Eigen-values of 2 × 2 and 3 × 3 real matrices –Eigen-vectors of 2 × 2 real matrices – Properties of eigen-values (excluding proof) –Cayley-Hamilton theorem (excluding proof) – Simple problems.

Unit II FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives of two variable and three variable functions (up to second order)– Homogeneous functions and Euler's theorem (excluding proof) – Jacobian matrix and determinant – Maxima and minima of functions of two variables –Simple problems.

Unit III VECTOR CALCULUS

Scalar field and Vector field – Vector differential operator – Gradient of a scalar field – Directional derivative – Divergence and curl of a vector field (excluding properties) – Solenoidal and irrotational vector fields – Simple problems.

Unit IV DIFFERENTIAL EQUATIONS

Differential equation – Formation – Order and degree – Solution of a differential equation – Equations of first order and first degree – Variable separable method – Leibnitz's Linear equations – Second order equations of the form where and are constants aD and the auxiliary 2 ($+ bD + c)y = enx$ a, b, c n equation am has only real roots) – Complementary function – 2 + $bm + c = 0$ Particular integral – General solution – Simple problems.

Unit V LAPLACE TRANSFORMS

Definition of Laplace transform – Laplace transforms of standard functions – Linearity and change of scale property (excluding proofs) – First shifting property– Laplace transforms of derivatives – Properties (excluding proofs) – Inverse Laplace transforms – Properties (excluding proofs) – Solving first order ordinary differential equation using Laplace transforms – Simple problems.

Reference Books:

1. John Bird, Higher Engineering Mathematics, Routledge, 9th Edition, 2021.

2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.

3. Arumugam, S., Thangapandi Isaac, A., & Somasundaram, A., Differential Equations and Applications, Yes Dee Publishing Pvt. Ltd., 2020.

4. Duraipandian, P., & Kayalal Pachaiyappa, Vector Analysis, S Chand and Company Limited, 2014.

5. Narayanan, S., & Manicavachagom Pillai T.K., Calculus Volume I and II, .Viswanathan Publishers Pvt. Ltd., 2007.

Web Reference

1. https://www.khanacademy.org/math/

2. https://www.mathportal.org/

3. https://openstax.org/subjects/math/

4. https://www.mathhelp.com/

5. https://www.geogebra.org/
6. https://www.desmos.com/
7. https://phet.colorado.edu/

Program Elective-i

(Additive Manufacturing)

RATIONALE:

This course is mainly designed to have a complete knowledge about Additive Manufacturing technologies which is a main component among the nine pillars of Industrie 4.0. This course is suitable for students opting for any pathway under Diploma in Mechanical Engineering stream. This course enhances the technical skills of students such as newer product design, testing and validation, problem solving, innovation, etc

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: familiarise the fundamentals, evolution, materials, and classification of Additive Manufacturing technologies.

CO2: Apply Design for Additive Manufacturing (DfAM) principles including CAD preparation, slicing, support generation, and reverse engineering.

CO3: Explain the construction, working principles, and process parameters of extrusion and sheet metal based AM processes.

CO4: Analyze photo-polymerization and powder-based AM processes and compare their advantages and limitations.

CO5: Identify and evaluate applications of Additive Manufacturing in various industrial and biomedical sectors.

DETAILED CONTENT

Unit I Introduction to Additive Manufacturing (AM)

Additive Manufacturing-Overview–Need–History–Classification–working principles (concepts only)-Materials for AM–PLA, ABS, PMMA, ceramics, composites and liquid resins–AM processes-Advantages, Limitations and Challenges–Rapid Prototyping–Rapid Tooling.

Unit II Design for Additive Manufacturing

Basic concept–CAD model preparation-file formats- Part orientation–Support material generation–Model slicing–honeycomb structure- Digitization techniques–Model reconstruction–Slicing software-Reverse Engineering–RE application in AM.

Unit III Extrusion and Sheet metal based Processes

Fused Deposition Modeling (FDM)–construction, working principle, advantages process parameters involved-Laminated Object Manufacturing (LOM) construction, working principle, advantages-gluing and adhesive bonding-Poly Jet construction, working principle, advantages.

Unit IV Photo polymerization and Powder based Processes

Stereo lithography process (SLA)–construction, photo curable materials, working principle, advantages–Selective Laser Sintering (SLS)-construction, working principle, advantages–Electron Beam Melting (EBM)-construction, working principle, advantages– Laser Engineered Net Shaping (LENS)-construction, working principle, advantages.

Unit V Applications of Additive Manufacturing

Applications of Additive manufacturing technologies–new product development after sales and service-automobile, aerospace, consumer products, healthcare industries– customized implants, bio-organs, bio-bones etc.

Reference Books:

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.

2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.

3. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.

4. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

5. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRCpress, 2000.

6. TomPage"Design for Additive Manufacturing" LAP Lambert Academic Publishing, 2012.

Program Elective-i

(Project Management)

RATIONALE:

Project management is the systematic application of knowledge, skills, tools, and techniques to project activities to meet specific project requirements. It involves planning, organizing, and managing resources to achieve project goals within defined scope, time, and budget constraints. Project management encompasses several key processes and phases, including initiation, planning, execution, monitoring and controlling, and closing. It is essential across various industries to ensure projects are completed successfully, efficiently, and effectively, aligning with organizational objectives and stakeholder expectations. Project managers play a crucial role in leading teams, managing risks, ensuring quality, and communicating with stakeholders to drive project success.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Familiarise with fundamentals of project management, project structures, portfolio management, and causes of project delays.

CO2: Analyze project feasibility studies, project life cycle phases, and project constraints.

CO3: Evaluate projects under certainty and uncertainty using financial, commercial, and social cost–benefit analysis techniques.

CO4: Develop and analyze project networks using PERT and CPM techniques and apply project appraisal and control mechanisms.

CO5: Apply project leadership and team management principles to effectively manage stakeholders and project teams.

DETAILED CONTENT

Unit I Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays

Project – Classification – Importance of Project Management – An Integrated Approach – Project Portfolio Management System – The Need – Choosing the appropriate Project Management Structure: Organizational considerations and project considerations – steps in defining the project – project Rollup – Process breakdown structure – Responsibility Matrices – External causes of delay and internal constraints.

Unit II Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints

Project feasibility studies - Opportunity studies, General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study – components of project feasibility studies – Managing Project resources flow – project planning to project completion: Pre-investment phase, Investment Phase and operational phase – Project Life Cycle – Project constraints.

Unit III Project Evaluation under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis

Project Evaluation under certainty - Net Present Value (Problems - Case Study), Benefit Cost Ratio, Internal Rate of Return, Urgency, Payback Period, ARR – Project Evaluation under uncertainty – Methodology for project evaluation – Commercial vs. National Profitability – Social Cost Benefit Analysis, Commercial or National Profitability, social or national profitability.

Unit IV Developing Project Network using PERT and CPM, Project Appraisal and Control Process.

Developing a Project Plan - Developing the Project Network – Constructing a Project Network (Problems) – PERT – CPM – Crashing of Project Network (Problems – Case Study) – Resource Leveling and Resource Allocation – how to avoid cost and time overruns – Steps in Project Appraisal Process – Project Control Process – Control Issues – Project Audits – the Project Audit Process – project closure – team, team member and project manager evaluations.

Unit V Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls.

Managing versus leading a project - managing project stakeholders – social network

building (Including management by wandering around) – qualities of an effective

project manager – managing project teams – Five Stage Team Development Model –

Situational factors affecting team development – project team pitfalls.

Reference Books:

1. Clifford F. Gray And Erik W. Larson, Project Management – The Managerial Process, Tata Mcgraw Hill.

2. Dragan Z. Milosevic, Project Management Toolbox: Tools And Techniques For The Practicing Project Manager,

3. Gopalakrishnan, P/ Ramamoorthy, V E, Textbook Of Project Management, Macmillan India. Ltd.

4. Harold Kerzner, Project Management: A Systems Approach To Planning, Scheduling, And Controlling, Eighth Edition, John Wiley & Sons

5. Jason Charvat, Project Management Methodologies: Selecting, Implementing, And Supporting Methodologies And Processes For Projects, John Wiley & Sons.

6. Kevin Forsberg, Ph.D, Hal Mooz, Visualizing Project Management: A Model For Business And Technical Success, Second Edition, Pmp And Howard Cotterman, John Wiley & Sons.

Web Reference

https://youtu.be/pc9nvBsXsuM

NPTEL Courses

https://youtu.be/PqQqTAu_FiM

Program Elective-i

(Finance Fundamentals)

RATIONALE:

This course gives a deep insight into the finance fundamentals such as money management and the process of acquiring needed funds. It also encompasses the oversight, creation, and study of money, banking, credit, investments, assets, liabilities that make up financial systems and improves overall financial literacy.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Study the personal finance concepts, savings instruments, risk–return trade-offs, and financial discipline.

CO2: Analyze various sources of business funding including venture capital, banking, and government schemes.

CO3: Interpret financial terminology and classify financial statements elements accurately.

CO4: Prepare and analyze different budgets using budgetary control techniques.

CO5: Apply marginal costing techniques for managerial decision-making.

DETAILED CONTENT

UNIT I Personal Finance

Personal Finance – Meaning, Objectives and advantages – Individual Perspective – Family Perspective – Time Value of Money – Personal Savings: Meaning, Different modes of Saving – Bank Deposit, Online Investments, Insurance, Stocks, Gold, Real Estate – Returns Vs Risk – Financial Discipline – Setting Alerts for commitments (With Real time Examples).

UNIT II Business Funding

Sources: Personal Savings – Borrowings - Venture Capital – Venture Capital Process– Commercial Banks – Government Grants and Scheme.

UNIT III Finance language

Capital – Drawing – Income – Expenditure – Revenue Vs Capital Items – Assets – Fixed Assets – Current Assets – Fictitious Assets – Liabilities – Long-term Liabilities – Current Liabilities – Internal Liabilities – External Liabilities –Shareholders fund: Equity Share capital, Preference Share Capital, Reserve & Surplus – Borrowings: Debentures, Bank Loan, Other Loan – Depreciation – Reserve Vs Provision.

UNIT IV Budgeting

Budgetary Control – Meaning – Preparation of various budgets – Purchase budget – Sales Budget – Production budget – Cash Budget – Flexible budgets. (With Problems)

UNIT V Marginal Costing

Marginal Costing – Meaning – Marginal Costing Vs Absorption Costing – Concepts of Variable Cost, Fixed Cost and Contribution – PV Ratio – Break Even Point – Margin of Safety – Key Factor – Application of Marginal Costing in decision making – Make or Buy – Shutdown or Continue – Exploring New Markets (With Problems).

Reference Books:

1. Banking Theory, Law & Practice - Dr.L.Natarajan, Margham Publications.

2. Corporate Accounting by T.S.Reddy and Dr.A.Murthy, Margham Publications.

3. Management Accounting by T.S.Reddy and Dr.Y.Hariprasd Reddy, Margham Publications.

4. Cost Accounting by T.S.Reddy and Dr.Y.Hariprasd Reddy, Margham Publications

DME 602

Entrepreneurship And Start-UP

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COURSE OBJECTIVES:

To foster an entrepreneurial mind set by equipping students with the skills to identify business opportunities, formulate comprehensive business plans, understand management functions, and navigate the financial and legal landscapes of starting and sustaining a venture.

COURSE OUTCOMES(CO):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry-oriented COs associated with the above-mentioned competency:

CO1: Explain the concept of entrepreneurship, classify business structures, and distinguish between the roles of an entrepreneur and manager.

CO2: Identify feasible business ideas using activity maps and develop a preliminary Business Plan based on case study analysis.

CO3: Analyze market strategies using STP and SWOT analysis, and formulate the Vision, Mission, and Objectives for a start-up.

CO4: Discuss the fundamental functions of management, organizational structures, and the processes of recruitment, selection, and training.

CO5: Select appropriate financing methods (Govt schemes, Venture Capital) and apply Intellectual Property Rights (IPR) concepts to protect business ideas.

CO6: Describe the strategies for business succession, harvesting, and the legal types of dissolution.

COURSE CONTENTS

Unit – I: Introduction to Entrepreneurship and Start – Ups (05 Periods)

Definitions, Classification of Entrepreneur Traits of an Entrepreneur, Entrepreneurship, Motivation Types of Business Structures- On the Basis of size and on the basis of ownership Similarities/differences between entrepreneurs and managers

Unit – II: Business Ideas and their implementation (04 Periods)

Discovering ideas and visualizing the business

Activity map

Business Plan (Case Study)

Unit – III: Ideas to Start-up (08 Periods)

Marketing and Accounting- Definition and Importance. Market Analysis – STP (Segmentation, Targeting, Positioning) Competition evaluation and Strategy Development – Vision, Mission, Goal, Objectives. Risk analysis- SWOT Analysis.

Unit – IV: Management (06 Periods)

Definition Concept and Functions of Management Company's Organization Structure- Concept and Classification Recruitment and Selection- Definition, Training and Development- Importance.

Unit – V: Financing and Protection of Ideas (03 Periods)

Financing methods available for Entrepreneurship/ Startups in India (Government Scheme, Banking, NBFCs, SHG and Micro Financing). Intellectual Property Rights- Overview of - Copyrights, Trademark, Geographical Indicators, Patenting and Licenses Communication of Ideas to potential investors – Investor Pitch.

Unit – VI: Succession, Dissolution and Harvesting strategy (02 Periods)

Ways of succession

Types of Dissolution

NSTRUCTIONAL STRATEGY

Entrepreneurship and start-ups includes: use experiential learning, integrate real-world projects, provide mentorship, foster interdisciplinary collaboration, partner with businesses, invite industry professionals for lectures, organize business plan competitions, offer practical consulting opportunities, and help students launch real ventures to build entrepreneurial skills and mindsets.

MEANS OF ASSESSMENT

• Assignments and quiz/class tests

• Mid-term and end-term written tests

• Model/Proto type making.

RECOMMENDED BOOKS:

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. Entrepreneurship Development (A New Venture Creation) – Vasant Desai, Himalaya Publishing House

3. Entrepreneurship Development – S.S. Khanka, S. Chand & Company Ltd., New Delhi

4. Entrepreneurship Development – Gupta and Srinivasan, S. Chand & Company Ltd., New Delhi

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

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

DME 603 L-3 T-0 P-0

Program Elective-ii

(GREEN ENERGY & ENGINEERING)

RATIONALE

Traditional energy sources such as coal, oil, and natural gas contribute significantly greenhouse gas emissions, air pollution, and environmental degradation. By transitioning to green energy sources such as solar, wind, hydroelectric, and biomass, engineers can mitigate these harmful effects while meeting the growing global demand for energy. The green energy projects often have lower life cycle carbon footprints compared to conventional energy sources, making them essential for achieving climate targets and promoting sustainable development. In essence, incorporating green energy into engineering practices is not only necessary for addressing environmental concerns but also essential for creating a resilient, equitable, and prosperous future for all.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Study the conventional and renewable energy sources, energy scenarios, sustainability aspects, and environmental impacts.

CO2: Explain the principles, components, and applications of solar and wind energy conversion systems.

CO3: Analyze ocean energy, biomass energy systems, and various hydrogen production technologies.

CO4: Study energy-efficient systems including motors, lighting, fuel cells, compressors, and pumps.

CO5: Apply concepts of green manufacturing, sustainable production systems, and zero waste manufacturing practices.

DETAILED CONTENT

UNIT 1: INTRODUCTION-

Overview of conventional & renewable energy sources, types of renewable energy systems, Future of Energy Use, Present Indian and international energy scenario of conventional and RE sources, Energy for sustainable development, Environmental Aspects of Energy, Limitations of RE sources.

UNIT 2 : SOLAR ENERGY & WIND ENERGY-

Theory of solar cells - Concept of Solar PV systems - Flat plate and concentrating collectors, Solar PV Applications – solar heating/cooling technique, solar distillation and solar drying, solar cookers. Energy from Wind - Horizontal axis Wind Turbine -Vertical Axis Wind Turbine - Wind Energy Conversion Systems .

UNIT 3: OCEAN ENERGY, BIO-MASS ENERGY & HYDROGEN PRODUCTION-OTEC,

Principles of utilization, setting of OTEC plants - Tidal and wave energy. Principles of bio-conversion - types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects. Chemical Production of Hydrogen Electrolytic Hydrogen- Thermolytic Hydrogen- Photolytic Hydrogen Photobiologic

Hydrogen Production.

UNIT 4: ENERGY EFFICIENT SYSTEMS –

Energy efficient motors, energy efficient lighting and control. Fuel cells- prin thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT 5: GREEN MANUFACTURING SYSTEMS-

Environment impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, Sustainable green production systems - alternate casting and joining techniques, zero waste manufacturing.

INSTRUCTIONAL STRATEGY

● Engage and Motivate: Instructors should actively engage students to boost their learning confidence

● Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

● Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

● Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

MEANS OF ASSEESSMENT

1 Assignments and quiz/class tests

2 Sessional test

3 Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

Text and Reference Books:

1. D. S. Chauhan & S. K. Srivastava, Non-Conventional Energy Resources, New Age International Private Limited, 4 th Edition, 2021.

2. John Twidell & Tony Weir, Renewable Energy Resources, Routledge; 3 rd Edition, 2015.

3. D.P. Kothari, K.C. Singal & Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI Learning; 3 rd Edition, 2022.

4. Ritu Dogra, Renewable Energy and Green Technology, Brillion Publishing, 1 st Edition, 2023.

5. Soli J. Arceivala, Green Technologies, McGraw Hill Education (India) Private Limited, 1 st Edition, 2017.

6. Chandan Deep Singh & Harleen Kaur, Sustainable Green Development and Manufacturing Performance through Modern Production Techniques, Taylor & Francis Ltd, 1 st Edition, 2021.

Web-based/Online Resources:

- https://onlinecourses.nptel.ac.in/noc21_ch11/preview

Program Elective-ii

(MAINTENANCE OF MACHINE TOOLS)

RATIONALE

Diploma technocrats who are in the field of maintenance of machine tools should have thorough knowledge about the dismantling and assembly procedure, installation, maintenance and repair of the machines and know about the technology used for the prediction of premature failure of components in advance.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Describe the objectives, types, and importance of maintenance and identify instruments required for effective maintenance.

CO2: Identify and use measuring equipment and tools for testing and evaluating the

accuracy of machine tools.

CO3: Perform maintenance activities on lathe machines including alignment,

adjustments, and inspection of components.

CO4: Analyze and carry out geometrical checks and alignment tests on various machine

tools such as milling, grinding machines, and slotters.

CO5: Inspect lubricants and coolants, identify wear and contaminants, and perform oil

removal and refilling operations for gearboxes.

DETAILED CONTENT

UNIT 1: MAINTENANCE:

Objective-Definition –Types of maintenance-Advantages of good maintenance-Disadvantages of bad maintenance-Instruments needed for maintenance.

UNIT 2 : TESTING OF MACHINE TOOLS Measuring Equipment and Tools used for

testing of machine tools:

Dial gauges – test mandrels – straight edges - squares- spirit levels- level measurement by water level- alignment by wire and measuring microscope.

UNIT 3: Maintenance of Lathe:

Lathe maintenance-Drive belts- Adjusting belt tension, Gib adjustment (cross slide, Compound slide),Wiper pads, Adjusting the Tail stock clamp. Alignment test on lathe

UNIT 4: Types of geometrical checks on machine tools-Various test conducted on machine tools-Alignment test on surface grinding and milling .Details for testing various machine tools : Slotter maintenance- Diving Pulley alignment checking-Belt tension adjustment –Pinion gear inspection , table jib adjustment.

UNIT 5: Inspection of the drained oil for contaminants & wear debris with focus on visual inspection. Preparation of coolants. Practice on oil removing & filling for a gear box.

INSTRUCTIONAL STRATEGY

●Engage and Motivate: Instructors should actively engage students to boost their learning confidence

● Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

● Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

● Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

● Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

● Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies

MEANS OF ASSEESSMENT

• Assignments and quiz/class tests

• Sessional test

• Viva-voce

REFERENCE BOOKS/ ONLINE RESOURCES

Text and Reference Books:

1. Er.Sushil kumar Srivastava - Maintenance Engineering - Reprint2016 - S.Chand publication.

2. Georg Schlesinger, F. Koenigsberger , M. Burdekin - TESTING MACHINE TOOLS - 8th edition- Pergamon Press-1978.

3. K.J.Bag- Preventive Maintenance - ISTE Professional centre continuing education Programme- Distributed by ISTE Professional centre AnnaUniversity campus, Chennai.

Web-based/Online Resources:

- https://www.youtube.com/watch?v=f58SW0Hwcf0

–Principle of Maintenance –

NPTELIIT Kharagpur DIRECTORATE OF TECHNICAL EDUCATION, CHENNAI –

Program Elective-ii

(Non- Destructive Testing)

RATIONALE

Non-destructive testing (NDT)is a multidisciplinary profession that blends quality assurance and materials science. NDT is used to inspect and evaluate materials, components, or assemblies without destroying their serviceability. Through a set of test methods, skilled technicians identify cracks, voids, inclusions, and weld discontinuities, as well as identify mis- assembled subcomponents. This makes NDT crucial to help prevent catastrophic failures such as air plane and locomotive crashes, pipeline leaks and explosions, nuclear reactor failures, and ship disasters.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Study the fundamentals of Non-Destructive Testing, types of defects, and compare NDT with destructive testing methods.

CO2: Explain the principles, procedures, advantages, and limitations of Visual Inspection and Liquid Penetrant Testing (LPT).

CO3: Analyze the principles, instrumentation, applications, and limitations of Magnetic Particle Testing (MPT) and Eddy Current Testing (ECT).

CO4: Explain the working principles, techniques, and applications of Ultrasonic Testing (UT) and Radiographic Testing (RT).

CO5: Study advanced and special NDT techniques such as acoustic emission, microwave inspection, thermal inspection, residual stress measurement, and optical holography.

DETAILED CONTENTS

Unit I-Introduction

Non-Destructive Testing (NDT) and comparison with Destructive Testing Defects/flaws due to: Primary processing, Secondary processing, In-service conditions ,Types of defects detected by NDT, Common NDT techniques ,Advantages, limitations, and applications of NDT.

Unit II -Visual Inspection Liquid Penetrant Test (LPT)

Principle of Visual Inspection, Defects detectable by unaided visual inspection, Optical aids used in visual inspection ,Advantages and limitations of visual inspection, Advantages and limitations of LPT, Physical principles of LPT, Procedure for conducting LPT Penetrant methods, Materials used in LPT.

Unit III -Magnetic Particle Test (MPT) & Eddy Current Test (ECT)

Advantages and limitations of MPT, Procedure for MPT ,Magnetizing techniques, Magnetic particles and suspending liquids, Detectable discontinuities, Non-relevant indications , Applications, Advantages and limitations of ECT, Operating variables, Eddy current instrumentation Reference standards, Applications.

Unit IV -Ultrasonic Test (UT) & Radiography Test (RT)

Advantages and limitations of UT, General characteristics of ultrasonic waves, Wave propagation and types of ultrasonic waves,Major variables in UT ,Angle beam techniques, Immersion testing, Applications .,Uses and applicability of RT, Advantages and limitations of RT, Interaction between penetrating radiation and matter (attenuation),Image conversion media, Film radio graphy, Real-time radiography

UNIT V- Other Non-Destructive Inspection Techniques

Acoustic emission inspection, Microwave inspection, Thermal inspection, Electromagnetic techniques for residual stress measurements, Optical holography..

TEXTBOOKS AND REFERENCES

1. “Non Destructive Evaluation and Quality Control”,Metals Handbook, Vol. 17, 9thEd., ASM.1989

2. Srivastava,K.C.,“Handbook of Magnetic Particle Testing”,Oscar publications.1998

3. Hull,B.,“Non Destructive Testing”,Springer.2012

4.Dr.V.Jayakumar,Dr. K.Elangovan”Non-Destructive Testing of Materials”Lakshmi Publications,Chennai,2017

5. Baldev Raj, Jayakumar T, ThavasimuthuM , Practical Non-Destructive Testing,3rdEd., Narosa.201

Program Elective-ii

(Product Design & Development)

RATIONALE

A product is something sold by an enterprise to its customers. Product design deals with conversion of ideas into reality and, as in other forms of human activity, aims at fulfilling human needs. Product development is the set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a product.

Course Outcomes (COs)

At the end of the subject, the students will be able to:

CO1: Study the product life cycle, product policies, and the new product design and development process including commercialization.

CO2: Apply product planning methodologies to identify opportunities, evaluate projects, allocate resources, and manage pre-project planning.

CO3: Identify and analyze customer needs to translate them into product specifications and establish targets.

CO4: Develop product concepts and architecture, assess industrial design requirements, and manage the design process effectively.

CO5: Study prototyping principles, technologies, and economic considerations in product development and conduct qualitative and quantitative project analyses.

DETAILED CONTENTS

Unit I- INTRODUCTION

Product life cycle, Product policy of an organization, Selection of a profit able product, Product design process, New product strategy Idea generation, Screening Concept development, Testing Business analysis ,Product development testing and Analysis Commercialization Collaboration. Gantt chart product life-cycle management .

Unit II - PRODUCT PLANNING

The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, pre project planning.

Unit III -IDENTIFYING CUSTOMER NEEDS

Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results

and the process. Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications.

Unit IV CONCEPT GENERATION

Product implications of the architecture, establishing the architecture, variety and supply chain considerations. Industrial design: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.

Unit V PROTOTYPING

Prototyping basics, principles of prototyping, technologies, planning for prototypes. Product development economics, Elements of economic analysis ,base case financial mode, sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Text and Reference Books:

1. Karl TUlrich, StevenDEppinger , "ProductDesign&Development."TataMcGrawhillNew Delhi2003

2.HollinsB&PughS"SuccessfulProductDesign."ButterworthsLondon.

3.BrallaJG"HandbookofProductDesignforManufacture,McGrawhillNewYork.

4. A K Chitale and R C Gupta, Product Design and Manufacturing, 6th Edition, PHI, New Delhi, 2003.

5. Boothroyd G, Dewhurst P and Knight W, Product Design for Manufacture and Assembly, 2nd Edition, Marcel Dekker, New York, 2002

DME 604 **L-0 T-0 P-24**

PROJECT WORK

RATIONALE

Major projects for mechanical engineering diploma students are essential because it provides them advantage like apply theoretical knowledge to real-world problems, develop critical skills like problem-solving and teamwork, provide hands-on experience with tools and technologies, encourage innovation and creativity, prepare students for their careers by demonstrating initiative and independence, Familiarize students with industry standards.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

• Use effectively oral, written and visual communication

• Demonstrate skill and knowledge of current technological tools and techniques specific to the professional field of study.

• Identify, analyse and solve problems creatively through sustained critical investigation.

• Develop leadership abilities.

• Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

Major projects are crucial for mechanical engineering diploma students for several reasons:

1. Application of Knowledge: They allow students to apply theoretical concepts learned in class to practical, real-world problems, reinforcing their understanding.

2. Skill Development: Projects help in developing essential skills such as problem solving, critical thinking, teamwork, and project management, which are highly valued in the engineering industry.

3. Hands-On Experience: Students gain hands-on experience with tools, materials, and technologies used in mechanical engineering, which is invaluable for their future careers.

4. Innovation and Creativity: Working on projects encourages students to think creatively and come up with innovative solutions to engineering challenges.

5. Career Preparation: Completing projects demonstrates a student's ability to take initiative, work independently, and successfully complete tasks, making them more attractive to potential employers.

6. Industry Standards: Projects familiarize students with industry standards and practices, preparing them for professional work environments.

7. Networking: Collaborating on projects provides opportunities to build networks with peers, faculty, and industry professionals, which can be beneficial for future career prospects.

Note: The Project selected in the 5th semester will be continued in 6th Semester.

As a major project activity each student is supposed to study the operations at site and prepare a detail project report of the observations/processes/activities by him/her. The students should be guided by the respective subject teachers. Each teacher may guide a group of 4 to 5 students.

The teachers along with field supervisors/engineers will conduct performance assessment of students. Criteria for assessment will be as follows:

S.NO. CRITERIA MARKS

1. Attendance and Punctuality 40

2. Project Progress Presentation-I 50

3. Project Progress Presentation-II 50

4. Project Model & final Presentation 90

5. Report Writing 60

Total 240