West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Mechanical Engineering [ME]

Part-III (5th Semester)

Revised 2022

CURRICULUM STRUCTURE FOR PART-III (SEMESTER 5) OF THE FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING

BRANCH: **MECHANICAL ENGINEERING**				**SEMESTER 5**						
SL No	**Category**	**Code No**	**Course Title**	**L**	**P**	**Total Class per week**	**Credit**	**Full marks**	**Internal Marks**	**ESE Marks**
1	**Program Core**	**MEPC301**	**Power Engineering**	**3**		**3**	**3**	**100**	**40**	**60**
2	**Program Core**	**MEPC303**	**Advanced Manufacturing Processes**	**3**		**3**	**3**	**100**	**40**	**60**
3	**Program Core**	**MEPC309**	**Fluid Mechanics and Machinery**	**3**		**3**	**3**	**100**	**40**	**60**
4	**Program Elective**	**MEPE301**	**Program Elective (withoutLab)**	**2**		**2**	**2**	**100**	**40**	**60**
5	**Program Elective**	**MEPE303**	**Program Elective (with Lab)**	**2**		**2**	**2**	**100**	**40**	**60**
6	**Program Core**	**MEPC311**	**Power Engineering Lab**		**2**	**2**	**1**	**100**	**60**	**40**
7	**Program Core**	**MEPC313**	**Advance Manufacturing Processes Lab**		**2**	**2**	**1**	**100**	**60**	**40**
8	**Program Core**	**MEPC315**	**Fluid Mechanics and Machinery Lab**		**2**	**2**	**1**	**100**	**60**	**40**
9	**Program Elective**	**MEPE305**	**Program Elective Lab (for Sl. No. 5)**		**2**	**2**	**1**	**100**	**60**	**40**
10	**Major Project**	**PR301**	**Major Project**		**2**	**2**	**1**	**100**	**60**	**40**
11	**Internship**	**SI301**	**Internship - II**	**-**	**-**		**1**	**100**	**100**	**0**
			Total	**13**	**10**	**23**	**19**	**1100**	**600**	**500**

STUDENT CONTACT HOURS PER WEEK: 26 hours (Lecture-16 hours; Practical-10 hours)
Theory and Practical Period of 60 minutes each.
FULL MARKS-1100 (Internal Marks-600; ESE Marks-500)
L-Lecture, P-Practical, ESE- End Semester Examination

Credit Distribution	**Credit**
Program Core	12
Program Elective	5
Project	1
Internship 2	1
Total	19

Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately in each subject.

Program Elective (without Lab)		**Total Credit**
1. Power Plant Engineering (Sub code: **MEPE301/1**)	Any one	2
2. Material Handling System (Sub code: **MEPE301/2**)		
Program Elective (with Lab)		
1. Computer Aided Design & Manufacturing (Sub code: **MEPE303/1**)	Any one	3
2. Automobile Engineering (Sub code: **MEPE303/2**)		

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Fifth**
Code no. : MEPC301	**Full Marks : 100**
Course Title : Power Engineering	**Examination Scheme :** (i) **External Assessment : 60** marks (End Semester Examination) (ii) **Internal Assessment: 40** marks [Class test : 20 marks Assignment / viva voce : 10 marks Class attendance : 10 marks]
Duration : 17 weeks (total hours per week = 3)	
Total lecture class/week : 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course outcomes (COs):

After completion of this course, the student will be able to -

a) Identify different component of IC engine and differentiate between diesel engine and petrol engine.
b) Calculate various performance characteristics of IC Engines.
c) Understand the working principle and use of different types of nozzles and diffusers in steam turbines used in steam power plant.
d) Describe construction and working of various types of Steam Turbines.
e) Identify different components of gas turbine and jet engines.
f) UnderstandworkingofHydraulicTurbinesandtheirapplicationinactualpowergeneration.

2. Theory Components:

The following topics/subtopics should be taught and assessed in order for achieving the course outcomes to attain the identified competency.

Unit	Topics & Sub-topics	Teaching Hour
UNIT 1: **Internal Combustion Engine**	1.1. Basic working principles, representation on P-V & T-S diagrams of Otto cycle, Diesel cycle and dual combustion cycle and deduction of thermal efficiency of Otto cycle & Diesel cycle. (simple numerical) 1.2. Introduction and classification of I.C. engines. 1.3. Working principle, construction with function of components and comparison of two-stroke and four-stroke I. C. engines (petrol and diesel engine). 1.4. Hypothetical & actual indicator diagram of two-stroke and four-stroke I. C. engine (petrol and diesel engine).	**14**

	1.5. Valve timing diagram of two-stroke and four-stroke engines (petrol and diesel engine). 1.6. Brief description on firing-order of multi-cylinder I.C. engine, pre-ignition, detonation, knocking, scavenging, supercharging, turbo-charging, simple carburettor, M.P.F.I. 1.7. Basic concept of governing of I.C engine. 1.8. Purpose of lubrication of I.C. engine and cooling of I.C engine. 1.9. Performance of I.C engine – indicator power, brake power, Morse test, mechanical efficiency, thermal efficiency, specific fuel consumption and heat balance sheet. (simple numerical).	
UNIT 2: **Nozzle/Diffuser and Steam Turbine**	NOZZLE **/** DIFFUSER: 2.1. Working principle and classification of steam nozzles & diffusers. 2.2. Application areas for steam nozzles & diffusers. 2.3. Continuity equation, sonic velocity and concept of Mach number. 2.4. Steady flow energy equation for flow through steam nozzles. (simple numerical). 2.5. Concept of critical pressure and critical pressure ratio (no deduction). STEAM TURBINE: 2.6. Introduction and classification of steam turbines. 2.7. Constructions and working principles of simple impulse turbine and simple impulse-reaction turbine. 2.8. Velocity diagrams, work done, power and efficiency of simple impulse turbine. (simple numerical using graphical method only). 2.9. Concept on compounding of steam turbine. 2.10. Concept on governing of steam turbine.	**11**
UNIT 3: **Gas Turbine and Jet Propulsion**	GAS TURBINE: 3.1 Basic principle, representation on P-V & T-S diagrams and deduction of thermal efficiency of Brayton or Joule cycle. (no numerical). 3.2 Classification of gas turbine. 3.3 Applications areas of gas turbine. 3.4 Schematic flow diagram and description of closed cycle & open cycle gas turbines. 3.5 Methods to improve thermal efficiency of gas turbine (regeneration, inter-cooling, reheating; representation on T-S diagram). JET PROPULSION: 3.6 Jet propulsion – Basic working principles of turbojet, turbo propeller & ram jet. 3.7 Rocket propulsion- solid propellants and liquid propellants.	**10**

	3.8 Components & working principle of liquid propellants rocket engine.	
UNIT 4: **Hydraulic Turbines**	4.1. Introduction and classification of hydraulic turbines. 4.2. Construction and working principle of Pelton wheel, Francis and Kaplan turbine. 4.3. Velocity diagrams, work done, power and efficiency of Pelton wheel & Francis turbine. (Simple numerical). 4.4. Basic concept of governing of turbine. 4.5. Concept on specific speed and selection of turbine based on head and discharge available. 4.6. Schematic layout and description of hydroelectric power plant.	**10**
Sub Total : Total Lecture Classes		**45**
No. of classes required for conducting Internal Assessment examination		**6**
Grand Total:		**51**

3. Suggested Home Assignments/Students' Activities: (any Four)

a) Determine the thermal efficiencies of Otto cycle, Diesel cycle and dual combustion cycle (simple numerical).
b) Describe the valve-timing diagram of four-stroke diesel and petrol engine.
c) Describe the valve-timing diagram of two-stroke diesel and petrol engine.
d) Describe with schematic diagram of different types of lubrication system used in IC engine.
e) Describe with schematic diagram of a forced circulation cooling system used in a multi-cylinder I.C. Engine.
f) Describe Morse test to determine efficiency of a multi-cylinder IC engine.
g) Describe with figure, different types of nozzles and diffusers. Identify the areas of application for different types of nozzles and diffusers.
h) Determine work done, power and efficiency of a simple impulse turbine using graphical method only.
i) Draw the P-V & T-S diagrams of Brayton cycle and describe it.
j) Describe with schematic diagrams of turbojet, turbo propeller & ram jet.
k) Comparative discussion among Pelton wheel, Francis and Kaplan turbine.
l) Describe with schematic layout of hydroelectric power plant.

4. Suggested scheme for question paper design for conducting internal assessment examination:
(Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test - 1	4	8	8	20

Class Test - 2	4	8	8	20

5. Suggested scheme for End Semester Examination: [Duration 2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1 & 2	15	20	20 x 01 = 2**0**
	3 & 4	10		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	05	05	05 x 08 = **40**
C	3 & 4	04		
	Sub Total: (B + C):	**09**	**05**	**40**
			Total [A+B+C]:	**60**

6. Rubrics for the Assessment of Students Activity: (20 marks)

Sl. No.	**Performance Indicators**	**Weightage in %**	
1	In time submission of home assignment or submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model etc.		40
2	Viva voce or present seminar on submitted report.		60
2a	Communication skill	10	
2b	Technical interpretation skill	10	
2c	Answering / Conclusion with justification	40	
		Total:	100

7. Suggested Learning Resources:

Sl. No.	**Title of Book**	**Author**	**Publication**
1	A Course in Thermal Engineering.	V.M. Domkundwar	Dhanpat Rai & Co.
2	Engineering Thermodynamics (Principles & Practices)	D.S.Kumar	S.K. Kataria& Sons
3	A text book of Thermal Engineering.	R. S. Khurmi	S. Chand & Co.
4	A Course in Thermal Engineering.	P. L. Ballaney	Khanna Publishers
5	Power Plant Engineering	R. K. Rajput	Laxmi Publications (P) Ltd.

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Name of the Course: **Diploma in Mechanical Engineering**	
Category: Programme Core	**Semester : Fifth**
Code no.: MEPC303	**Full Marks : 100**
Course Title: Advanced Manufacturing Processes	**Examination Scheme:**
Duration : 17 weeks(Total class hour/week = 3)	(i) **External Assessment**: **60** marks (End Semester Examination)
Total lecture class/week: 3	(ii) **Internal Assessment**:**40** marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. **Course Outcomes (COs):**
   The theory, practical experiences and relevant soft skills associated with this subject are to be taught and implemented, so that the student demonstrates the following industry oriented course outcomes:
   a) Student should be able to understand the fundamental concept, demonstrate the necessity, classification, mechanism of material removal, working principal and identify the specific application of Non-traditional Machining Processes.
   b) Student should be able to demonstrate the utility and select suitable Jig and /or Fixture for making a product economically.
   c) Student should be able to understand the basic concept of NC /CNC along with its utility and demonstrate the sequential processes /steps (along with part programming) to be followed to produce a specific job with the help of CNC Machine Tool.
   d) Student should be able to understand the basic concept, objective, identify the types of layout, basic components along with their function and demonstrate the advantages & disadvantages of Flexible Manufacturing System.

2. **Theory Components:**
   The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

Unit	Topics and Sub-topics	Teaching Hours
UNIT: 1 **Introduction to Non-traditional Machining**	1.1 Basic concept of non-traditional machining. 1.2 Necessity of non traditional machining. 1.3 Classification of non traditional machining processes. 1.4 Advantages, limitations and field of applications of non-traditional machining. 1.5 Comparison among traditional and non-traditional machining.	**04**
UNIT: 2	2.1 Mechanism of material removal, working principle, setup,	**10**

Non-traditional Machining Processes	process parameters, advantages, limitations and applications of Ultrasonic Machining (USM). 2.2 Mechanism of material removal, working principle, setup, process parameters, advantages, limitations and applications of Electrical Discharge Machining (EDM) and Wire-EDM. 2.3 Mechanism of material removal, working principle, setup, process parameters, advantages, limitations and applications of Electrochemical Machining (ECM). 2.4 Mechanism of material removal, working principle, setup, process parameters, advantages, limitations and applications of Electron Beam Machining (EBM) and Laser Beam Machining (LBM).	
UNIT: 3 **Jigs and Fixtures**	3.1 Basic concept, difference and benefits of jig and fixtures. 3.2 Basic components of jig and fixture. 3.3 Concept of degree of freedom, locating and clamping. 3.4 3-2-1 principle of locating. 3.5 Types and applications of locators and clamping devises. 3.6 Types of jig and fixture. 3.7 General principles of jig and fixture design.	**08**
UNIT: 4 **CNC Machine Tools**	4.1 Basic concept of NC & CNC, applications of NC / CNC in manufacturing. 4.2 Basic concept of CNC turning centre and CNC machining centre. 4.3 Advantages and disadvantages of CNC machine tools. 4.4 Classification of CNC machine tools (Based on function, motion type, control loops, number of axis and power supply). 4.5 Basic components of CNC machine tools and their functions. 4.6 Function and application of the following components of CNC system: stepper motor, servo motor, encoders (rotary and linear encoder), recirculating ball screw, automatic tool changer, tool magazine. 4.7 Work holding methods for CNC machining centre (name of the devices and their applications). 4.8 Steps to be followed for machining a job in a CNC machine tool.	**10**
UNIT: 5 **CNC Part Programming**	5.1 Concept of part programming. 5.2 Structure of part programming. 5.3 Concept of reference point (machine zero, program zero, part zero). 5.4 Axis identification of CNC turning centre & CNC machining centre. 5.5 CNC codes for manual part programming: commonly used word address codes, G-codes and M-codes. 5.6 Part programming for CNC turning centre using different codes with or without fixed cycles (Canned cycle) to perform a job involving one or more of the following operations: turning, step turning, taper turning, facing, external thread cutting and	**08**

	parting off. 5.7 Part programming for CNC machining centre considering cutter radius compensation, ramp on/off motion, tool offset and using different codes with or without fixed cycles (Canned cycles) for generating different milled surface. 5.8 CNC part program verification.	
UNIT: 6 **Flexible Manufacturing System (FMS)**	6.1 Concept of flexible manufacturing system (FMS). 6.2 Basic components and their purpose of FMS (different workstations, automated material handling & storage system, computer control system). 6.3 Objectives of FMS. 6.4 Advantages & disadvantages of FMS.	**05**
Total Lecture Classes (Sub Total):		**45**
No. of classes required for conducting Internal Assessment:		**06**
Grand Total :		**51**

3. Suggested Home Assignments/ Student Activities:(Any Four)

Other than classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in the course:

Note:

A suggested list of home assignments / student activities is given here. Similar home assignments / student activities could be added by the concerned faculty member also. Four (04) home assignments / student activities are to be undertaken by an individual student that needs to be assigned to him / her by the concern faculty member during the course. The execution of such home assignments / student activities may be done by an individual student or by a group of students as per discretion of the concern faculty member. Students should prepare and submit report for each of their assignment / activity.

a) Prepare a comparative study on traditional and non-traditional machining processes.
b) Prepare a chart containing the labelled machining setup of Electric Discharge Machining process showing all of its components and their functions.
c) Prepare a chart containing the labelled machining setup of Electrochemical Machining process showing all of its components and their functions.
d) Prepare a report on Acoustic Head as used in Ultrasonic Machining process explaining the mechanism of vibration generation of required frequency and amplitude as suitable for machining.
e) Prepare a comparative study on Electron Beam Machining and Laser Beam Machining processes.
f) Prepare a report on 3-2-1 principle of locating as used in designing of jig or fixture.
g) Prepare a chart containing the labelled diagrams of different types of jig and their specific application in manufacturing.
h) Prepare a comparative study on CNC machine tool and traditional machine tool.
i) Prepare a chart containing the labelled diagram of a CNC turning centre showing all of its components and their functions.
j) Prepare a chart containing the labelled diagram of a CNC machining centre showing all of its components and their functions.
k) Prepare a chart containing commonly used word address codes, G-codes, M-codes and their interpretation as used in manual part programming of CNC machine tool.

l) Prepare a part programming for CNC turning centre using different codes with or without fixed cycles for a specific job as assigned by the subject teacher.
m) Prepare a part programming for CNC machining centre using different codes with or without fixed cycles for a specific job as assigned by the subject teacher.
n) Prepare a report on different types of lay out used in flexible manufacturing system.

4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:
(Duration: 45 Minutes)

Questions to be set as per Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks:			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test: 1	4	8	8	20
Class Test: 2	4	8	8	20

5. Suggested Scheme for End Semester Examination:(Duration: 2.5 hours)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1 & 2	08	20	20 x 01 = **20**
	3 & 4	10		
	5 & 6	07		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	03	05	05 x 08 = **40**
C	3 & 4	04		
D	5 &6	02		
	Sub-Total [B+C+D]:	**09**	**05**	**40**
			Total [A+B+C+D]:	**60**

6. Rubrics for the assessment of students' activity:

Sl. No.	**Performance Indicators**
1	Originality of completing the Assigned task / micro-project work
2	Presentation Skill
3	In time submission of assignment work / micro-project work
4	Viva voce

7. Suggested Learning Resources:

Sl. No.	**Title of Book**	**Author**	**Publication**

01	Advanced Machining Processes, Non-traditional and Hybrid Machining Processes	Hassan El-Hofy	McGraw-Hill
02	Elements of workshop Technology – Volume I & II.	S. K. Hajra Chowdhury, Bose, Roy	Media Promoters and Publishers limited, Mumbai.
03	A Textbook of Manufacturing Technology (Manufacturing Processes)	R.K. RAJPUT	Laxmi Publications (P) Ltd.
04	A Course in Workshop Technology - Volume I & II.	B.S.Raghuwanshi	Dhanpat Rai Publications, New Delhi.
05	Manufacturing Processes.	Kalpakjian & Schemid	Pearson Education, New Delhi.
06	Manufacturing Technology – Volume I & II.	P. N. Rao	Tata McGraw-Hill, New Delhi.
07	CAD/CAM Principals and Applications	P. N. Rao	Tata McGraw-Hill, New Delhi.
08	Manufacturing Science.	Amitabh Ghosh, Mallik	East-West Press Pvt. Ltd., New Delhi.
09	Materials and Processes in Manufacturing.	DeGarmo	Wiley India Pvt. Ltd., New Delhi.
10	Machining & Machine Tool.	A.B. Chattopadhyay	Wiley India Pvt. Ltd., New Delhi.
11	CNC programming Handbook-Third edition	Peter Smid	Industrial Press Inc.
12	CNC Machining Handbook - Building, Programming, and Implementation	Alan Over	Tata McGraw-Hill, New Delhi.

8. Suggested Learning Websites:

a) ELS web-portal of WBSCTE

b) Fundamentals of CNC Machining, AUTODESK CAM, A Practical guide for beginners, Desk Copy, Document Number: 060711

c) https://nptel.ac.in

d) https://www.nitttrchd.ac.in

e) https://swayam.gov.in

f) https://www.mechanicalbooster.com

g) https://www.machinedesign.com

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Name of the Course: **Diploma in Mechanical Engineering**	
Category: Programme Core	**Semester : Fifth**
Code no.: MEPC309	**Full Marks : 100**
Course Title: Fluid Mechanics and Machinery	**Examination Scheme:**
Duration : 17 weeks(Total class hour/week = 3)	(i) **External Assessment**: **60** marks (End Semester Examination)
Total lecture class/week: 3	
Credit : 3	(ii) **Internal Assessment**:**40** marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. **Course Outcomes (Cos):**
   - i) Interpret the various types fluid properties and relation between them
   - ii) Measure pressure of fluid
   - iii) Identify various types of flow,
   - iv) Interpret the concept of continuity equation and Bernoulli's theorem
   - v) Measure of fluid velocity using pitot tube and discharge using orifice mete, venturimeter.
   - vi) Interpret the principle of flow through pipes and measure the frictional loss in pipe flow
   - vii) Determine the impact of jet on different types of fixed and moving jets
   - viii) Describe the construction and working and use of centrifugal and reciprocating pumps.
   - ix) Solve problems on various performance parameters of pumps
   - x) Plot TGL & HGL (velocity and pressure profiles) for fluid flow.
   - xi) Concept of flow measuring devices and velocity measuring devices
   - xii) Select the proper pump, given the required flow rate and pressure rise,

2. **Theory Components:**
   The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

Unit	Topics& Sub-topics	Teaching Hours

UNIT: 1 **Properties of Fluid**	1.1 Concept of fluid. 1.2 Properties of fluid - Density, Specific gravity, Specific Weight, Specific Volume, simple numerical. 1.3 Concept of viscosity, Newton's law of viscosity, Dynamic Viscosity, Kinematic viscosity, simple numerical. 1.4 Types of fluid- Ideal fluid, real fluid (Newtonian & Non-Newtonian by graphical representation). 1.5 Concept of cohesion, adhesion, surface tension & capillarity. 1.6 Concept of Vapour Pressure& Compressibility.	**04**
UNIT: 2 **Fluid Pressure & Pressure Measurement**	2.1 Fluid pressure, pressure head, pressure intensity, simple numerical. 2.2 Concept of atmospheric pressure, gauge pressure, vacuum pressure, absolute pressure, simple numerical. 2.3 Measurement of pressure using simple, inclined and differential manometers, Burdon pressure gauge, simple numerical on manometer. 2.4 Concept of total pressure on immersed surfaces (having flat vertical and flat inclined planes), centre of pressure, pressure distribution diagram; simple numerical.	**08**
UNIT: 3 **Fluid Flow**	3.1 Types of fluid flow: steady-unsteady, uniform-non uniform, streamline, path line and streak line, laminar-turbulent. 3.2 Continuity equation. 3.3 Bernoulli's theorem – potential head, pressure head & kinetic head. 3.4 Venturimeter – construction, principle of working, coefficient of discharge, derivation for discharge through venturimeter. 3.5 Orifice meter – Construction, Principle of working, hydraulic coefficients and discharge through orifice meter (no derivation). 3.6 Pitot tube – construction, principle of working, velocity measurement. **Note:** Numerical on continuity equation, venturimeter, orifice meter, and pitot tube.	**08**
UNIT: 4 **Flow through Pipes**	4.1 Laminar, turbulent flows& Reynolds number. 4.2 Darcy's equation and Chezy's equation for frictional losses. No deduction; simple numerical. 4.3 Minor losses in pipes, simple numerical. 4.4 Concept of hydraulic gradient line and total gradient line.	**05**
UNIT: 5 **Impact of jet**	5.1 Impact of jet on fixed vertical flat plate, moving vertical flat plate, simple numerical. 5.2 Impact of jet on curved vanes with special reference to turbines & pumps, simple numerical.	**06**
UNIT: 6	Centrifugal Pump:	**14**

Hydraulic Pumps	6.1 Construction, working principle and applications. 6.2 Types of casings and impellers. 6.3 Concept of multistaging. 6.4 Priming and its methods. 6.5 Concept of manometric head, work done, manometric efficiency, overall efficiency, NPSH, cavitation. 6.6 Submersible pump and Jet pump – construction and working principle and application. Reciprocating Pump: 6.7 Construction, working principle and applications of single and double acting reciprocating pumps. 6.8 Concept of slip, negative slip, cavitation and separation 6.9 Use of air vessel. 6.10 Indicator diagram with effect of acceleration head & frictional head.	
	Sub Total : Total Lecture Classes	**45**
No. of classes required for conducting Internal Assessment Examination		**06**
	Grand Total :	**51**

3. Suggested List of Assignments/Tutorial: (any five)

1. Numerical on manometers, total pressure & centre of pressure.
2. Numerical on viscosity, Newton laws of viscosity.
3. Numerical on venturimeter, orifice meter, pitot tube.
4. Draw HGL and TEL for flow through pipe having different diameter.
5. Simple Numerical on work done and efficiency on impact of jet.
6. Numerical on calculations of overall efficiency andpower required to drive centrifugal pumps.
7. List different types of pumps and their use.
8. Selection of pump as per requirement for a given head and capacity
9. Numerical on major and minor loss calculations in pipe flow

4. Suggested scheme for question paper design for conducting Internal Assessment Examination: (Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test -1	4	8	8	20
Class Test -2	4	8	8	20

5. Suggested Scheme for End Semester Examination: [Duration2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1&2	05	20	20x01=**20**
	3&4	05		
	5& 6	05		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	03	05	05 x 08 = **40**
C	3 & 4	03		
D	5 & 6	03		
	Sub-Total [B+C+D]:	**09**	**05**	**40**
			Total [A+B+C+D]:	**60**

6. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1	Fluid Mechanics & Hydraulic Machines	R.D. Bansal	Laxmi Publication
2	Fluid Mechanics & Hydraulic Machines	R.K.Rajput	S. Chand
3	Fluid Mechanics & Hydraulic Machines	Jagadishlal	Metropolitan Book Company
4	Fluid Mechanics & Hydraulic Machines	S. Pati	Tata McGraw Hill
5	Fluid Mechanics & Hydraulic Machines	D.S.Kumar	S.K. Kataria

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Elective	**Semester : Fifth**
Code no. : MEPE301/1	**Full Marks : 100**
Course Title : Power Plant Engineering	**Examination Scheme :** (iii) **External Assessment : 60** marks (End Semester Examination) (iv) **Internal Assessment: 40** marks [Class test : 20 marks Assignment / viva voce : 10 marks Class attendance : 10 marks]
Duration :17 weeks (Total class hours per week = 2)	
Total lecture class/week : 2	
Credit : 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

After completion of this course, the student will be able to-

i. Get concept of power scenario in India and World.
ii. Draw the layouts of different types of power plants.
iii. Select suitable location for any type of power plant.
iv. Explain the hazards associated with all types of power plants.
v. Describe the working principal of different types of conventional as well as non-conventional power generation systems.
vi. Identify and describe the function of major electrical components associated with any power plant.
vii. Explain the basic economics associated with power plant.

2. Theory Components:

The following topics/subtopics should be taught and assessed for achieving the course outcomes to attain the identified competency.

Unit	Topics & Sub-topics	Teaching Hour
UNIT 1: **Introduction to Power Plant**	1.1. Basic concept of power plant. 1.2. Power scenario in India and World. 1.3. Classification of power plants. 1.4. Future trends in power generation. 1.5. General criteria for selection of site for different type of power plant.	**3**
UNIT 2: **Steam Power**	2.1 Layout of steam power plant. 2.2 High pressure (sub-critical & super critical boilers) –	

Plant	concept and characteristics. 2.2 Construction and working of Loeffler boiler and Volex boiler. 2.3 Coal handling system – from coal delivered at power station to feeding the coal into the furnace. 2.4 Ash handling system–layout of ash handling system for bottom ash & fly ash from boiler house to ash pond, electrostatic precipitator. 2.5 Hazards associated with ash disposal and its precautionary measures. 2.6 Pollution associated with steam power plant – air, water and soil pollution.	**7**
UNIT 3: **Diesel Engine Power Plant**	3.1 Advantages and disadvantages of diesel engine power plant. 3.2 Application of diesel engine power plant. 3.3 Types of diesel engine used for power plant. 3.4 General layout of diesel engine power plant. 3.5 Air intake system, exhaust gas system and fuel system (only layout and brief description). 3.6 Pollution associated with diesel engine power plant and its environmental effects and control.	**4**
UNIT 4: **Gas Turbine Power Plant**	4.1 General layout of gas turbine power plant. 4.2 Main components of gas turbine plants and their brief description. 4.2 Fuels used in gas turbine. 4.4 Regenerative and reheat process (only schematic diagram and brief description). 4.5 Environmental impact of gas turbine power plant.	**3**
UNIT 5: **Hydro-electric Power Plant**	5.1. General layout of a hydro-electric power plant and brief description of the function of each major component. 5.2. Classification& selection of hydro-electric power plant (only basic concept).	**2**
UNIT 6: **Nuclear Power Plant**	6.1. Basic concept of nuclear energy. 6.2. General layout of nuclear power plant. 6.3. Brief description of main components of nuclear power plant. 6.4 Safety measures for nuclear power plant and hazards associated with waste disposals.	**4**
UNIT 7: **Non-Conventional Power Generation**	7.1. Introduction to different types of non-conventional energy sources used for power generation. 7.2. Layout and brief description of – Wind power plant, Tidal power plant, Solar power plant and Geothermal power plant. 7.3. Merits and demerits of above mentioned power plants.	**4**
UNIT 8: **Basic Operation and Economics of Power**	8.1. Layout of major electrical component associated with any power plant and their function (no working principle). 8.2. Important terms associated with power- connected load, load curve and load factor.	**3**

Generation	8.3. Economics of power plant selection. 8.4. Factors affecting economics of generation and distribution of power. 8.5. Tariff for electrical energy.	
	Sub Total : Total Lecture Classes	**30**
No. of classes required for conducting Internal Assessment examination		**4**
	Grand Total :	**34**

3. Suggested Home Assignments/Students' Activities: (any Four)

a) Classify the power plants operating in India and make a table for major power plants along with their location, year of establishment and capacity.
b) Make a general layout for a steam power plant and describe briefly the function of each component mentioned in the lay out.
c) Draw a lay out of a Coal Handling System – from coal delivered at power station to feeding the coal into the furnace. Briefly describe the system.
d) List and describe the pollutant generate from steam power plant and their effects on air, water and soil.
e) Describe with schematic diagram of any three types of dust collectors – Settling chamber, Cyclone separators, Fibre filters, Fly ash scrubber and Electrostatic precipitator.
f) Describe the pollution aspect associated with Diesel Engine Power Plant and its environmental effects and control.
g) Draw the general layout of Gas Turbine Power Plant and describe briefly the function of the main components of it.
h) Draw the schematic diagrams of Regenerative process and Reheat process and describe briefly.
i) Draw the general layout of a Hydro-electric Power Plant and briefly describe the function of each major component.
j) Describe the hazards associated with Nuclear Power Plant and safety measures to be followed.
k) Draw the layout and briefly describe (any two) – Wind Power Plant, Tidal Power Plant, Solar Power Plant and Geothermal Power Plant.
l) Draw the layout of major electrical component associated with any power plant and describe their functions.
m) Describe the factors affecting economics of generation and distribution of power from a power plant.

4. **Suggested scheme for question paper design for conducting internal assessment examination** : (Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (understand)	Level 3 (Apply & above)	Total
Class Test - 1	4	8	8	20
Class Test - 2	4	8	8	20

5. **Suggested Scheme for End Semester Examination:** [Duration 2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1 & 2	08	20	20 x 01 = **20**
	3, 4 & 5	09		
	6, 7 & 8	08		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	03	05	05 x 08 = **40**
C	3, 4 & 5	03		
D	6, 7 & 8	03		
	Sub-Total [B+C+D]:	**09**	**05**	**40**
			Total [A+B+C+D]:	**60**

6. Rubrics for the Assessment of Students Activity: (20 marks)

Sl. No.	**Performance Indicators**	**Weightage in %**	
1	In time submission of home assignment or submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model etc.		40
2	Viva voce or present seminar on submitted report		60
2a	Communication skill	10	
2b	Technical interpretation skill	10	
2c	Answering / Conclusion with justification	40	
		Total:	100

7. Suggested Learning Resources:

Sl. No.	**Title of Book**	**Author**	**Publication**
1	Power Plant Engineering	G. R. Nagpal	Khanna Publishers
2	A Course in Thermal Engineering.	V.M. Domkundwar	Dhanpat Rai & Co.
3	Power Plant Engineering	Raja, Srivastava and Dwivedi	New Age International Publishers
4	A text book of Thermal Engineering.	R. S. Khurmi	S. Chand & Co.
5	A Course in Thermal Engineering.	P. L. Ballaney	Khanna Publishers
6	Power Plant Engineering	R. K. Rajput	Laxmi Publications (P) Ltd.

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Elective	**Semester : Fifth**
Code no. : MEPE301/2	**Full Marks : 100**
Course Title : Material Handling System	**Examination Scheme :** **(i) External Assessment : 60** marks (End Semester Examination) **(ii) Internal Assessment: 40** marks [Class test : 20 marks Assignment / viva voce : 10 marks Class attendance : 10 marks]
Duration :17 weeks (Total class hours per week = 2)	
Total lecture class/week : 2	
Credit : 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. **Course Outcomes (COs):**
   a. Understand constructional & operational features of various materials handling systems.
   b. Understand different material handling processes used in industries.
   c. Identify, compare & select proper material handling equipment for specified applications.
   d. Appreciate the role of material handling devices in mechanization and automation of industrial process.

2. **Theory Components:**
   The following topics/subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes:

Unit	Topics and Sub-topics	Teaching Hours
UNIT 1: **Introduction to Material Handling System**	1.1 Main types of material handling equipments & their applications. 1.2 Types of load to be handled- unit load, bulk load and their designation by code. 1.3 Types of movements; Methods of stacking, loading & unloading systems. 1.4 Principles of material handling systems. 1.5 Modern trends in material handling.	**04**
UNIT 2: **Hoisting Machinery & Equipments**	2.1 Construction, working &applications of different types of hoists such as Portable hand chain hoist and Electric hoists. 2.2 Construction, working& safety arrangement of EOT Cranes. 2.3 Construction, working &applications of Jib Crane and mobile Crane.	**05**

	2.4 Construction, working &applications of Bucket Elevator.	
UNIT 3: **Conveying Machinery**	3.1 Construction, working &applications of Traction type conveyors such as Belt Conveyors and Chain Conveyors. 3.2 Construction, working &applications of Traction less type conveyors such as Screw Conveyors, Hydraulic Conveyors, Pneumatic Conveyors, Vibrating Conveyors.	**06**
UNIT 4: **Surface Transportation Equipment**	4.1 Construction, working& applications of Trackless equipment such as Hand operated trucks, Powered trucks, Fork Lifts, Automatic Guided Vehicle (AGV), and Industrial Trailers.	**04**
Unit 5: **Basic Components of Material Handling System**	5.1 Construction and function of Welded load chains, Steel wire ropes, Eye bolts, Lifting tackles, various types of hooks such as forged, triangular eye hooks. 5.2 Crane grab for unit & piece loads, Grabbing attachment for loose materials, Crane attachment for handling liquids/molten metals. 5.3 Construction & applications of Arresting gear & Brakes. 5.4 Construction & applications of electromagnetic shoe brakes, Control brakes.	**06**
Unit 6: **Selection of Material Handling Equipment**	6.1 Factors affecting choice of material handling equipment such as type of loads, hourly capacity of the unit, direction & length of travel, methods of stocking at initial, final & intermediate points, nature of production process involved, specific load conditions & economics of material handling system.	**05**
	Sub Total : Total Lecture Classes:	**30**
	No. of classes required for conducting Internal Assessment:	**04**
	Grand Total :	**34**

3. Suggested Home Assignments/Students' Activities: (any Four)

i. Write a brief report on modern trends in material handling.
ii. Enlist the essential parts of Bucket Elevator and their function with a suitable diagram.
iii. Enlist the essential parts of Belt Conveyor and their function with a suitable diagram.
iv. Enlist the essential parts of Screw Conveyor and their function with a suitable diagram.
v. Enlist the essential parts of AGV and their function with a suitable diagram.
vi. Write the names and their specific use of different hand Operated trucks used in actual industries.
vii. Enlist the various safety components and their functions used in EOT cranes.
viii. Enlist the various basic components and their functions used in material handling system.

4. Suggested scheme for question paper design for conducting internal assessment examination:
(Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy

	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (understand)	Level 3 (Apply & above)	Total
Class Test - 1	4	8	8	20
Class Test - 2	4	8	8	20

5 Suggested Scheme for End Semester Examination: [Duration 2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1 & 2	09	20	20 x 01 = **20**
	3 & 4	09		
	5 & 6	07		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	03	05	05 x 08 = **40**
C	3 & 4	03		
D	5 & 6	03		
	Sub-Total [B+C+D]:	**09**	**05**	**40**
			Total [A+B+C+D]:	**60**

6 **Rubrics for the Assessment of Students Activity: (20 marks)**

Sl. No.	**Performance Indicators**	**Weightage in %**	
1	In time submission of home assignment or submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model etc.		40
2	Viva voce or present seminar on submitted report		60
2a	Communication skill	10	
2b	Technical interpretation skill	10	
2c	Answering / Conclusion with justification	40	
		Total:	100

7 **Suggested Learning Resources:**

Sl. No.	**Title of Book**	**Author**	**Publication**
1	Introduction to Materials Handling	S. Ray	New Age International (P) Ltd.
2	Mechanical Handling of Materials	T. K. Ray	Asian Books Pvt. Ltd.

3	Material Handling Equipment	M. P. Alexandrov	MIR Publishers, Moscow
4	Material Handling Equipment	R. B. Chowdary & G. R. N. Tagore	Khanna Publishers
5	Material Handling (Principles & Practice)	T. H. Allegri	CBS Publishers, New Delhi

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Elective	**Semester : Fifth**
Code no. : MEPE303/1	**Full Marks : 100**
Course Title : Computer Aided Design & Manufacturing	**Examination Scheme :** **(i) External Assessment : 60** marks (End Semester Examination) **(ii) Internal Assessment: 40** marks [Class test : 20 marks Assignment / viva voce : 10 marks Class attendance : 10 marks]
Duration :17 weeks (Total class hours per week = 2)	
Total lecture class/week : 2	
Credit : 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

CO1 : Understand and develop the geometric models using CAD software.
CO2 : Develop programs for CNC to manufacture industrial components.
CO3: Understand the application of computers in various aspects of manufacturing viz., Design, Proper planning, Manufacturing, Quality control & Material handling system.
CO4 : Understand Flexible manufacturing system.

2. Theory Components:

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

Unit	Topics and Sub-topics	Teaching Hours
Unit 1: **Introduction to CAD/CAM**	1.1 Computers in industrial manufacturing. 1.2 Basic concept of CAD & CAM with reference to the product cycle in a computerized manufacturing environment and objective of CAD & CAM. 1.3 CAD/CAM hardware: Basic structure, CPU, Memory, Input / Output Devices, Hard-copy devises, Storage devices, Software and system configuration.	**03**
Unit 2: **Geometric Modelling**	2.1 Objective and requirement of geometric modelling. 2.2 Types and comparison of geometric models. 2.3 Geometric construction methods: sweep or extrusion, solid modelling (primitives & Boolean operators), free formed surfaces (classification and basic concept of surfaces only).	**06**

Unit 3: **Introduction to Computer Numerical Control**	3.1 Basic concept of NC, CNC and DNC. 3.2 Advantages and limitations of NC and CNC. 3.3 Application of CNC. 3.4 The coordinate systems in CNC. 3.5 Motion control systems in CNC: point to point, straight line, continuous path (contouring).	**03**
Unit 4: **CNC Programming**	4.1 Part-programming fundamentals. 4.2 Manual part-programming methods: word address format, primary function, miscellaneous functions, program number, tool-length compensation, cutter-radius compensation, canned cycle. 4.3 Part programming for CNC turning centre. 4.4 Part programming for CNC machining centre. 4.5 Concept of computer aided part programming.	**06**
Unit 5: **Group Technology (GT)&Computer Aided Process Planning (CAPP)**	5.1 Concept of group technology. 5.2 Part families. 5.3 Part classification and coding: benefits, classification and coding system (Opitz system, MICLASS system and CODE system). 5.4 Concept to machine cell design 5.5 Benefits of group technology. 5.6 Concept of computer aided process planning(CAPP); 5.7 Concept of retrieval-type CAPP system. 5.8 Concept of generative type CAPP system. 5.9 Benefits of computer aided process planning.	**06**
Unit 6: **Computer Aided Quality Control (CAQC)**	6.1 Concept and objectives of computer aided quality control. 6.2 Contact inspection methods. 6.3 Noncontact inspection methods (optical and non-optical).	**02**
Unit 7: **Flexible Manufacturing System (FMS)**	7.1 Concept of Flexible Manufacturing System (FMS). 7.2 Automated material handling systems of FMS: Automated Guided Vehicles (AGV) and robots (types, advantages and applications only). 7.3 Other basic components of FMS and their purpose (different workstations, automated storage system and computer control system). 7.4 Types of FMS layout. 7.5 Objectives of FMS. 7.6 Advantages & limitations of FMS.	**04**
	Sub Total : Total Lecture Classes:	**30**
	No. of classes required for conducting Internal Assessment:	**04**
	Grand Total :	**34**

3. Suggested Home Assignments/Students' Activities: (any three)

Other than classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in the course:

Note:

A suggested list of home assignments / student activities is given here. The concerned faculty member could add similar home assignments / student activities also. Three (03) home assignments / student activities are to be undertaken by an individual student that needs to be assigned to him / her by the concern faculty member during the course. The execution of such home assignments / student activities may be done by an individual student or by a group of students as per discretion of the concern faculty member. Students should prepare and submit report for each of their assignment / activity.

i. List the various software and equipment related to CAD / CAM / FMS / CAQC / CAPP used in various industries.

ii. Prepare a power point presentation on CMM / Application of AVG in material handling system.

iii. Visit industries consisting CAD / CAM / FMS system and submit a report.

iv. Use CNC m/c tool or virtual CNC m/c to make utility product as assigned by faculty member.

v. Develop a CAD model by using any CAD software as assigned by faculty member.

vi. Prepare a complete specification of a CNC machine tool (Turning Centre / Machining Centre) for procurement that would be used in training institute.

4. Suggested scheme for question paper design for conducting internal assessment examination:
(Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (understand)	Level 3 (Apply & above)	Total
Class Test - 1	4	8	8	20
Class Test - 2	4	8	8	20

5. Suggested Scheme for End Semester Examination: [duration 2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1 & 2	09	20	20 x 01 = 20
	3 & 4	08		
	5, 6 & 7	08		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				

Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	03	05	05 x 08 = **40**
C	3 & 4	03		
D	5, 6 & 7	03		
	Sub-Total [B+C+D]:	**09**	**05**	**40**
			Total [A+B+C+D]:	**60**

6 **Rubrics for the Assessment of Students Activity: (20 marks)**

Sl. No.	**Performance Indicators**	**Weightage in %**	
1	In time submission of home assignment or submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model etc.		40
2	Viva voce or present seminar on submitted report.		60
2a	Communication skill	10	
2b	Technical interpretation skill	10	
2c	Answering / Conclusion with justification	40	
		Total:	100

7 **Suggested Learning Resources:**

Sl. No.	**Title of Book**	**Author**	**Publication**
1	CAD/CAM Principles and Applications	P. N. Rao	Tata-McGraw-Hill
2	CNC Machine	B. S. Pabla & M. Adithan	New Age International(P) Ltd.
3	CAD & CAM Theory and Concepts	K. Sareen & C. Grewal	S. Chand
4	CNC Machine & Automation	J. S. Narang	Dhanpat Rai & Co.
5	Computer Aided Design and Manufacturing	Groover M. P. & Zimmers Jr	Prentice Hall of India

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Elective	**Semester : Fifth**
Code no. : MEPE303/2	**Full Marks : 100**
Course Title : Automobile Engineering	**Examination Scheme :** **(i) External Assessment : 60** marks (End Semester Examination) **(ii) Internal Assessment: 40** marks [Class test : 20 marks Assignment / viva voce : 10 marks Class attendance : 10 marks]
Duration :17 weeks (Total class hours per week = 2)	
Total lecture class/week : 2	
Credit : 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course outcomes (COs):

At the end of this course, the student will be able to:

a. Identify various systems equipped with a vehicle.
b. Identify the main components of fuel feed systems, cooling & lubrication systems used in automobile.
c. Explain how do transmission gear box and differential gearbox work.
d. Explain the construction and working various systems (such as braking systems, suspension systems, starting system) used in automobile.

2. Theory Components:

The following topics/subtopics should be taught and assessed in order to develop unit outcomes for achieving the course outcomes:

Unit	Topics and Sub-topics	Teaching Hours
UNIT-1: **Introduction**	1.1 Concept and Classification of automobiles. 1.2.Vehicle layout and its types. 1.3 Function of Chassis and frame. 1.4 Nomenclature of car body.	**02**
UNIT-2: **Fuel Feed Systems**	2.1. Layout of S.I.engine fuel feed system and function of each component. 2.2 Requirement of air-fuel ratio, function and types of carburettor, working principle of simple carburettor. 2.3 Circuits of carburettor– float, starting, idling, low speed, high speed & accelerating circuit. 2.4 Types, layout and working of multi-point fuel injection system of petrol engine, advantages and disadvantages.	**06**

	2.5 Layout and working of common rail fuel supply system of diesel engine. 2.6 Layout and working of individual pump fuel supply system of diesel engine. 2.7 Function of fuel injector. 2.8 Use of single orifice and multiple orifice Injector. 2.9 Working of fuel level gauge.	
UNIT-3: **Cooling & Lubrication Systems**	3.1 Necessity of lubrication system and components of automobile need lubrication. 3.2. Layout and working of splash, wet sump, and dry sump type lubrication system. 3.3 Necessity of engine cooling system. 3.4 Layout and working of pump circulation type water cooling system; use of anti-freeze solutions. 3.5 Working of thermostat, oil pressure gauge, and water temperature gauge.	**04**
UNIT-4: **Transmission Systems**	4.1 Necessity and types of clutch. 4.2 Construction and working of single plate friction clutch (both coil spring type & diaphragm type), field of applications. 4.3 Necessity and types of gear box. 4.4 Construction and working of synchromesh gear box, torque converter. 4.5 Necessity & working of propeller shaft & differential. 4.6 Functions of front axle and rear axle.	**05**
UNIT-5: **Control Systems**	5.1 Steering system –Requirement of steering system, layout and working of steering linkage for rigid axle suspension system and independent suspension system, steering ratio. 5.2 Working of rack& pinion type steering gear box and recirculating ball type steering gear box. 5.3 Introduction to power steering. 5.4 Steering geometry –Necessity of camber, caster, toe-in, toe-out, king pin inclination. 5.5 Brake system – construction and working of hydraulic brake and pneumatic brake. 5.6 Comparison of disc brake and drum brake.	**05**
UNIT-6: **Suspension Systems, Wheels & Tyres**	6.1. Necessity of suspension system. 6.2 Construction & working of leaf spring, rigid axle suspension. 6.3 Construction & working of McPherson and Wishbone suspension. 6.4 Construction & working of telescopic type shock absorber. 6.5 Introduction to air suspension. 6.6 Construction of disc wheel& light alloy cast wheel. 6.7 Types of tyres, construction and working of conventional tubed tyre and tubeless tyre, tyre specifications, Factors affecting tyre life.	**05**
UNIT-7: **Starting, Ignition & Charging Systems**	7.1 Function of battery in automobile; Rating of battery. 7.2 Construction & working of self-starter. 7.3 Construction & working of high energy electronic ignition system and capacitive discharge ignition system. 7.4 Construction and working of charging system with alternator. 7.5 Use of microprocessor in automobile control system.	**03**

Sub Total : Total lecture classes	**30**
No. of classes required for conducting Internal Assessment examination	**4**
Grand Total :	**34**

3. Suggested Home Assignments/Students' Activities: (any four)

i) Draw labeled schematic flow diagram of multipoint fuel injection (MPFI) system of petrol engine and write functions of each components.

ii) Draw labeled schematic flow diagram of conventional fuel feed system of petrol engine and write functions of each components.

iii) Draw labeled schematic diagram of differential gearbox and explain its working – a. while taking a turn, b. while moving along a straight path.

iv) Draw labeled schematic flow diagram of common rail type fuel feed system of diesel engine and write functions of each components.

v) Draw labeled schematic flow diagram of individual pump type fuel feed system of diesel engine and write functions of each components.

vi) Draw labeled schematic flow diagram of torque converter and write functions of each components.

vii) Draw labeled schematic flow diagram of telescopic type shock absorber and write functions of each components.

viii) Draw labeled schematic flow diagram of hydraulic braking system and write functions of each components.

ix) Draw labeled schematic flow diagram of pneumatic braking system and write functions of each components.

x) Draw labeled schematic flow diagram of steering linkage for rigid axle suspension system and write functions of each components.

xi) Draw labeled schematic flow diagram of pressure feed lubrication system and write functions of each components.

xii) Draw labeled schematic flow diagram of force-feed water cooling system and write functions of each components.

xiii) Draw labeled schematic flow diagram of synchromesh gearbox and write the methods to obtain various speed of it.

4. **Suggested scheme for question paper design for conducting Internal Assessment examination:**
(Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (understand)	Level 3 (Apply & above)	Total
Class Test - 1	4	8	8	20
Class Test - 2	4	8	8	20

5. Suggested Scheme for End Semester Examination [Duration 2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2& 3	7	20	20 x 01 = **20**
	4&5	5		
	6&7	3		
	Total:	**25**	**20**	**20**
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1, 2& 3	4	05	05 x 08 =**40**
C	4&5	3		
D	6&7	2		
	Sub-Total [B+C+D]:	**09**	**05**	**40**
			Total [A+B+C+D]:	**60**

8 **Rubrics for the Assessment of Students Activity:**

Sl No.	**Performance Indicators**
1	Originality of completing the assigned task
2	Presentation Skill
3	In Time submission of Assignment report / micro-project task
4	Viva-voce

9 **Suggested Learning Resources:**

Sl. No.	**Title of Book**	**Author**	**Publication**
1	Automobile Engineering (Vol.-I and Vol.-II)	Dr. Kirpal Singh	Standard Publication
2	Automobile Engineering	G. B. S. Narang	Khanna Publication
3	Automobile Engineering	R. K. Singal	S. K. Kataria
4	A text book in Automobile Engineering	S. K. Gupta	S. Chand
5	Automobile Mechanics	William Crouse	Tata McGraw-hill

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<table>
<tr><th colspan="4">Name of the Course: Diploma in Mechanical Engineering</th></tr>
<tr><td>Category: Programme Core</td><td colspan="3">Semester: Fifth</td></tr>
<tr><td>Code No.: MEPC311</td><td colspan="3">Full Marks:100</td></tr>
<tr><td rowspan="3">Course Title: Power Engineering Lab</td><td colspan="3">Sessional Examination Scheme:</td></tr>
<tr><td colspan="3">External Assessment
(End Semester Sessional Examination)</td></tr>
<tr><td>Assignment on the day of Viva Voce:</td><td>20</td><td rowspan="2">40 marks</td></tr>
<tr><td rowspan="4">Duration : 17 weeks (2 hours per week)</td><td>Viva Voce (before Board of Examiners):</td><td>20</td></tr>
<tr><td colspan="3">Internal Assessment</td></tr>
<tr><td>Continuous assessment of class performance and in time submission of Assignments:</td><td>30</td><td rowspan="3">60 marks</td></tr>
<tr><td rowspan="2">Total practical classes/week: 2</td><td>Viva Voce:</td><td>20</td></tr>
<tr><td>Class Attendance:</td><td>10</td></tr>
<tr><td>Credit: 1</td><td colspan="2">Total Marks:</td><td>100</td></tr>
<tr><td colspan="4">Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.</td></tr>
</table>

1. **Practical Components:**
   The list of practical to be completed **(**any Five) by the students towards attainment of the required competency.

Sl. No.	List of Practical
1	Study and demonstration of the construction and working of two-stroke IC engine and identify different components of it.
2	Study and demonstration of the construction and working of four-stroke IC engine and identify different components of it.
3	Conduct trial on Petrol Engine Test Rig to find out the Brake Thermal Efficiency and Brake Specific Fuel Consumption.
4	Conduct trial on Diesel Engine Test Rig to find out the Brake Thermal Efficiency and Brake Specific Fuel Consumption.
5	Conduct Morse Test to obtain the approximate Indicated Power of a Multi-cylinder IC Engine.
6	Conduct Valve / Port timing diagram of an IC engine.
7	Study with suitable model of Water Cooling System generally installed in four-stroke I.C. Engine, identify major components of it and demonstrate their functions.

8	Study with suitable model of Lubrication System generally installed in four-stroke I.C. Engine, identify major components of it and demonstrate their functions.
9	Study with suitable model the working of impulse steam turbines.
10	Study with suitable model the working of gas turbine/Turbojet propulsion system.
11	Study with suitable model the working of any type of water turbine.
12	Study of schematic layout of Hydroelectric Power Plant and explain the working principle of it.

3. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1	A Course in Thermal Engineering	V.M. Domkundwar	Dhanpat Rai & Co.
2	Engineering Thermodynamics (Principles & Practices)	D.S.Kumar	S.K. Kataria& Sons
3	A text book of Thermal Engineering	R. S. Khurmi	S. Chand & Co.
4	A Course in Thermal Engineering	P. L. Ballaney	Khanna Publishers
5	Power Plant Engineering	R. K. Rajput	Laxmi Publications (P) Ltd.
6	Power Plant Engineering	G. R. Nagpal	Khanna Publishers

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Name of the Course: Diploma in Mechanical Engineering			
Category: Programme Core	**Semester: Fifth**		
Code No.: MEPC313	**Full Marks:100**		
Course Title: Advanced Manufacturing Processes Lab	**Sessional Examination Scheme:**		
	External Assessment (End Semester Sessional Examination)		
	Assignment on the day of Viva Voce:	20	**40 marks**
Duration : 17 weeks (2 hours per week)	Viva Voce (before Board of Examiners):	20	
	Internal Assessment		
	Continuous assessment of class performance and in time submission of Assignments:	30	**60 marks**
Total practical classes/week: 2	Viva Voce:	20	
	Class Attendance:	10	
Credit: 1	**Total Marks:**		**100**
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.			
Pre-requisite: Knowledge of Advanced Manufacturing Processes **[Code No.: MEPC303]**.			

1. **Course Outcomes (COs):**

   The theory, practical experiences and relevant soft skills associated with this subject are to be taught and implemented, so that the student demonstrates the following industry oriented course outcomes:

   a) Student should be able to understand the fundamental concept, demonstrate the necessity, working principle and identify the specific application of Non-traditional Machining Processes.
   b) Student should be able to demonstrate the utility and select suitable Jig or Fixture for making a product economically.
   c) Student should be able to understand the basic concept of NC /CNC along with its utility and should be able to produce a specific job with the help of CNC Machine Tool.

2. **Suggested Assignments / Practical for Continuous Assessment:**

   The list of practical to be completed by the students towards attainment of the required competency:

Sl. No.	List of Practical	Unit No. with Subject Code	Minimum Hours
GROUP: A			
01	Prepare a chart showing the working principle and setup of Ultrasonic Machining (USM) for demonstration purpose and also prepare a detailed study report on working principle, setup, process parameters, advantages, limitations and applications of Ultrasonic Machining (USM).	01 & 02 [MEPC303]	04

02	Prepare charts showing the working principle and setup of Electrical Discharge Machining (EDM) and Wire-EDM for demonstration purpose and also prepare a detailed study report on working principle, setup, process parameters, advantages, limitations and applications of Electrical Discharge Machining (EDM) and Wire-EDM.	01 & 02 [MEPC303]	04
03	Prepare a chart showing the working principle and setup of Electrochemical Machining (ECM) for demonstration purpose and also prepare a detailed study report on working principle, setup, process parameters, advantages, limitations and applications of Electrochemical Machining (ECM).	01 & 02 [MEPC303]	04
04	Prepare charts showing the working principle and setup of Electron Beam Machining (EBM) and Laser Beam Machining (LBM) for demonstration purpose and also prepare a detailed study report on working principle, setup, process parameters, advantages, limitations and applications of Electron Beam Machining (EBM) and Laser Beam Machining (LBM).	01 & 02 [MEPC303]	04
GROUP: B			
05	Prepare a suitable Jig for machining holes on standard 100 NB**,** MS Pipe Flange (As per BS-10, Table: D) (three nos. at a time) involving Fitting Shop, Welding Shop and Machine Shop. **(Refer Annexure: 1)**	03 [MEPC303]	04
06	Prepare a model of a specific jig (as assigned by the concern teacher) with a suitable material for demonstration of its basic elements, purpose of each elements and function of the whole setup. **(Refer Annexure: 2)**	03 [MEPC303]	04
GROUP: C			
07	Study of CNC Turning Centre (CNC Lathe) and identify different parts, drives, work holding device etc. and also study all sequential steps are to be followed for machining a job in a CNC Turning Centre.	04 [MEPC303]	04
08	Study of CNC Machining Centre (CNC Milling Machine) and identify different parts, drives, work holding device etc. and also study all sequential steps are to be followed for machining a job in a CNC Machining Centre.	04 [MEPC303]	04
09	Prepare Part Program by using different codes with or without fixed cycles (Canned Cycle) for at least three specific jobs as assigned by the concern teacher, which are to be performed on CNC Turning Centre. **(Refer Annexure: 3)**	04 & 05 [MEPC303]	04
10	Prepare Part Program by using different codes with or without fixed cycles (Canned Cycle) for at least three specific jobs as assigned by the concern teacher, which are to be performed on CNC Machining Centre. **(Refer Annexure: 4)**	04 & 05 [MEPC303]	04
11	Digital Manufacturing or Manufacturing of at least three specific jobs as assigned by the concern teacher by using CNC Turning Centre Simulator (on a virtual platform) or CNC Turning Centre (CNC Lathe). **(Refer Annexure: 3)**	04 & 05 [MEPC303]	04
12	Digital Manufacturing or Manufacturing of at least three specific	04 & 05	04

	jobs as assigned by the concern teacher by using CNC Machining Centre Simulator (on a virtual platform) or CNC Machining Centre (CNC Milling Machine). **(Refer Annexure: 4)**	[MEPC303]	
GENERAL			
13	Prepare a detailed report on Machine Tool installation process as assigned by the concern teacher.	General	04

Note:

- A suggested list of Practical is given in the above table. The concerned faculty member may add similar Practical Assignment also. **Five (05)** practical, among which **at least One (01) from each Group: A, B and C** are need to be performed during the course, so that the student achieves the desired level of competency as generally required by the industry.
- **Annexure: 1** containing the detailed dimensions of **Standard MS Flanges as per BS-10, Table: D** which may be referred during execution of Practical Assignment as listed in Sl. No. 05.
- **Annexure: 2** containing the **diagram of a typical Jig** which may be referred during execution of Practical Assignment as listed in Sl. No. 06. Concern teacher also have full liberty to use similar JIG diagram of their own selection for execution of such Practical Assignment.
- Few simple job diagrams are given in the **Annexure: 3** and **Annexure: 4** which may be executed in **CNC Turning Centre (or CNC Turning Centre Simulator)** and **CNC Machining Centre (or CNC Machining Centre Simulator)** respectively. Concern teacher may refer those diagrams or may use similar job diagram of their own selection during execution of Practical Assignments related to CNC Turning Centre and CNC Machining Centre (as detailed under Group: C).

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of Assignments.	30
Viva Voce on to the Engineering Practice at the end of the semester.	20
Class attendance.	10
Total Internal Assessment:	60
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

4. **Suggested Scheme for End Semester Examination:** [Total Marks: 40]

Involvement	Total Marks
Assignment on the day of End Semester Exam.	20
Viva Voce on to the Engineering Practice on the day of End Semester Exam.	20
Total External Assessment:	40
Pass criterion for Internal Assessment = 16 Marks [Minimum]	

5. Rubrics for the internal assessment of Laboratory Practice:

The 'Process and Product' related skills associated with each practical work are to be assessed according to a suggested sample as given below:

Sl. No.	Performance Indicators
01	Preparing job/component drawing and process Plan
02	Setting up of machine, tool and job
03	Operating machine /executing production process to produce the component
04	Inspecting the component during production process using measuring instruments
05	Submission of job and workshop report in time
06	Viva voce

During conducting such Practical (laboratory / field based) work, the following social Skills/attitudes which are Affective Domain Outcomes (ADOs) are to be developed through the experiences:

- Follow the safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader / team member.
- Maintain tools and equipment in good working condition.
- Follow ethical practice.

6. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01	Advanced Machining Processes, Non-traditional and Hybrid Machining Processes	Hassan El-Hofy	McGraw-Hill
02	Elements of workshop Technology – Volume I & II	S. K. Hajra Chowdhury, Bose, Roy	Media Promoters and Publishers limited, Mumbai.
03	A Textbook of Manufacturing Technology (Manufacturing Processes)	R.K. RAJPUT	Laxmi Publications (P) Ltd.
04	A Course in Workshop Technology - Volume I & II.	B.S.Raghuwanshi	Dhanpat Rai Publications, New Delhi.
05	Manufacturing Processes.	Kalpakjian & Schemid	Pearson Education, New Delhi.
06	Manufacturing Technology – Volume I & II.	P. N. Rao	Tata McGraw-Hill, New Delhi.
07	CAD/CAM Principals and Applications	P. N. Rao	Tata McGraw-Hill, New Delhi.
08	Manufacturing Science.	Amitabh Ghosh, Mallik	East-West Press Pvt. Ltd., New Delhi.
09	Materials and Processes in Manufacturing.	DeGarmo	Wiley India Pvt. Ltd., New Delhi.
10	Machining & Machine Tool.	A.B. Chattopadhyay	Wiley India Pvt. Ltd., New Delhi.
11	CNC programming Handbook-Third edition	Peter Smid	Industrial Press Inc.

12	CNC Machining Handbook - Building, Programming, and Implementation	Alan Over	Tata McGraw-Hill, New Delhi.

7. Suggested Learning Websites:

- ELS web-portal of WBSCTE
- Fundamentals of CNC Machining, AUTODESK CAM, A Practical guide for beginners, Desk Copy, Document Number: 060711
- https://nptel.ac.in
- https://www.nitttrchd.ac.in
- https://swayam.gov.in
- https://www.mechanicalbooster.com
- https://www.machinedesign.com

Annexure: 1

MS Flange Dimensions (BS-10, Table: D):

Figure: MS Flange (BS-10, Table: D)

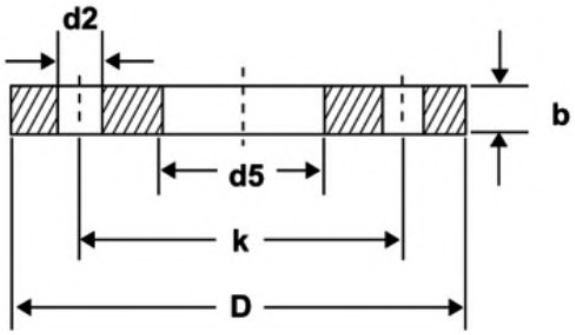

Figure: MS Flange Dimensions

Table D for W. Steam Pressure upto 50 lbs per Sq. Inch (in inchines)						
Nominal	Dia. of Flange	I.D. of Flange	Dia. of Bolt Circle	No. of	Dia. of Bolt	Thickness
Pipe Size	D	d5	k	Holes	d2	b
1/2"	3.3/4"	7/8"	2.5/8"	4	1/2"	3/16"
3/4"	4"	1.3/32"	2.7/8"	4	1/2"	3/16"
1"	4.1/2"	1.23/64"	3.1/4"	4	1/2"	3/16"
1.1/4"	4.3/4"	1.45/64"	3.7/16"	4	1/2"	1/4"
1.1/2"	5.1/4"	1.15/16"	3.7/8"	4	1/2"	1/4"
2"	6"	2.7/16"	4.1/2"	4	5/8"	5/16"
2.1/2	6.1/2"	2.15/16"	5"	4	5/8"	5/16"
3"	7.1/4"	3.37/64"	5.3/4"	4	5/8"	3/8"
3.1/2"	8"	4.5/64"	6.1/2"	4	5/8"	3/8"
4"	8.1/2"	4.37/64"	7"	4	5/8"	3/8"
5"	10"	5.43/64"	8.1/4"	8	5/8"	1/2"
6"	11"	6.23/32"	9.1/4"	8	5/8"	1/2"
7"	12"	7.5/8"	10.1/4"	8	5/8"	1/2"
8'	13.1/4"	8.23/32"	11.1/2"	8	5/8"	1/2"
9"	14.1/2"	9.23/32"	12.3/4"	8	5/8"	/8"
10"	16"	10.7/8"	14"	8	3/4"	5/8">
12"	18"	12.7/8"	16"	12	3/4"	5/8"
14"	20.3/4"	14.9/64"	18.1/2"	12	7/8"	3/4"
16"	22.3/4"	16.5/32"	20.1/2"	12	7/8"	3/4"
18"	25.1/4"	18.3/16"	23"	12	7/8"	7/8"
20"	27.3/4"	20.13/16"	25.1/4"	16	7/8"	1"
24"	32.1/2"	24.1/4"	29.3/4"	16	1"	1.1/8"

All dimensions are in 'inch'

Note: Bolt hole diameters are as follows:

- For 1/2 in and 5/8 in bolts, the bolt hole shall be 1/16 in larger than the bolt diameter.
- For 3/4 in bolts and larger, the bolt hole shall be not more 1/8 in larger than the bolt diameter.

Annexure: 2

Diagram of basic elements of a Jig:

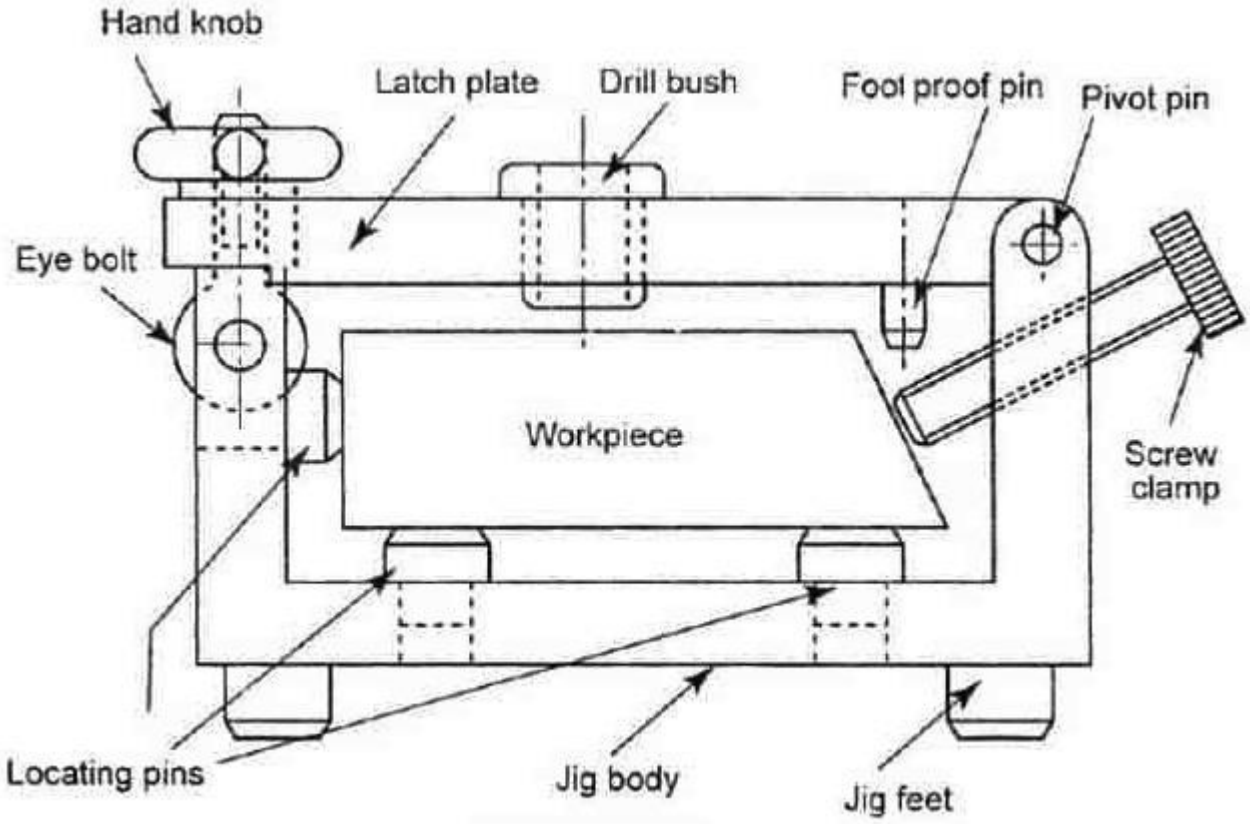

Figure: Basic Elements of JIG

1. Jig body	2. Locators
3. Jig feet	4. Clamps
5. Jig bushing	6. Jig plate or bush plate
7. Fool proof element	

Annexure: 3

Few simple job diagrams which may be executed in CNC Turning Centre (CNC Lathe)

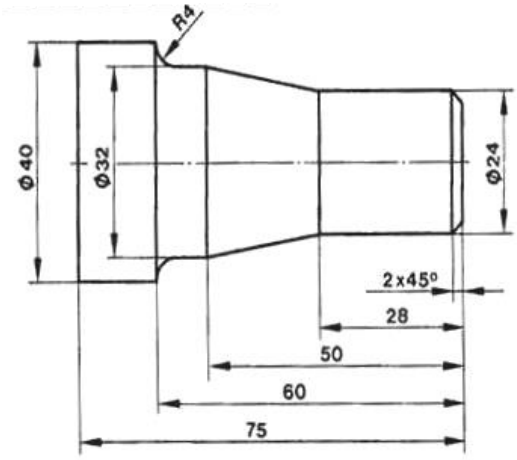

Figure: 01

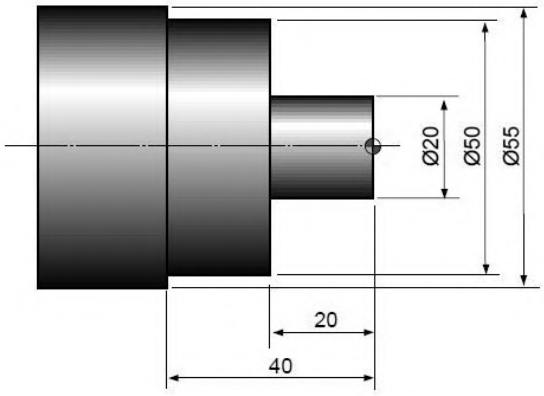

Figure: 02

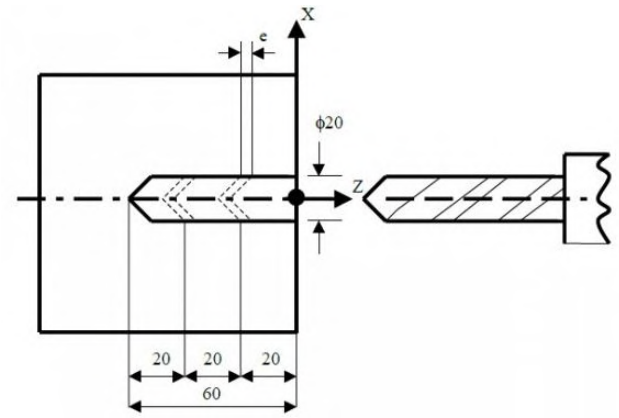

Figure: 03

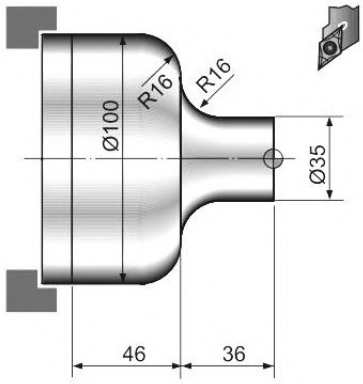

Figure: 04

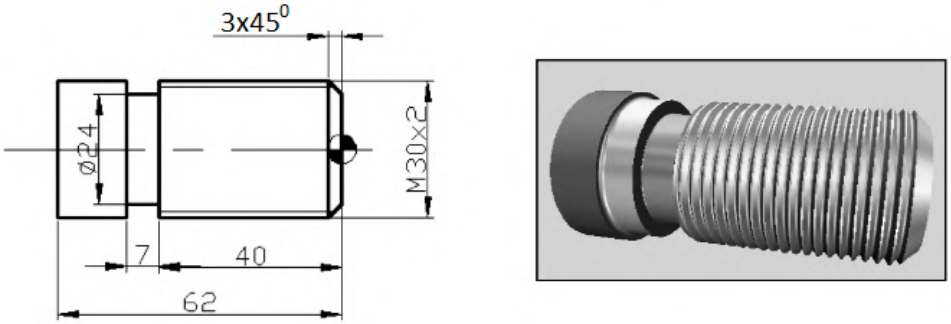

Figure: 05

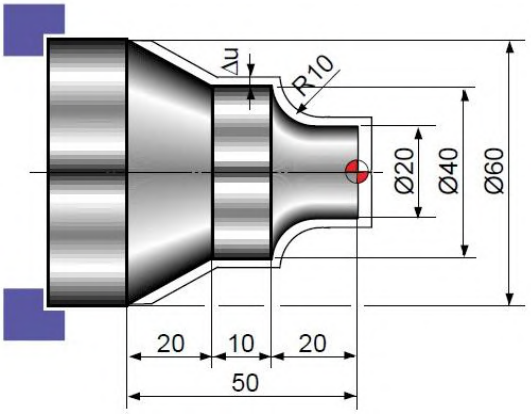

Figure: 06

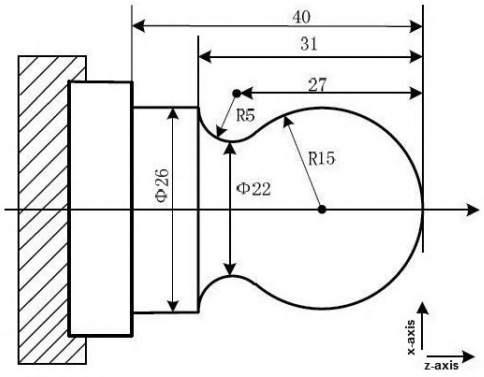

Figure: 07

Annexure: 4

Few simple job diagrams which may be executed in CNC Machining Centre (CNC Milling machine):

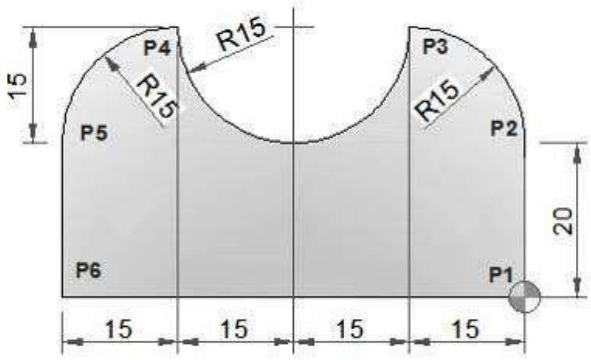

Figure: 01

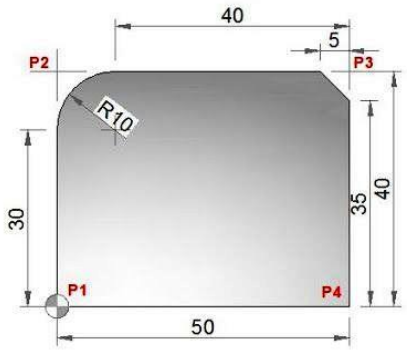

Figure: 02

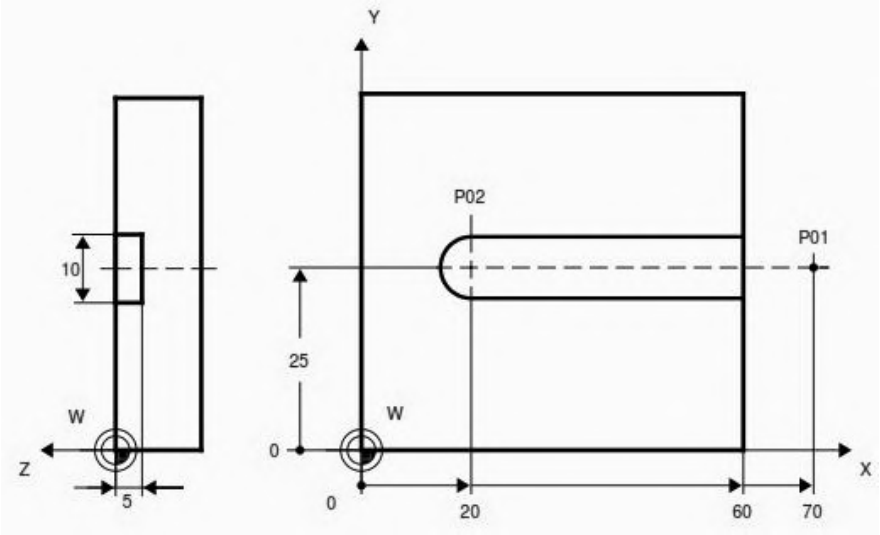

Figure: 03

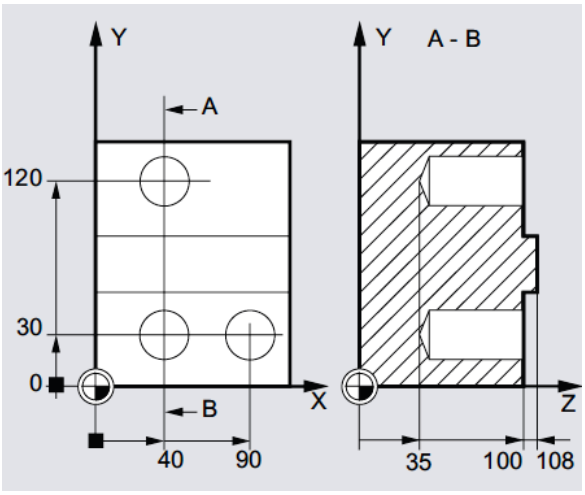

Figure: 04

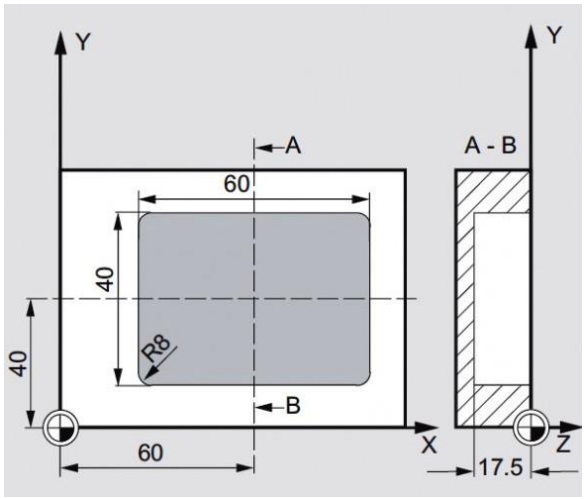

Figure: 05

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<table>
<tr><td colspan="4">Name of the Course: Diploma in Mechanical Engineering</td></tr>
<tr><td>Category: Programme Core</td><td colspan="3">Semester : Fifth</td></tr>
<tr><td>Code No. : MEPC315</td><td colspan="3">Full Marks: 100</td></tr>
<tr><td>Course Title : Fluid Mechanics and Machinery Lab</td><td colspan="3">Sessional Examination Scheme:</td></tr>
<tr><td rowspan="6">Duration : 17 weeks (total hours per week = 2)</td><td colspan="3">External Assessment
(End Semester Sessional Examination)</td></tr>
<tr><td>Assignment on the day of viva voce :</td><td>20</td><td rowspan="2">40 marks</td></tr>
<tr><td>Viva voce (before Board of Examiners) :</td><td>20</td></tr>
<tr><td colspan="3">Internal Assessment</td></tr>
<tr><td rowspan="3">Total Practical class/week : 2</td><td>Continuous assessment of class performance and submission of assignment (in scheduled time)</td><td>30</td><td rowspan="3">60 marks</td></tr>
<tr><td>Class attendance</td><td>10</td></tr>
<tr><td>Credit: 1</td><td>Viva voce (after submission of lab reports)</td><td>20</td></tr>
<tr><td colspan="2">Total marks</td><td>100</td></tr>
<tr><td colspan="4">Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.</td></tr>
</table>

1.Course Outcomes (COs):

CO1 : Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2 : Calculate different parameters such as co-efficient of friction of pipe flow
CO3 : Understand the need and importance of calibration of pressure gauges.
CO4 : Describe the construction and working of pumps.
CO5 : Test the performance of pumps

2. Suggested Assignments/Practical for Continuous Assessment:

The lists of practical (any Five) are to be completed by the students towards attainment of the required competency:

Sl. No	List of Practical
1	Calibration of Bourdon tube pressure gauge with the help of Dead Weight Pressure gauge.
2	Verification of Bernoulli's Theorem.
3	Determination of Coefficient of Discharge of Venturimeter.
4	Determination of Coefficient of Discharge of orifice meter.

5	Measurement of velocity of flow through pipe with the help of Pitot tube.
6	Measurement of flow of liquid by using Rotameter
7	Determination of coefficient of friction of flow through pipes.
8	Trial on centrifugal pump to determine overall efficiency.

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of Assignments.	30
Viva Voce on to the Engineering Practice at the end of the semester.	20
Class attendance.	10
Total Internal Assessment:	60
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

4. Suggested Scheme for End Semester Examination: [Total Marks: 40]

Involvement	Total Marks
Assignment on the day of End Semester Exam.	20
Viva Voce on to the Engineering Practice on the day of End Semester Exam.	20
Total External Assessment:	40
Pass criterion for Internal Assessment = 16 Marks [Minimum]	

5. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1	Fluid Mechanics and Machinery Laboratory Manual	N. Kumara Swamy	Charotar Publishing House Pvt. Ltd., ANAND 388 001, Ed. 2008

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Name of the Course: Diploma in Mechanical Engineering			
Category: Programme Elective	**Semester : Fifth**		
Code No. : MEPE305/1	**Full Marks: 100**		
Course Title : CAD / CAM Laboratory	**Sessional Examination Scheme:**		
Duration : 17 weeks (total hours per week = 2)	**External Assessment** (End Semester Sessional Examination)		
	Assignment on the day of viva voce :	20	**40 marks**
	Viva voce (before Board of Examiners) :	20	
	Internal Assessment		
Total Practical class/week : 2	Continuous assessment of class performance and submission of assignment (in scheduled time)	30	**60 marks**
	Class attendance	10	
Credit: 1	Viva voce (after submission of lab reports)	20	
	Total marks		**100**
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.			

1. Course outcomes (COs):

At the end of this course, the student will be able to:

CO1: Explain the 3D commands and features of CAD software.

CO2: Create 3D solid model and find the mass properties of simple solids.

CO3: Demonstrate the working of CNC turning and milling machine / CNC turning and machining centre simulators.

CO4: Develop and assess the part program using simulation software for Lathe and Milling or execute in CNC turning and machining centre.

2. Suggested Assignments for Continuous Assessment:

Sl. No.	Topics for practice
	Introduction: Part modeling; Datum Plane; constraint; sketch; dimensioning; extrude; revolve; sweep; blend; rib; shell; hole; round; chamfer; copy; mirror; assembly; align.

Part-A	Exercises:3D Drawings of- 1) Geneva wheel; 2) Bearing block; 3) Bushed bearing: 4) Gib and cotter joint; 5) Screw jack; 6) Connecting rod. Note: Print the orthographic view and sectional view from the above assembled 3D drawing .(any three)
Part-B	CNC Programming and Machining: Introduction 1) Study of CNC lathe milling 2)Study of international standard codes: G-Codes and M-Codes 3)Format –Dimensioning methods 4) Program writing – Turning simulator – Milling simulator, IS practice – commands menus; 5) Editing the program in the CNC machines/CNC simulator; (at least two)
	CNC Turning Machine / CNC Turning Simulator: Using Linear and Circular interpolation- Create a part program and produce actual component / digital machining component. 1. Using Stock removal cycle–Create a part program for multiple turning operations &produce component using actual machine of CNC turning simulator. (at least one) 2. Using canned cycle- Create a part program for thread cutting, grooving and produce component using actual machine or turning simulator. (at least one)
	CNC Milling Machine / CNC Machining Centre Simulator : Using Linear interpolation and Circular interpolation–Create a part program for grooving and produce the component using actual machine or CNC machining centre simulator. 1. Using canned cycle-Create a part program for drilling, tapping, counter sinking and produce component using the actual machine or CNC machining centre simulator. (at least one) 2. Using sub-program-Create a part program for mirroring and produce component using the actual machine / CNC machining centre simulator. (at least one)

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of reports	30
Viva Voce on to the Engineering Practice at the end of the end of the semester	20
Class attendance	10
Total Internal Assessment	**60**
Pass criterion for the Internal Assessment = 24 Marks [Minimum]	

4. Suggested Scheme for End Semester Examination: [Total Marks: 40]

Involvement	Total Marks
Assignment on the day of End Semester Examination	20
Viva Voce on to the Engineering Practice on the day of End Semester Examination	20
Total ESE Assessment	**40**

5. Reference Books:

Title of the Book	Name of the Author(s)	Name of the Publishers
CNC Machine	B. S. Pabla & M. Adithan	New Age International(P) Ltd.
Computer Aided Design and Manufacturing	Groover M. P. & Zimmers Jr	Prentice Hall of India

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<table>
<tr><td colspan="4">Name of the Course: Diploma in Mechanical Engineering</td></tr>
<tr><td>Category: Program Elective</td><td colspan="3">Semester : Fifth</td></tr>
<tr><td>Code No. : MEPE305/2</td><td colspan="3">Full Marks: 100</td></tr>
<tr><td>Course Title : Automobile Engineering Laboratory</td><td colspan="3">Sessional Examination Scheme:</td></tr>
<tr><td rowspan="5">Duration : 17 weeks (total hours per week = 2)</td><td colspan="3">External Assessment
(End Semester Sessional Examination)</td></tr>
<tr><td>Assignment on the day of viva voce :</td><td>20</td><td rowspan="2">40 marks</td></tr>
<tr><td>Viva voce (before Board of Examiners) :</td><td>20</td></tr>
<tr><td colspan="3">Internal Assessment</td></tr>
<tr><td rowspan="3">Total Practical class/week : 2</td><td>Continuous assessment of class performance and submission of assignment (in scheduled time)</td><td>30</td><td rowspan="3">60 marks</td></tr>
<tr><td>Class attendance</td><td>10</td></tr>
<tr><td rowspan="2">Credit: 1</td><td>Viva voce (after submission of lab reports)</td><td>20</td></tr>
<tr><td colspan="2">Total marks</td><td>100</td></tr>
<tr><td colspan="4">Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.</td></tr>
</table>

1. Course outcomes (COs):

The Practical works associated with this course will help the students to demonstrate the following industry oriented COs:

CO1: Familiarize with the various technical terms and data related with different systems of automobile.
CO2: Illustrate the working of various systems (such as fuel feed system of petrol & diesel engine, transmission, brake, suspension, lubrication, steering etc.) of automobiles.
CO3: Describe the necessity and utility of retrofitting the CNG kits to petrol cars.
CO4: Demonstrate the procedure of battery testing and charging.

2. Suggested Assignments for Continuous Assessment: (Any five practical)

Sl.No.	List of Practical
1.	Study of transmission system, suspension system, braking system, and steering system equipped with medium duty vehicles. (any two)
2.	Prepare a comparative survey report based on technical data (type of clutch used, gearing ratio for forward speeds and reverse speed, final drive, type of steering used, type of suspension used, type of service brake used, tyre size, battery used, capacity of fuel tank, etc) of Indian light-duty diesel vehicles (Mahindra, Tata, Swaraj Mazda, Maruti and Ambassador).
3.	Demonstration of differential gear box.

4.	Demonstration of transmission gear box (preferably synchromesh gearbox) used in medium duty vehicle.
5.	Demonstration of rack & pinion type steering gear box.
6.	Demonstration of braking system (hydraulic / pneumatic) used in light / medium duty vehicle.
7.	Demonstration of rear axle assembly used in light-duty vehicle.
8.	Demonstration of clutch (single plate coil spring / diaphragm spring type) used in light / medium duty vehicle.
9.	Demonstration of crankshaft and cam shaft lubrication system of multi-cylinder engine.
10.	Study of CNG kit retrofitting.
11.	Testing of battery and charging system.

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of reports	30
Viva Voce on to the Engineering Practice at the end of the end of the semester	20
Class attendance	10
Total Internal Assessment	**60**
Pass criterion for the Internal Assessment = 24 Marks [Minimum]	

4. Suggested Scheme for End Semester Examination: [Total Marks: 40]

Involvement	Total Marks
Assignment on the day of End Semester Examination	20
Viva Voce on to the Engineering Practice on the day of End Semester Examination	20
Total ESE Assessment	**40**
Pass criterion for the ESE Assessment = 16 Marks [Minimum]	

5. Reference Books:

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publishers
1	Automobile Engineering (Vol.-I and Vol.-II)	Dr. Kirpal Singh	Standard Publication
2	Automobile Engineering	G. B. S. Narang	Khanna Publication
3	A text book in Automobile Engineering	S. K. Gupta	S. Chand
4	Automobile Mechanics	William Crouse	Tata McGraw-hill

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<table>
<tr><td colspan="4">Name of the Course: Diploma in Mechanical Engineering</td></tr>
<tr><td>Category: Major Project</td><td colspan="3">Semester : Fifth</td></tr>
<tr><td>Code No. : PR301</td><td colspan="3">Full Marks: 100</td></tr>
<tr><td>Course Title : Major Project</td><td colspan="3">Sessional Examination Scheme:</td></tr>
<tr><td rowspan="8">Duration : 17 weeks (total hours per week = 2)</td><td colspan="3">External Assessment
(End Semester Sessional Examination)</td></tr>
<tr><td>Evaluation of progress report of major project</td><td>20</td><td rowspan="2">40 marks</td></tr>
<tr><td>Viva voce (before Board of Examiners)</td><td>20</td></tr>
<tr><td colspan="3">Internal Assessment</td></tr>
<tr><td>Continuous assessment of class performance and in time submission of progress report of major project</td><td>30</td><td rowspan="3">60 marks</td></tr>
<tr><td>Seminar presentation and viva voce</td><td>20</td></tr>
<tr><td>Class attendance</td><td>10</td></tr>
<tr><td colspan="2">Total marks</td><td>100</td></tr>
<tr><td>Total Practical class / week : 2</td><td colspan="3"></td></tr>
<tr><td>Credit: 1</td><td colspan="3"></td></tr>
<tr><td colspan="4">Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.</td></tr>
</table>

1. **Course Outcomes (COs):**
   Depending upon the nature of the projects undertaken, some of the following major course outcomes can be attained:
   After completion of the project, the students will be able to:

a) Implement the planned activity individually and/or as team.
b) Select, collect and use required information / knowledge to solve the identified problem.
c) Take appropriate decisions based on collected and analysed information.
d) Ensure quality in product.
e) Communicate effectively and confidently as a member and leader of team.
f) Prepare project report following proper guideline using appropriate tools (if any).

2. **Course details:**
   As the implementation of the major project progresses and which has to be submitted at the end of project work, one of the outputs of this course is a detailed Project Report that is continuously prepared by the student. Such major project work has to be executed throughout 5th and 6th semester and has to be completed at the end of 6th semester. At the end of 5th semester, each student has to present a 'Seminar' presentation on progressand has to submit a 'Progress Report' on major project.

3. **Suggested contents of the project report:**
   a) Title page (Polytechnic name along with name of team members and guide teacher).
   b) Certificate (in the format given in this document as annexure A).
   c) Acknowledgement
   d) Abstract (not more than 200/ 150 words)
   e) Content (Objective of the project, Methodology/Planning of Execution, Procedure Followed, Results, Conclusions, Appendix if any, and References)
   f) Abbreviations (if any)

4. **Suggested fields of Major Projects :**
   The list of major projects which may be selected and executed by the students towards attainment of the required competency:
   a) Fabrication based project.
   b) Design and fabrication based project.
   c) Experiment based project.
   d) Survey based projects.
   e) Maintenance based projects.
   f) Industrial engineering based project.
   g) Innovative/Creative projects.
   h) Project (related to mechanical engineering) may be selected other than the area specified above.

5. **Suggested Scheme for Internal Assessment: [Total Marks: 60]**

Involvement	Total Marks
Continuous assessment of performance, contribution and in time submission of progress of major project.	30
Seminar Presentation and Viva Voce on to the progress of major projects at the end of the semester.	20
Class attendance	10
Total Internal Assessment:	**60**
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

6. **Suggested Scheme for End Semester Examination: [Total Marks: 40]**

Involvement	Total Marks
Evaluation of progress report on the day of End Semester Exam.	20
Viva Voce on to the progress and future plans of completion of major project on the day of End Semester Exam.	20
Total External Assessment:	**40**
Pass criterion for Internal Assessment = 16 Marks [Minimum]	

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Name of the Course: Diploma in Mechanical Engineering	
Category: Internship	**Semester: Fifth**
Code No.: SI301	**Full Marks : 100**
Course Title: Internship - II	**Examination Scheme:** **Internal Assessment:100 marks** [Submission of report after Industrial visit – 60 marks (in scheduled time) Seminar on Internship – 40 marks]
Duration:	
Total practical class/week (after 4th Semester) : Nil	
Credit:1	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in internal assessment.	

Suggested Internship Project Work in 5thSemester

After the **4thSemester,** for **Internship-II**, students are required to be involved to undergo internship with industry / NGOS / Government Organizations / Micro / Small / Medium Enterprises to make themselves ready for the industry. All stakeholders including Training & Placement Cell and concerned teachers will take necessary initiatives to coordinate the internship program for the students. Online internship options may be explored.

After completion of Internship II, the student should prepare a comprehensive report to indicate what he/she has observed and learnt during internship period. The student may contact Industrial Supervisor / Faculty Mentor/TPO for assigning topics and problems and should prepare the final report on the assigned topics. The Industrial Supervisor / Internship Faculty Mentor, TPO and HOD would sign the training report.

The Internship report will be evaluated based on the following criteria (as applicable):

Sl.No.	**Criteria for evaluation of Internship Report** [60 marks]
1.	Originality
2.	Adequacy and purposeful write-up
3.	Organization, format, drawings, sketches, style, language
4.	Practical applications and relationships with basic theory
5.	Concepts taught in the course outcome
6.	Practical applications, relationships with basic theory and concepts taught in the course.
7.	Attendance record, daily diary, quality of the Internship Report

Seminars must be arranged for the students based on his/her training report, before an internal committee constituted by the concerned department of the institute. The evaluation will be based on the following criteria:

Sl.No.	**Criteria for evaluation of Internship Seminar** [40marks]
1.	Quality of content presented
2.	Proper planning for presentation

3.	Effectiveness of presentation
4.	Depth of knowledge and skills
5.	Viva voce
Total Marks:100	
Pass criterion for Internship-II = 40 Marks [Minimum]	

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