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

Syllabus
of

Diploma in Mechanical Engineering [ME]

Part-II (3rd Semester)

Revised 2022

CURRICULUM STRUCTURE FOR PART-II (SEMESTER 3) OF THE FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION										
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES										
COURSE NAME: FULL TIME DIPLOMA IN **MECHANICAL ENGINEERING**										
DURATION OF COURSE: 6 SEMESTERS										
BRANCH: **MECHANICAL ENGINEERING**										
SL No	**Category**	**Code No**	**Course Title**	**L**	**P**	**Total Class per week**	**Credit**	**Full marks**	**Internal Marks**	**ESE Marks**
1	**Program core**	**MEPC201**	**Mechanical Engineering Drawing**	**2**	**-**	**2**	**2**	**100**	**40**	**60**
2	**Program core**	**MEPC203**	**Mechanical Engineering Materials**	**3**	**-**	**3**	**3**	**100**	**40**	**60**
3	**Program core**	**MEPC205**	**Strength of Materials**	**3**	**-**	**3**	**3**	**100**	**40**	**60**
4	**Program core**	**MEPC207**	**Manufacturing Processes-I**	**3**	**-**	**3**	**3**	**100**	**40**	**60**
5	**Program core**	**MEPC209**	**Thermal Engineering -I**	**3**	**-**	**3**	**3**	**100**	**40**	**60**
6	**Program core**	**MEPC211**	**Mechanical Engineering Drawing Practice**	**-**	**4**	**4**	**2**	**100**	**60**	**40**
7	**Program core**	**MEPC213**	**Materials Testing Lab**	**-**	**2**	**2**	**1**	**100**	**60**	**40**
8	**Program core**	**MEPC215**	**Thermal Engineering -I Lab**	**-**	**2**	**2**	**1**	**100**	**60**	**40**
9	**Program core**	**MEPC217**	**Manufacturing Processes -I Practice**	**-**	**4**	**4**	**2**	**100**	**60**	**40**
10	**Internship**	**SI201**	**Internship I**	**-**	**-**	**0**	**1**	**100**	**60**	**40**
			Total:	**14**	**12**	**26**	**21**	**1000**	**500**	**500**
STUDENT CONTACT HOURS PER WEEK: 26 hours (Lecture-14 hours; Practical-12 hours) Theory and Practical Period of 60 minutes each. FULL MARKS-1000 (Internal Marks-500; ESE Marks-500) L-Lecture, P-Practical, ESE- End Semester Examination										

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[A Statutory Body under West Bengal Act XXVI of 2013]
(Formerly West Bengal State Council of Technical Education)
"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code No. : MEPC201	**Theory : 100** Marks
Course Title : Mechanical Engineering Drawing	**Examination Scheme:** i) External Assessment**: 60** Marks (End Semester Examination) ii) Internal Assessment**: 40** Marks [Class test : 20 Marks Home assignments : 10 Marks Class attendance : 10 Marks]
Duration : 17 weeks (Total 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: After completion of this course the students will be able to

i) Comprehend the methods of development of lateral surfaces of different truncated and frustum objects, such as tray, funnel, hopper, bend pipe, transition pieces, etc.
ii) Realise the curves of intersection of commonly used two interpenetrating solids.
iii) Interpret machining symbols and surface texture on production drawings.
iv) Interpret various drawing symbols, codes and conventions as per IS: SP-46.
v) Realise the sectional views of various casting / machining components.
vi) Interpret assembly drawing and detailed drawings of various objects such as machine tool parts, power transmission elements, bearings, valves etc.

2. Theory Components:

Unit	Topics& Sub-topics	Teaching Hours
Unit: 1 **Development of Surfaces**	1.1 Developments of lateral surfaces of the regular oblique solids for the following cases: Truncated oblique prism, truncated oblique cylinder, truncated / frustum oblique pyramid and truncated / frustum oblique cone. 1.2 Applications of development of surfaces such as hopper, funnel, tray, transition piece (square to circular).	**06**
Unit: 2 **Intersection of Surfaces of Two Interpenetrating Solids**	2.1 Curves of intersection of the two interpenetrating regular solids for the following cases: Square prism with square prism, Cylinder with cylinder when the axes of them are at 90^0 and bisecting. Cylinder with cone when the cone is resting vertically on HP and the axis of cylinder is parallel to both HP and VP and axes of them are intersecting at 90^0.	**05**

Unit: 3 **Standard Convention for Engineering Drawing using SP 46 : 2003**	3.1 Conventional representation of the following materials: Cast Iron, Mild Steel, Aluminium, Brass Bronze, Glass, Concrete, Wood & Rubber. 3.2 Conventional long and short break in pipe, rod and shaft. 3.3 Conventional representation of common features like slotted head, knurling, serrated shaft, splined shaft, ratchet & pinion, holes on circular pitch, internal & external thread, square on shafts, repeated parts. 3.4 Conventional representation of standard parts like gears, springs, ball & roller bearings. 3.5 Counter sunk and counter- bored holes. 3.6 Pipe joints and valves. 3.7 Tapers. 3.8 General welding symbols, sectional representation and symbols used in engineering practices.	**03**
Unit: 4 **Limits, Tolerances, Fits and Surface Roughness**	4.1 Limits, Fits and Tolerances: a) Introduction to ISO system of Tolerance. b) Selection and representation of dimensional tolerance- number and grade method. Definitions concerning tolerance and limit system, Unilateral and bilateral tolerance, Hole basis and shaft basis system, Clearance fit, Interference fit, Transition fit, Selection of fit for various engineering applications. c) Calculation of limit sizes and identification of types of fit from the given sizes like Φ50H7/c8, Φ50H6/k5, Φ50H7/s6 etc. 4.2Geometrical Tolerances: Types, terminology for deviation, representation of geometrical tolerance on drawing. 4.3Machining Symbols and Surface Texture: Indication of machining symbol showing direction of lay, sampling length, machining allowances, manufacturing methods and roughness grades. Representation of surface roughness on drawing.	**03**
Unit: 5 **Sectional Views**	5.1Isometric views to Orthographic views (front view, top view and side view) of the following objects: a) Machine components b) Castings like hanger and shaft support. 5.2Sectional views of the following casting objects: a) Bearing bracket b) Shaft bracket c) Sliding block.	**03**
Unit: 6 **Assembly Drawings**	6.1 Introduction, types of assembly drawing, accepted norms to be observed for assembly drawings, sequence for preparing assembly drawing. Bill of material. 6.2 Assembly drawing from the following detailed drawings: a) Couplings: Rigid flange coupling & Universal coupling. b) Knuckle joint.	**04**

	c)C.I. pulleys: Fast pulley and Stepped cone pulley. d) Bearing: Plummer block. e) Screw jack. f) Bench vice. g) Square tool post of Lathe machine.	
Unit: 7 **Part Drawings (assembly to detailing)**	7.1 Detailing of the following assemblies: a) Knuckle joint b) Castor wheel c) Socket and spigot type cotter joint. d) Foot step bearing e) Crane hook f) Drilling jig g) Tail stock of Lathe machine h) Non-return valve. 7.2 Construction of tooth profile of a spur gear – (i) by using approximate construction method, (ii) by using involute method.	**04**
Sub Total : Total Lecture Classes		**28**
No. of classes required for conducting Internal Assessment examination		**06**
Grand Total :		**34**

3. Suggested Home Assignment/Student Activities :(At least four assignments)

Other than practice work in classroom, students should conduct the following suggested activities in group or individual, which are suitable for this subject as per instruction of the subject teacher:

(a) Students should maintain a separate A3 size sketch book which will be their part of practice work and has to submit that sketch book along with drawing sheets in scheduled time. Following additional Home Assignments are to be attempted on this sketch book (not to scale drawing following first angle method of projection) as instructed by the subject teacher for the attainment of the COs of MEPC201:

Unit No.	Topics for Home assignment	Marks
03	a. Conventional representation as per IS: SP-46 (1988) of the following: - Materials: Cast Iron, Mild Steel, Aluminium, Brass Bronze, Glass, Concrete, Wood & Rubber. - Conventional long and short break in pipe, rod and shaft. - Common features like slotted head, knurling, serrated shaft, splined shaft, ratchet& pinion, holes on circular pitch, internal & external thread, square on shafts, repeated parts. - Standard parts like gears, springs, ball & roller bearings. - Counter sunk and counter bored holes. - Pipe joints and valves. - Tapers.	**10**

	- General welding symbols, sectional representation and symbols used in engineering practices.	
04	a. Calculation of limit sizes and identification of types of fit from the given sizes like Φ50H7/c8, Φ50H6/k5, Φ50H7/s6 etc. b. Representation of geometrical tolerance on drawing. c. Machining Symbols and Surface Texture: Indication of machining symbol showing direction of lay, sampling length, machining allowances, manufacturing methods and roughness grades. Representation of surface roughness on drawing.	
05	Assembly drawing (including bill of materials and conventional representation of tolerances and surface finish symbols) of the following detailed drawings of components: a) Universal coupling, b) Stepped cone pulley, c) Plummer block, d) Screw jack, e) Bench vice, f) Square tool post of Lathe machine.	
06	Part drawing including conventional representation of tolerances and surface finish symbols of the following assembly drawing: a) Castor wheel, b) Crane hook, c) Foot step bearing, d) Drilling jig, e) Tail stock of Lathe machine, f) Non-return valve,	

b) They should prepare paper-models of development of lateral surfaces of objects such as tray, funnel, hopper, transition piece etc., and paper-models of two interpenetrating solids showing curves of intersection.

c) Only one micro-project is planned to be undertaken by each student assigned to him/her by the subject teacher at the beginning of the semester. The micro-project could be industry application based, workshop-based or field-based. It should be individually undertaken to build up the skill and confidence in every student so that she/he contributes to the projects of the industry. A suggestive list of micro-projects is given here for the attainment of the COs:

(i) Visit Institute's workshop (Fitting shop or Machine shop) and prepare assembly drawing and detailed drawings of lathe tool post / lathe tail-stock / shaper tool head / Drilling machine vice etc (as per availability) using proper measuring instruments.

ii) Visit nearby sheet metal workshop (if possible) and prepare a report related to type of components, dimensions, material, field of applications, operations performed etc.

iii) Other than practice work, at least one visit for students to nearby industries**/**workshops is to be arranged for understanding various production drawings. Students should collect production drawings (if possible) and try to interpret the object from the given views in collected drawing.

iv) Any other micro-projects suggested by the subject-teacher on similar field.

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 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	1 & 2	05	10	10 x 01 = **10**
A2	3 & 4	04		
A3	5 , 6 & 7	06		
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	1 & 2	05	10	10 x 01 = **10**
B2	3 & 4	04		
B3	5 , 6 & 7	06		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	1& 2	05	10	10 x 01 = **10**
C2	3 & 4	04		
C3	5 , 6 & 7	06		
	Total:	**15**	**10**	**10**
			Sub-Total [A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	1, 2 & 5	04	06	06 x 02 = **12**
D2	3 & 4	03		
D3	6 & 7	03		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions(Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	1, 2 & 5	04	03	06 x 03 = **18**
E2	3 & 4	02		
E3	6 & 7	03		
	Total:	**09**	**03**	**18**
			Sub-Total [D+E]:	**30**
			Total [A+B+C+D+E]:	**60**

6**. Rubrics for the assessment of student's activity [20 marks]:**

Sl No.	**Performance Indicators**
1	Imitation of Solved Drawing,
2.	Accomplishing assigned problem,
3.	Performing the drawing task masterfully/expertly using drafting instruments.

4.	Performing the task following standards and ethics,
5.	Submitting assignment sketch book / micro-project related activity on time,

7. **Suggested Learning Resources**:

Sl. No.	Title of Book	Author	Publication
1	Machine Drawing	N. D. Bhatt V. M. Panchal	Charotar Publishing house Pvt. Ltd. Anand, Gujrat, ISBN: 9789380358635
2	A text book of Machine Drawing	P. S. Gill	S. K. Kataria & Sons, New Delhi, ISBN: 9789350144169
3	A text book of Machine Drawing	R. K. Dhawan	S. Chand & Company New Delhi
4	Production Drawing	K. L. Narayana, P. Kannaiah, K. Venkata Reddy	New Age International Publication, New Delhi, ISBN: 9788122435016
5	Machine Drawing	Basudev Bhattacharya	Oxford University Press ISBN: 0-19-807077-2
6	Engineering Drawing Practice for Schools & Colleges- SP 46 : 1988	Bureau of Indian Standard	Bureau of Indian Standard New Delhi -110002 First Revision July 2003 ISBN: 81-7061-019-2

8. Suggested software / learning website link

i)https://law.resource.org/pub/in/bis/S01/is.sp.46.2003.pdf

Complete the Orthographic views from the following isometric views: Annexure 1

1) Annexure 1:https://drive.google.com/file/d/136tkLk_vxBLGiVF0LvZK631eae3L0wQm/view?usp=sharing

Surface Development: Annexure 2

2) Annexure 2: https://drive.google.com/file/d/1Z6XD90eWApikxQTyRbTi7fEAAY6iOa-E/view?usp=sharing

Isometric view to Orthographic view: Annexure 3

3) Annexure 3: https://drive.google.com/file/d/1FT6wc7wXMNTfN5BjmQHLlHJtd1vRzXLL/view?usp=sharing

Intersection of Solids: Annexure 4

4) Annexure 4: https://drive.google.com/file/d/1zpNoLbQ0e9GD1N_K0PalXeFZLqu5o2dr/view?usp=sharing

Introduction to sectional view (as per SP: 46-1988): Annexure 5

5) Annexure 5: https://drive.google.com/file/d/1T2p-veL2dG_KPhABIrQlhOqdQ2gM-0vX/view?usp=sharing

Assembly Drawing from Detailing: Annexure 6

6) Annexure 6: https://drive.google.com/file/d/1TSS_zyAyywdwhShCd20CmEU13z7y0YvF/view?usp=sharing

Part Drawing from Assembly: Annexure 7

7) Annexure 7: https://drive.google.com/file/d/13oc3fZgklShtSpByIuzRJGhUmZQqTgRg/view?usp=sharing

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code no. : MEPC203	**Theory : 100** Marks
Course Title : Mechanical Engineering Materials	**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):

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

a. Explain about crystal structures.
b. Identify properties of materials.
c. Classify the ferrous metals and describe their properties and applications.
d. Describe the non-ferrous metals, cutting tool materials, and composites along with their properties and applications.
e. Explain various heat treatment processes & their applications on various engineering components for improving their mechanical properties.
f. Describe plastic moulding process and its applications.
g. Understand non-destructive testing methods & its applications.

2. Theory Components:

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

Unit	Topics and Sub-topics	Teaching Hours
Unit-1: **Basics of Engineering Materials**	1.1 Introduction, classification of engineering materials. 1.2. Crystal structures: Unit cell and space lattice. Crystal system- The seven basic crystal systems. Crystal structure for metallic elements- BCC, FCC and HCP. Coordination number for simple cubic, BCC and FCC. Atomic radius- definition, atomic radius for simple cubic, BCC and FCC. Atomic packing factor (APF) for simple cubic, BCC, FCC and HCP. Simple problems on finding number of atoms and atomic packing factor for a unit cell. 1.3 Mechanical properties of materials - elasticity, plasticity, ductility, malleability, toughness, hardness, harden ability, brittleness, fatigue, and creep. 1.4. Introduction to corrosion, methods to prevent of corrosion.	**06**
Unit-II	2.1. Cooling curve and showing allotropic transformation of iron. Iron- Carbon equilibrium diagram and its explanation. Critical temperatures and its significance. Principal micro	**09**

Ferrous Metals and Alloys	constituents of an iron carbon system up to 2.0% C content (austenite, ferrite, cementite, pearlite, eutectoid, hypo-eutectoid & hyper –eutectoid steel) 2.2 Broad classification of ferrous metals (steel, cast iron, wrought iron) according to percentage of carbon. Process flow diagram for production of iron and steel. 2.3 Steel: compositions, properties and applications of - i) Plain carbon steel: low (including dead steel & free cutting steel), medium and high carbon steel; effect of silicon, sulphur, phosphorus and manganese. ii) Alloy steel: low, medium and high alloy steel, purpose of alloying, effects of various alloying elements like chromium, nickel, manganese, tungsten, vanadium, cobalt, and molybdenum. iii) Tool steel: cold work tool steel, hot work tool steel, high speed steel (HSS) - composition and applications. iv) Stainless steel: types and applications.vi). Spring steel: composition and applications. vii) Designation of steels on the basis of chemical composition (IS -7598: 1974). 2.4 Type of Steel used for following: shafts, axles, nuts, bolts, crank shafts, camshafts, house hold utensils, surgical instrument, anti-friction bearings and gears. 2.5Cast Iron & Wrought Iron: Classification and application of cast iron as white grey, nodular, and malleable. Wrought iron - composition and its use.	
Unit-III: **Heat Treatment of Steel**	3.1 Introduction to heat treatment, TTT Diagram for eutectoid steel. 3.2 Heat Treatment Process: Purpose, process and applications of - Annealing, Normalising, Hardening & Tempering. 3.3 Austempering & Martempering: Purpose, process and application. 3.4 Surface hardening: Purpose, process and application of - case hardening, flame hardening, and induction hardening.	**10**
Unit-IV: **Non-Ferrous Metals and Alloys**	4.1 Properties and application of copper and its alloys such as brass, muntz metal, gun metal and bronze. 4.2 Properties and application of aluminium alloys such as Y-alloy, hindalium, and duralumin. 4.3 Properties and application of nickel alloys such as inconel, monel metal, and nichrome. 4.3 Properties and application of bearing metals such as white metal, babitt metal, and phosphor bronze.	**05**
Unit-V: **Non-Metallic and Advanced Materials**	5.1 Polymeric materials. 5.2 Properties and applications of thermoplastics, thermosetting plastics and rubbers. 5.3 Plastic Moulding process: compression moulding, transfer moulding, injection moulding, blow moulding, vacuum forming, extrusion, calendaring, rotational moulding. 5.4 Application of ABS, acrylics, nylons and vinyl, polyesters, epoxies, melamine and bakelite. 5.5 Application of rubbers: neoprene, butadiene, buna and silicon. 5.6 Ceramics - properties and applications of glasses and refractories. 5.7 Composite materials - properties and applications of laminated and fibre reinforced materials. 5.8 Advanced engineering materials- Properties and applications of Nano materials and smart materials.	**10**
Unit-VI: **Non-Destructive Testing**	7.1 Importance of non-destructive testing, difference between destructive and non-destructive testing. 7.2 Non-destructive testing methods – Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetration test, Magnaflux test – comparison & applications.	05

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)

List of assignments are to be performed by the students in subject of **Mechanical Engineering Materials [any two]**:

1. Prepare a chart showing the diagrams and detailed calculations of coordination number, atomic radius and atomic packing factor for BCC, FCC and HCP Crystal Structures for demonstration purpose.
2. Prepare a chart showing the composition and applications of the following materials for demonstration purpose: a) Babitt Metal, b) Phosphor Bronze, c) Brass, d) Bronze, e) Gun Metal, f) Bell Metal, g) Duralumin, h) German silver, i) Monel Metal, j) Inconel, k) Nichrome **[any five].**
3. Prepare a chart showing the Iron-Carbon Equilibrium Diagrams (drawn in proper scale) and explain its critical temperatures, micro constituencies up to 2% carbon content in tabulated form for demonstration purpose.
4. Prepare a chart showing the selection of material with their composition and proper justifications for the following components: a) Shaft and spindle, b) Rail track, c) Wires, d) Boiler plate, e) Connecting rod, f) Die block, g) Cutting tool, h) Hand chisel i) Hammer, j) Drill bit **[any five]**.
5. Prepare a chart showing the microstructure, composition and properties of the following steels for demonstration purpose: a) Ferrite, b) Pearlite, c) Cementite, d) Bainite, e) Sorbite, f) Martensite.
6. Prepare a chart showing the process flow diagram with proper explanations for production of steel from iron ore for demonstration purpose.
7. Prepare a flow chart showing the sequential processes of suggested heat treatment with explanation and proper justifications for enhancing the performances of the following components: a) Gear used in power transmission in lathe, b) Anvil of smithy shop, c) Crank shaft used in 4 stroke engines, d) Cast Iron pulley, f) Rail wheels **[any one]**.
8. Prepare a chart showing sequential process flow diagrams with explanation and specific applications of any two types of non-destructive testing methods generally being used in Industry for material testing.
9. With suitable diagram explain and specify its applications of the following plastic forming processes: a) Compression moulding, b) Transfer moulding, c) Injection moulding, d) Blow moulding, e) Vacuum forming, f) Extrusion **[any two]**.
10. Prepare a chart by organizing the following engineering materials such as Cast iron, Mild steel, Wrought iron, Copper, Aluminium according to their mechanical properties such as Strength, Malleability, Ductility, Hardness and Machinability.

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 3 hours]

A: Multiple Choice Type Questions(Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	1& 2	05	10	10 x 01 = **10**
A2	3 & 6	05		
A3	4 & 5	05		
	Total:	**15**	**10**	**10**
B: Fill-in the BlankType Questions(Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	1& 2	05	10	10 x 01 = **10**
B2	3 & 6	05		
B3	4 & 5	05		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions(Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	1& 2	05	10	10 x 01 = **10**
C2	3 & 6	05		
C3	4 & 5	05		
	Total:	**15**	**10**	**10**
			Sub-Total [A+B+C]:	**30**
D: Subjective Type Questions(Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	1& 2	03	06	06 x 02 = **12**
D2	3 & 6	04		
D3	4 & 5	03		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions(Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	1& 2	03	03	06 x 03 = **18**
E2	3 & 6	03		
E3	4 & 5	03		
	Total:	**09**	**03**	**18**
			Sub-Total [D+E]:	**30**
			Total [A+B+C+D+E]:	**60**

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

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

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1	A Text Book of Materials Science and Metallurgy	O.P.Khanna	Dhanpat Rai and Sons, New Delhi.
2	Materials Science for Polytechnic	R.K.Rajput	S. K. Kataria & Sons, New Delhi, ISBN: 9789350144169

3	Engineering Materials	B.K.Agrawal	McGraw Hill Education, New Delhi.
4	Material Science	R.S. Khurmi,	S. Chand & Co. Ltd., New Delhi, 2005.
5	Material Science & Engineering	Raghavan	PHI

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code no. : MEPC205	**Theory : 100** Marks
Course Title : Strength of Materials	**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 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**:

a. Demonstrate different types of stress induced on components under the action of different types of loading condition.
b. Interpret the variation of MOI for different cross-sections of mechanical components.
c. Determine stresses, deformations in the simple load carrying members subjected to an axial, transverse, radial, twisting or thermal loading,
d. Draw shear force and bending moment diagrams for beams with different support conditions and different load conditions,
e. Analyze both solid and hollow shaft subjected to torsion,
f. Solve the problems of column for different end conditions using different methods like Euler's Formula & Rankine-Gordon formula,

2. Theory Components:

Unit	**Topics& Sub-topics**	**Teaching Hours**
Unit-01: **Simple Stresses and Strains**	1.1 Definition of SOM & concept of rigid body, deformable body & equilibrium of forces. 1.2 Types of loads (normal and tangential), types of stresses - normal stress (tensile stress and compressive stress) & shear stress, strain -concept, types- longitudinal and lateral strain, and Poisson's ratio. 1.3 Hooke's law, Young's modulus, longitudinal stress and strain values of uniform and stepped bar under the influence of normal force; stress and strain values of uniform bar due to self-weight only. 1.4. Behaviour of ductile and brittle materials subjected to axial tension, stress-strain or load-deformation curve for ductile (MS) and brittle material (CI) - discussion on salient point, limit of proportionality, yielding, permanent set, yield stress and ultimate stress, factor of safety (simple problems on normal stresses and longitudinal strain. No discussion on composite section). 1.5 Direct shear stress (single/double shear) and shear strain, modulus of rigidity, (simple problems on direct shear in riveted joint, punching press). 1.6 Lateral strain, Poisson's ratio, volumetric strain, bulk modulus, relation among elastic constants without deduction.	**12**

	1.7 Thin cylindrical shell - hoop stress, longitudinal stress and relation between them (simple problems). 1.8 Temperature stress and strain in case of bodies having uniform cross-section with and without yielding (simple problems but no discussion on composite section).	
Unit-02: **Moment of Inertia**	2.1 Definition of area and mass moment of inertia. 2.2 Parallel axis theorem, Perpendicular axis theorem, Polar moment inertia, Radius of gyration. 2.3 MOI about axes passing through the centroid (for solid having square, rectangular, circular, semi-circular, triangular sections and for hollow having square, rectangular, circular sections only) 2.4 MOI of angle section, channel section, Tee section, and I-section about centroidal axis and any other axis parallel to centroidal axis. Polar moment of inertia of circular sections (solid and hollow). 2.5 Simple problems.	**06**
Unit-03: **Shear Force & Bending Moment of Beam**	3.1 Types of beams, types of loads (point load, uniformly distributed load, UVL, VL), and types of supports. 3.2 Meaning of SF, BM of beam, and relation between them, sign convention of SF & BM. 3.3 Shear force and bending moment diagram (for simply supported beam and cantilever subjected to point loads/uniformly distributed load/their combination). 3.4 Location of point of maximum bending moment for simply supported beam. 3.5 Concept of overhanging beam and point of contra flexure. 3.6. Problems on cantilever and simply supported beam.	**08**
Unit-04: **Bending stresses in Beams**	4.1. Theory of pure bending, assumption in theory of bending, flexural formula, neutral axis. 4.2 Moment of resistance, section modulus and neutral axis. 4.3 Simple problems on bending stress in beams having rectangular, circular, and I-section (symmetrical section about both axes).	**04**
Unit-05: **Deflection of Beams**	5.1 Concepts of deflection, maximum deflection and slope in a beam. 5.2 Maximum deflection and slope of simply supported beam subjected to point load at mid span and / or uniformly distributed load on entire span (no deduction). 5.3 Maximum deflection and slope of cantilever beam subjected to point load at free end and / or uniformly distributed load on entire span(no deduction) 5.4 Simple problems on maximum deflection and maximum slope of simply supported beam and cantilever subjected to above mentioned loading.	**03**
Unit-06: **Columns & Struts**	6.1 Introduction, difference between strut and column, types of column. 6.2 Concept of slenderness ratio, equivalent length of column for different end conditions. 6.3 Euler's formula, assumptions, formula for critical/buckling loads of columns for different end conditions (no deduction), safe load, limitations of Euler's formula. 6.4 Rankin's formula, calculation of critical / buckling load. 6.5 Simple problems.	**04**
Unit-07: **Torsion of circular shafts**	7.1 Concept of pure torsion, field of applications (shaft, flange couplings, shear bolts), torsional rigidity, angle of twist, polar modulus, torsional equation for solid and hollow circular shafts, assumptions made for deriving the pure torsion equation. 7.2 Torsional resistance for solid and hollow circular shafts, comparison between them, power transmitted by shaft. 7.3 Simple problems on pure torsion.	**05**
Unit-08 **Springs:**	8.1 Function, types, materials used, practical applications. 8.2 Coiled spring terminology - spring stiffness, solid length, spring index, and mean radius of coil. 8.3 Angle of twist in the spring wire, deformation, and energy stored in the closely coiled helical spring subjected to an axial load. [No Derivation; Only Formula use] 8.4 Equivalent stiffness of coiled springs in series & parallel. 8.5 Simple problems on closed-coil helical spring subjected to an axial load.	**03**
Sub Total : Total Lecture Classes		**45**

No. of classes required for conducting Internal Assessment examination	**06**
Grand Total :	**51**

3. Suggested Home Assignments/Students' Activities: Students are to solve at least four assignments from the set of assignment attached in separate sheet (Annexure 1).

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 3 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	1 & 3	07	10	10 x 01 = **10**
A2	2, 4, 5 & 6	05		
A3	7 & 8	03		
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	1 & 3	07	10	10 x 01 = **10**
B2	2, 4, 5 & 6	05		
B3	7 & 8	03		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	1 & 3	07	10	10 x 01 = **10**
C2	2, 4, 5 & 6	05		
C3	7 & 8	03		
	Total:	**15**	**10**	**10**
			Sub-Total [A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	1 & 3	03	06	06 x 02 = **12**
D2	2, 4, 5 & 6	05		
D3	7 & 8	02		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions (Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	1 & 3	03	03	06 x 03 = **18**
E2	2, 4, 5 & 6	04		
E3	7 & 8	02		
	Total:	**09**	**03**	**18**
			Sub-Total [D+E]:	**30**
			Total [A+B+C+D+E]:	**60**

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

Sl No.	Performance Indicators
1	Originality of completing the assigned task
2	Presentation Skill
3	In time submission of the Assignment work / Micro Project Work
4	Viva voce

7. Suggested Learning Resources:

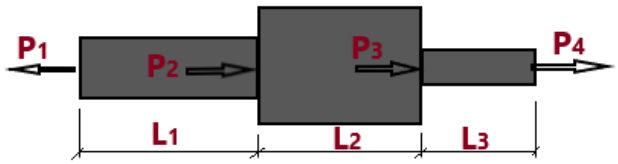
Sl. No.	Title of Book	Author	Publication
1	Strength of Materials	R.S. Khurmi	S.Chand
2	Strength of Materials	R. Subramanian	Oxford
3	Strength of Materials	S.S. Rattan	McGraw Hill Education
4	Strength of Materials	R.K Rajput	S. Chand
5	Strength of Materials	S. Ramamurtham	Dhanpat Rai Publishing.

(Annexure 1)

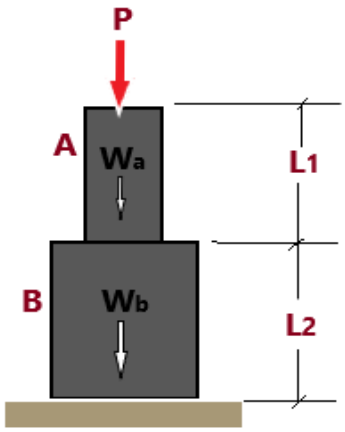
Samples of SOM Assignment

(any two from first four and any two from next six)

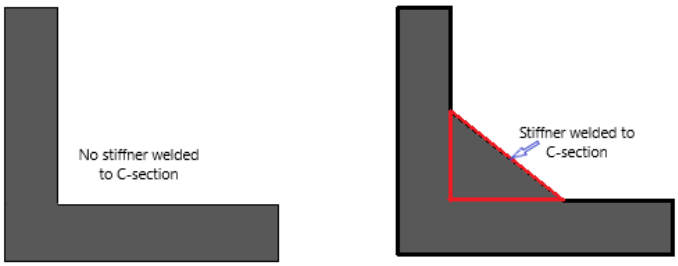
1. To find the induced stress and its nature, and deformation in each part and the resultant deformation of whole body. Given – E and cross sectional area of each part.



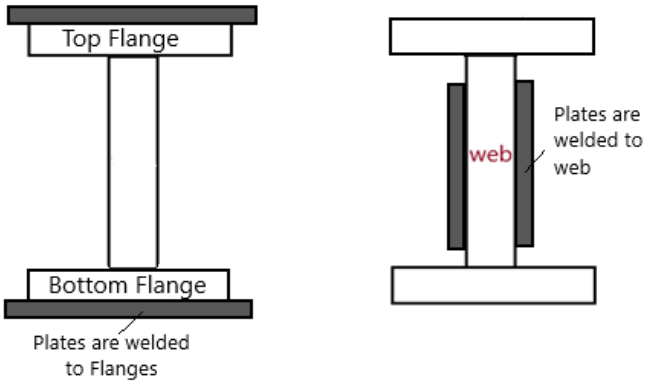
2. To find the decrease in length of the body made up of different materials A and B, under the action of axial compressive load. Given E_A , E_B , cross sectional area of each section, considering the self weight of W_A , W_B and axial load P.



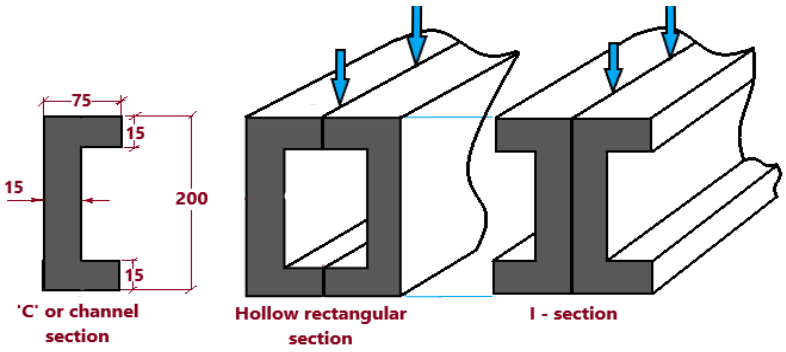
3. To justify the joining of stiffener to the C-section as shown below and determine the increase of moment of resistance of C-section with stiffener in comparison to without stiffener. Given, various dimensions associated with sketches, bending stress.



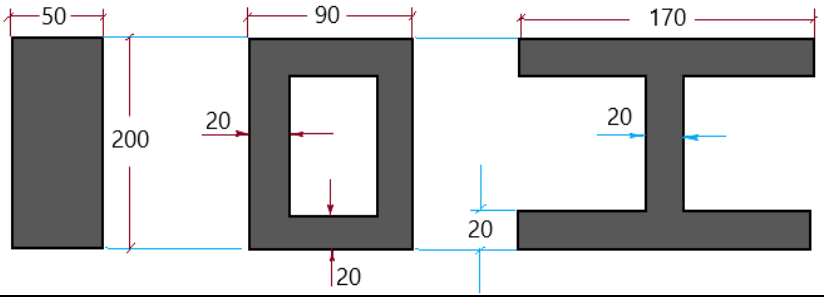
OR, To choose the best option from two given alternatives in which two identical plates are welded to the (i)flanges of symmetrical I-section, and (ii) webof symmetrical I-section as shown. Given, various dimensions associated with sketches and bending stress.



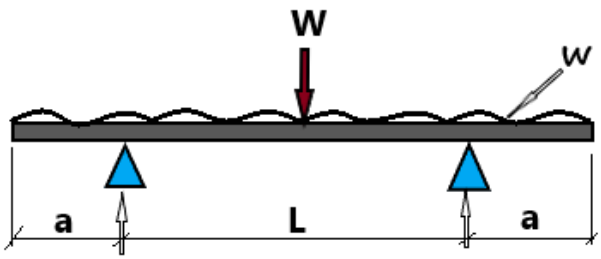
4. Compare the bending strength of the two beams having different cross section (one is of hollow rectangular cross section and other is of I-section). I-section is formed by welding of back to back webs of two 'C' sections whereas hollow rectangular section is formed by welding of face to face top & bottom flange of two 'C' sections as shown.



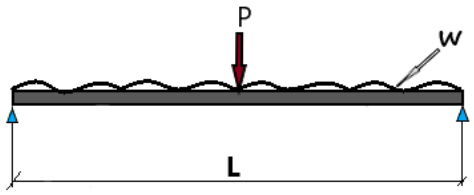
OR, Compare the bending strength of three sections of the same cross sectional area and depth if one of them has a solid rectangular section (50 mm wide and 200 mm deep), the second one is of hollow rectangular section (external dimensions of 90 mm wide and 200 mm deep with 20 mm wall thickness), and the last one is an I-section of equal flanges (170 mm wide web and flange thickness equal to 20 mm).



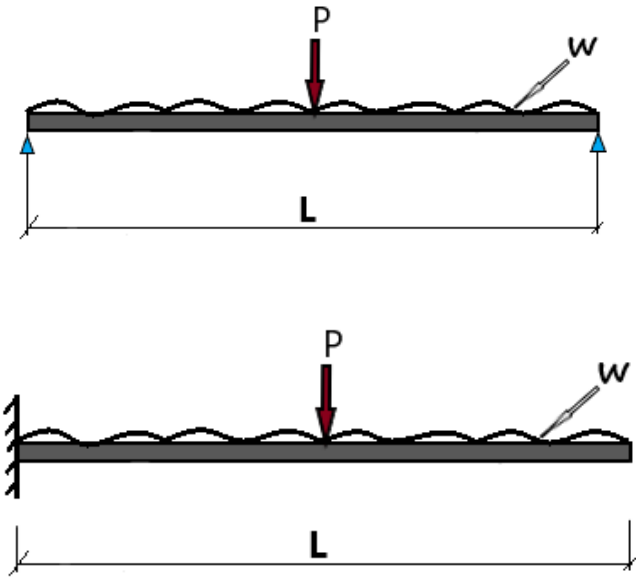
5. To determine the position of two supports of an equally overhanging beam for the least maximum BM, draw SF and BM diagram of such loaded beam. To find the point of contra flexure, if any.



6. To determine the economical cross-section of a simply supported beam subjected to combined loading from the given two options - square cross section and circular cross section. Given, allowable bending stress, length of beam, magnitude of point load and intensity of u.d.l.



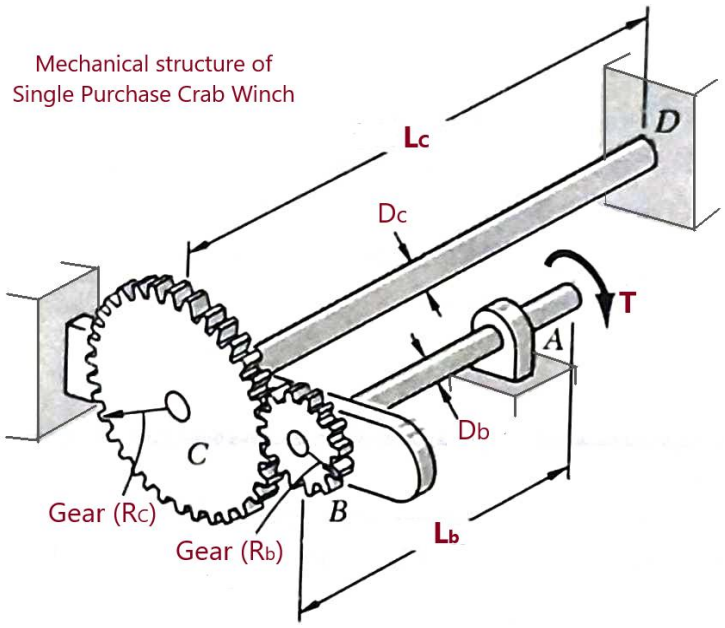
7. To draw the elastic curve and determine maximum defection and maximum slope of cantilever and simply supported beam subjected to combined loading. Given, E, length of beam and moment of inertia of the cross section of beam.



8. To compare the crippling loads given by the Rankin's formula and Euler's formula for a column. Given, cross section of column and its MOI about centroidal axes (I_{GX}, I_{GY}), allowable crushing stress f_C, modulus of elasticity E, value of α, length and end condition of column.

9. To design the hollow shaft and determine the % saving in material for the replacement a solid shaft by a hollow shaft of same material. Given, maximum allowable shear stress is same for both the shafts, diameter of solid shaft, and ratio of the outer and inner diameter of hollow shaft.

10. Mechanical structure of a single purchase crab winch is shown in figure where two solid steel shafts AB & CD of same material are connected by two gears. Determine the largest torque 'T' that can be applied to the end A of shaft AB and the corresponding angle of twist for each shaft. Given, modulus of rigidity and allowable torsional shear stress of the shaft material, $\mathbf{L_c}$&$\mathbf{L_b}$, $\mathbf{D_c}$&$\mathbf{D_b}$, $\mathbf{R_c}$&$\mathbf{R_b}$.



11. A solid circular shaft is transmitting 100 kW at 180 rpm. The shaft is not to twist more than 1^o in a length of 3 meters.The allowable torsional shear stress of the shaft material is 60 N/mm^2. Assume modulus of rigidity of the shaft material is 80 kN/mm^2. Determine the suitable shaft diameter for this purpose.

12. Two close-coiled helical springs wound from same wire having same length but with different core radii and are placed one into the other between two rigid plates at their two extreme ends. This mechanical structure is being subjected to compressive load. Determine the maximum shear stress induced in each coil spring. Given, diameter of wire, compressive load applied between the two rigid plates and core radii of the two springs.

WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT
[A Statutory Body under West Bengal Act XXVI of 2013]
(Formerly West Bengal State Council of Technical Education)
"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code no. : MEPC207	**Theory : 100** Marks
Course Title : Manufacturing Processes-I	**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 hour/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):

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. Understand the fundamental concept of manufacturing and identify different manufacturing processes to be performed for the given job.
b. Prepare products using different metal forming processes.
c. Plan, estimate and produce jobs by using Lathe.
d. Prepare products using different casting processes.
e. Assess and apply different metal joining processes to produce jobs.

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 Fundamentals of Manufacturing Processes	**1.1** Concept of Manufacturing Processes and Classification: Metal forming processes, Metal machining processes, Metal joining processes and Metal finishing processes.	**02**
Unit: 2 Metal Forming Processes	**Forging:** 2.1.1 Concept of Hot Working & Cold Working. 2.1.2 Advantages and Disadvantages of Cold and Hot Working Processes. 2.1.3 Principle of forging processes. 2.1.4 Forging temperature and grain flow in forged parts. 2.1.5 Classifications of forging processes. 2.1.6 Types of dies: Open Die, Impression Die (Single Impression and Multi-impression) and Closed die Forging. 2.1.7 Types of forging presses and hammers. 2.1.8 Forging defects.	**04**

	Rolling and Extrusion: 2.2.1 Basic principles of rolling and extrusion. 2.2.2 Hot and cold rolling. 2.2.3 Types of rolling mills: 2 Hi, 3 Hi & 4 Hi mills. 2.2.4 Rolling defects. 2.2.5 Hot and cold extrusion. 2.2.6 Methods of extrusion: Direct, Indirect, Backward & impact Extrusion, 2.2.7 Advantages, disadvantages & applications of rolling & extrusion.	**05**
	Press Working: 2.3.1 Basic principles of press work on sheet metals. 2.3.2 Different components and their functions of standard die set with a punch. 2.3.3 Types of presses. 2.3.4 Press working operations: Cutting, bending, drawing, punching, banking, notching, lancing, piercing, coining and embossing.	**05**
Unit: 3 Fundamentals of Machining Processes	**Machining:** 3.1 Basic concept of machining, cutting speed, feed and depth of cut. 3.2 Chip formation mechanism and types of chips. 3.3 Orthogonal cutting and oblique cutting. 3.4 Desirable properties of cutting tool materials and examples. 3.5 Cutting tool nomenclature & tool signature of single point cutting tool. 3.6 Tool life, factors effecting the tool life and different ways of measuring tool life. 3.7 Desirable properties, purpose and examples of cutting fluids.	**04**
Unit: 4 Lathe	**Lathe:** 4.1 Basic components and their functions of centre Lathe. 4.2 Classification of Lathe. 4.3 Specification of Centre Lathe. 4.4 Comparison among Centre Lathe, Capstan Lathe and Turret Lathe. 4.5 Lathe accessories: Chucks, mandrels, rests, face plates, centres and angle plates. 4.6 Taper turning on Lathe: Different ways of representing taper on a job, different methods of taper turning and simple problems on taper turning. 4.7 Thread cutting on Lathe: Procedure, change gears calculation for thread cutting operation and related simple problems. 4.8 Other Lathe operations: Centering, facing, Turning, parting off, undercutting, grooving, Knurling, drilling and boring. 4.9 Cutting parameters & machining time calculation.	**10**
Unit: 5 Casting Processes	**Casting:** 5.1 Types of patterns, pattern materials, and pattern allowances. 5.2 Moulding materials, types of moulding sands, properties of sand, moulding methods, cores and core prints. Elements of gating system. Bench and floor moulding methods. 5.3 Furnaces, construction and working of cupola furnace and electric arc furnace. 5.4 Special casting processes: Die casting, centrifugal casting, investment casting and shell moulding. 5.5 Casting defects and its remedies.	**07**
Unit: 6 Joining Processes	**Welding, Brazing and Soldering:** 6.1 Classification of welding. 6.2 Gas welding (Process, Equipment and Applications). 6.3 Types of gas welding flame. 6.4 Arc Welding (Process, Equipment and Applications). 6.5 TIG and MIG welding (Process, Equipments and Application).	**08**

	6.6 Submerged arc welding (Process and Application). 6.7 Shielded metal arc welding (Process and Application). 6.8 Thermit welding (Process and Application). 6.9 Resistance welding (Process and Application): Spot welding, Seam welding and Projection welding. 6.10 Welding defects. 6.11 Brazing and soldering (Process, Fillers and Applications).	
Sub Total : Total Lecture Classes		**45**
No. of classes required for conducting Internal Assessment examination		**06**
Grand Total :		**51**

3. Suggested Home Assignments/ Student Activities:

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:

3.1 It may be submission of home assignment (at least three) 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 or present seminar on specific topic which is suitable for the given subject as per instruction of subject teacher as explained in 3.2 and 3.3.

3.2 Students may conduct one of the following activities in group and prepare reports for their (student's) activity, also collect / record physical evidences for their (student's) portfolio which will be useful for their placement interviews.

a. Visit a / an Industry / Workshop where processes like metal forming (forging / rolling / extrusion / press work) or machining (Lathe operations) or casting or welding are carried out. Collect information on types of machines in operation, their specifications; observe various activities performed and characteristic of output products.
b. Collect information of recent advancement in manufacturing processes like metal forming or machining or casting (Machines / Tools / Equipment) and also collect their specification, manufacturer's name & application in industry.
c. Collect information on present status and recent advancement in welding. Also collect information on process specific machines, accessories required and their applications in industry.

3.3 Students may undertake one micro projects for their (student's) activity. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based, or field-based. The micro-project may be executed by the individual or by a group of students but the number of students in the group should not exceed five students. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it at the time of submission (ie. end of semester). The total duration of the micro-project should not be less than 16(sixteen) student engagement hours during the course.

A suggested list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty member also.

a. Prepare a cast product of different mechanical engineering drawing models with wax material.
b. Prepare various types of welding joints (with metal components) for display and demonstration purposes.
c. Prepare different types of keys (with metal components) for display and demonstration purpose.
d. Prepare various types of patterns / core / core box etc. with suitable material.
e. Prepare model or suitable chart of the drive mechanism generally being used in Lathe.
f. Prepare working model of direct extrusion process for display and demonstration purposes.
g. Prepare hammer forging working model for display and demonstration purposes.
h. Prepare working model of the taper turning attachment generally being used in Lathe.

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: 3 hours)

A: Multiple Choice Type Questions(Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	1& 2	04	10	10 x 01 = **10**
A2	3 & 4	06		
A3	5 & 6	05		
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions(Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	1& 2	04	10	10 x 01 = **10**
B2	3 & 4	06		
B3	5 & 6	05		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions(Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	1& 2	04	10	10 x 01 = **10**
C2	3 & 4	06		
C3	5 & 6	05		
	Total:	**15**	**10**	**10**
			Sub-Total [A+B+C]:	**30**
D: Subjective Type Questions(Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	1& 2	02	06	06 x 02 = **12**
D2	3 & 4	04		
D3	5 & 6	04		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions(Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	1& 2	02	03	06 x 03 = **18**
E2	3 & 4	04		
E3	5 & 6	03		
	Total:	**09**	**03**	**18**
			Sub-Total [D+E]:	**30**
			Total [A+B+C+D+E]:	**60**

6. Rubrics for the Assessment of Student's 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
1	Elements of workshop Technology – Volume I & II	S. K. Hajra Chowdhury, Bose, Roy	Media Promoters and Publishers limited, Mumbai,
2	A Course in Workshop Technology - Volume I & II	B.S.Raghuwanshi	Dhanpat Rai Publications, New Delhi,
3	Manufacturing Processes	Kalpakjian & Schemid	Pearson Education, New Delhi
4	Manufacturing Technology – Volume I & II	P. N. Rao	Tata McGraw-Hill, New Delhi,
5	Manufacturing Science	Amitabh Ghosh, Mallik	East-West Press Pvt. Ltd. New Delhi.
6	Materials and Processes in Manufacturing	DeGarmo	Wiley
7	Machining & Machine Tool	A.B. Chattopadhyay	Wiley
8	Welding & Welding Technology	Richard L Little	Tata McGraw-Hill, New Delhi,
9	Workshop Technology - Volume I , II & III	W.A.J. Chapman	Viva Books (p) Ltd.

8. Suggested Learning Websites:

a) ELS web-portal of WBSCTE
b) https://nptel.ac.in
c) https://swayam.gov.in
d) https://play.google.com/store/apps/details?id=com.mhrd.ndl
e) https://www.vlab.co.in

WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT
[A Statutory Body under West Bengal Act XXVI of 2013]
(Formerly West Bengal State Council of Technical Education)
"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course : Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code no. : MEPC209	**Theory : 100** marks
Course Title : Thermal Engineering - I	**Examination Scheme:** a) **External Assessment:60 marks** (End Semester Examination) i) **Internal Assessment:40 marks** **[**Class test: 20 marks Quizzes, assignment, viva voce: 10 marks Class attendance: 10 marks**]**
Duration : 17 weeks(Total hours per week = 3)	
Total Theoretical class/week : 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both continuous assessment and end semester assessment separately.	

1. **Course Outcomes (COs):**
   i. Understand fundamental concepts of thermodynamic systems and different laws of thermodynamic.
   ii. Understand various properties of perfect gas.
   iii. Apply 1st law of thermodynamics on open system and on closed system containing ideal gas executing thermodynamic processes.
   iv. Understand the formation and properties of steam.
   v. Solve simple numerical on properties of steam by using steam table / Mollier chart.
   vi. Determine dryness fraction of steam
   vii. Understand the working of different types of boilers and necessity of boiler mountings & accessories.

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: **Fundamentals and Laws of Thermodynamics**	1.1. Basic concept of thermodynamics. 1.2. Thermodynamic System, Boundary, Surrounding. Classification of thermodynamic system: open system, closed system and isolated system. 1.3. Thermodynamic properties of system (Intrinsic and Extrinsic properties) with units and its conversion like Pressure (Atmospheric, Gauge Pressure and Absolute pressure), volume, density and temperature. 1.4. State of a thermodynamic system, change of state, path, thermodynamic process.	**12**

	1.5. Thermodynamic equilibrium of a system (mechanical, thermal and chemical equilibrium), thermodynamic cycle. 1.6. Concept of N.T.P. 1.7. Energy-definition and units of transient energy (heat & work) and stored energy (PE, KE & IE). 1.8. Point function & path function. 1.9. Displacement work & flow work. 1.10 Concept& units of power, enthalpy. 1.11 Concept & units of heat, specific heat, specific heat at constant pressure (C_p), specific heat at constant volume (C_v) and adiabatic index. 1.12 Zeroth law of thermodynamics and concept of temperature. 1.13 First law of thermodynamics: Principle of energy conservation, simple energy equation for non-flow process, steady flow energy equation and its application to various thermodynamic system like boiler, nozzle, turbine, compressor & condenser, Concept of perpetual motion machine of 1st kind, limitations of First law of thermodynamics. 1.14 Second law of thermodynamics: Kelvin–Plank statement & Clausius statement, application of 2^{nd} laws to various thermodynamic system like heat engine, heat pump and refrigerator, thermal efficiency, coefficient of performance, concept of perpetual motion machine of 2^{nd} kind, concept and units of entropy. 1.15. Simple numerical on 1^{st} law of thermodynamics for steady flow process, atmospheric pressure, gauge pressure and absolute pressure.	
UNIT 2: **Properties of Perfect Gas**	2.1. Concept of ideal gas & real gas. 2.2. Laws of perfect gases such as Charle's law, Boyle's law and Avogadro's hypothesis, equation of state (PV = m.R.T), characteristic gas constant and universal gas constant. 2.3. Relation among two specific heats (C_p& C_v) with characteristic gas constant (R). 2.4. Ideal thermodynamic processes of gas: governing equation of processes like constant pressure process, constant volume process, constant temperature process, adiabatic process & polytropic process, representation of all the above processes on p-V and T-s plane, deduction of work transfer, heat transfer, change in internal energy, change in enthalpy and change in entropy for each process. 2.5. Simple numerical on above-mentioned perfect gas processes.	**11**
UNIT 3: **Properties of Steam**	3.1 Explanation of steam generation process with the help of p-V, T-s & T-h diagrams. 3.2. Basic terms and properties of steam such as saturation temperature, saturation pressure, saturated liquid, saturated steam (wet steam, dry saturated steam), superheated steam, critical point, triple point, dryness fraction, degree of superheat, degree of undercooling, enthalpy of steam, sensible heat, latent heat of vaporization, superheat, specific volume, entropy and internal energy of steam.	**10**

	3.3. Steam table & its use, enthalpy- entropy (h-s) diagram of steam (Mollier chart) and its use. 3.4. Vapour processes such as constant pressure processes, constant volume processes, constant entropy, constant temperature processes& constant enthalpy process and representation of the processes on p-V, T-s & h-s diagram. 3.5. Determination of dryness fraction of steam using (a) separating calorimeter, (b) throttling calorimeter, & (c) combined separating & throttling calorimeter. 3.6. Comparison of gas & vapour. 3.7. Simple numerical on steam properties only using steam table and Mollier diagram.	
UNIT 4: **Boilers (Steam Generator)**	4.1. Definition and classification of boilers. 4.2. Fire tube & water tube boilers with example, working principle, difference and applications. 4.3. Construction & working principle of Cochran boiler, Lancashire boiler, Babcock and Wilcox boiler and La-Mont boiler. 4.4. Definition of boiler mountings and accessories, Functions of boiler mountings and important accessories. 4.5. Basic concept of stoker fired fluidized bed and pulverized fuel boilers. 4.6. Boiler performance and sources of heat loss. 4.7. Boiler draught, classification and comparison of boiler draught and calculation of chimney height. 4.8. Necessity of boiler feed water treatment. 4.9. Concept of modern high pressure boiler. 4.10.Simple numerical on boiler performance and chimney heights calculation.	**12**
Sub Total : Total Lecture Classes		**45**
No. of classes required for conducting Internal Assessment examination		**6**
Grand Total :		**51**

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

1. Show all processes of ideal gas on single P-V plane. Also show the work transfer during various processes of ideal gas on different p-V plane.
2. Draw P-V, T-S & H-S plane of steam and display saturated liquid line, dry saturated vapour line, wet saturated steam zone, critical point, triple point, superheated zone& under cooled liquid zone.
3. Draw P-V, T-S & P-T plane of steam and show constant pressure, constant temperature, constant volume & constant entropy line.
4. Draw Mollier Diagram and show different vapor processes on this diagram.
5. Prepare a chart showing comparative study of different types of Boiler.
6. Prepare a Chart showing Feed Water Treatment Plant.
7. Prepare a chart showing working principle of at least two mountings,

8. Prepare a chart showing working principle of at least two accessories,
9. Prepare a schematic diagram showing mountings and accessories of a modern high boiler.
10. Prepare a chart showing Forced Draught, Induced Draught and Balanced Draught of a boiler plant.
11. Prepare a report on visit to steam power plant / Dairy industry / Sugar factory etc. with specification of boiler and list of mountings and accessories along with their functions.

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: 3 hours)

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
A1	1 & 2	08	10	10 x 01 = **10**
A2	3 & 4	07		
	Total:	**15**	**10**	**10**
B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
B1	1 & 2	07	10	10 x 01 = **10**
B2	3 & 4	08		
	Total:	**15**	**10**	**10**
C: Short Answer Type Questions (Carrying 1 mark each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
C1	1& 2	07	10	10 x 01 = **10**
C2	3 & 4	08		
	Total:	**15**	**10**	**10**
			Sub-Total [A+B+C]:	**30**
D: Subjective Type Questions (Carrying 2 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
D1	1, 2	05	06	06 x 02 = **12**
D2	3 & 4	05		
	Total:	**10**	**06**	**12**
E: Subjective Type Questions(Carrying 6 marks each)				
Group	**Unit**	**To be Set**	**To be Answered**	**Total Marks**
E1	1, 2	04	03	06 x 03 = **18**
E2	3 & 4	05		
	Total:	**09**	**03**	**18**
			Sub-Total [D+E]:	**30**
			Total [A+B+C+D+E]:	**60**

6. Rubrics for the Assessment of Student's Activity:(20 Marks)

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
1	A Course in Thermal Engineering.	R. S. Khurmi	S. Chand & Co.
2	Engineering Thermodynamics (Principles & Practices)	D.S.Kumar	S.K. Kataria& Sons
3	A text book of Thermal Engineering.	V.M. Domkundwar	Dhanpat Rai & Co.
4	A Course in Thermal Engineering.	P. L. Ballaney	Khanna Publishers

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<table>
<tr><td colspan="4">Name of the Course: Diploma in Mechanical Engineering</td></tr>
<tr><td>Course Title : Mechanical Engineering Drawing Practice</td><td colspan="3">Semester : Third</td></tr>
<tr><td>Category: Programme Core</td><td colspan="3">Full Marks: 100</td></tr>
<tr><td>Code no. : MEPC211</td><td colspan="3">Sessional Examination Scheme:</td></tr>
<tr><td rowspan="5">Duration : 17 weeks(4 hours per week)</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="4">Total Practical class/week : 4

Credit: 2</td><td>Submission of drawing sheets (in scheduled time)</td><td>40</td><td rowspan="3">60 marks</td></tr>
<tr><td>Class performance & attendance</td><td>10</td></tr>
<tr><td>Viva voce (after submission of drawing sheets)</td><td>10</td></tr>
<tr><td colspan="2">Total marks</td><td>100 marks</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>
<tr><td colspan="4">Pre requisite:
• Knowledge of Mechanical Engineering Drawing [Code No. – MEPC 201]</td></tr>
</table>

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

The practical exposures related with this course are to be taught and implemented, so that the student will be able to demonstrate the following industry oriented COs.

i) Draw the development of lateral surfaces of different truncated and frustum objects, such as tray, funnel, hopper, bend pipe, transition pieces, etc.
ii) Draw the curves of intersection of commonly used two interpenetrating solids.
iii) Exercise various drawing symbols, codes and conventions as per IS: SP-46.
iv) Apply machining symbols and surface texture on production drawings.
v) Draw the sectional views of various casting / machining components.
vi) Draw assembly drawing and detailed drawings of various objects such as machine tool parts, machine components, power transmission elements, bearings, valves etc.

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

Following assignments are to be attempted on A1 drawing sheets (to scale drawing by using requisite drawing instruments and following the First angle method of projection) for the attainment of COs of MEPC211:

Sheet No.	List of Practical	Unit No.	Approx. Hours required	Marks per sheet
Sheet No. -1 (containing at least five problems)	1a. Develop plain / single curved lateral surfaces of oblique solids like prisms and cylinders. 1b. Develop plain / single curved lateral surfaces of oblique solids like pyramids and cones.	01	08	5
Sheet No. -2 (containing at least five problems)	2a. Develop lateral surfaces of compound solids like funnel, tray, oil can, hopper, transition piece (square to circular).	01	08	5
Sheet No. -3 (containing at least 3 problems)	3a. Draw curves of intersection of two interpenetrating solids having plane surfaces (vertical square prism with horizontal square prism). 3b. Draw curves of intersection of two interpenetrating solids having single curved surface (vertical cylinder with horizontal cylinder). 3c. Draw curves of intersection of two interpenetrating solids having single curved surface (horizontal cylinder with vertical cone).	02	08	5
Sheet No. -4 (containing at least five problems)	4a. Draw different orthographic views from the given isometric view. 4b. Draw sectional front view, top view and side view from the given isometric view of machine component, castings etc. (using conventions of sections)	04	10	5
Sheet No. -5 (containing at least three problems) [Preferably shaft Coupling, C.I. Pulley and Knuckle joint]	5a. State the procedure for assembly from the given detailed drawing. 5b. Draw assembly drawing (sectional front view and side view) from the given detailed drawings of components including conventional representation of tolerances and surface finish symbols. 5c. Prepare Bill of materials. (See Annexure-5b: sample of industrial drawing).	05	12	10
Sheet No. -6 (containing at least three problems) [Preferably Knuckle joint, Socket & spigot type cotter joint and construction of tooth profile of a Spur Gear]	6a. Identify various components in the given assembly drawing and the sequence of dismantling it. 6b. Describe the procedure for dismantling the given assembly drawing. 6c. Draw part drawing (sectional front view and side view) from the given assembly drawing. 6d. Construct the tooth profile of a spur gear from given module, pressure angle and number of teeth.	06	14	10

Sub Total: Practical Classes	**60 hrs.**	**40 marks**
Preparation for ESE	**08 hrs.**	
Grand total :	**68 hrs.**	

3. Rubrics for the internal assessment of drawing sheets [40 marks]:

Sl No.	Performance Indicators
1	Interpretation of given problems
2	Drawing sheets using proper drafting instruments
3	Performing the task following standards and ethics,
4	Submitting of assigned drawing sheets in time
5	Viva voce

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

- Practice good housekeeping.
- Demonstrate working as a leader / team member.
- Care and Maintain drawing instruments in good working condition.
- Follow ethical practice.

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code No. : MEPC 213	**Total Marks : 100**
Course Title : Materials Testing Lab	**Examination Scheme:** **(i) Internal Assessment:60 marks** [Continuous assessment of class performance and in time submission of assignment : 30 marks Viva voce : 20 marks Class attendance : 10 marks] **(ii) External Assessment:40 Marks** (End Semester Examination) [Assignment on the day of viva voce : 20 marks Viva voce (before Board of Examiners) : 20 marks]
Duration : 17 weeks (2 hours per week)	
Total practical class /week : 2	
Credit : 1	
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 Strength of Materials [Code No. – MEPC 205] • Knowledge of Mechanical Engineering Materials **[C**ode No – MEPC 203**]**	

1. **Course Outcomes:**

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

CO1: Use different material testing machines

CO2: Measure values of stress at different loading condition for mild steel specimen subjected to axial tensile load and plot them on stress-strain / load-deformation diagram.

CO3: Measure the shear stress of given materials by using relevant material testing equipment

CO4: Measure the impact strength of given materials by using relevant material testing equipment

CO5: Measure the hardness of given materials by using relevant material testing equipment

CO6: Measure the torsional shear stress of given materials subjected to torque by using relevant material testing equipment

CO7: Detect the external surface cracks in the test specimen by using Visual inspection and ring test /Die penetration test / Magnetic particle test.

2. **Suggested Assignments for Continuous Assessment: (**Any Five**)**

Sl. No.	**List of Practical**	**Approx. Teaching Hours**
1.	Tensile test on mild steel/ aluminum on UTM.	06
2.	To determine shear strength of mild steel by Direct Shear Test on UTM.	06

3	To find out the resistance of a standard specimen of common engineering materials against impact load by Izod and Charpy test.	06
4.	To determine the hardness value of mild steel / aluminum by Brinell Hardness tester.	06
5.	To determine the hardness value of mild steel / aluminum specimen by Rockwell Hardness tester.	06
6.	Torsion test on mild steel/ Aluminum bar.	06
7.	To detect the exterior surface cracks in the specimen using (i) Visual inspection and ring test, (ii) Die penetration test, (iii) Magnetic particle test.	06
8.	Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Closed coil helical spring)	06
Sub Total: Practical Classes		**30 hrs.**
Preparation for ESE		**04 hrs.**
Grand total :		**34 hrs.**

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 ESE Assessment:	**40**
Pass criterion for ESE Assessment = 16 Marks [Minimum]	

5. Rubrics for the internal assessment of Laboratory practice [30 marks]:

Sl No.	Performance Indicators
1	Awareness about the significance of particular test
2	Understanding working principle of machine / set-up
3	Setting and operation of experimental set up
4	Observations and recording data
5	Interpretation of result and conclusion
6	Submission of report in time
7	Answer to sample questions

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

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

Reference Books:

1. Testing of Metallic Materials - A.V.K Surayanarayan- PHI
2. Measurement system (Application and Design) – Ernest O Doebelin.
3. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi
4. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester : Third**
Code No. : MEPC 215	**Total Marks : 100**
Course Title : Thermal Engineering-I Lab	**Examination Scheme:** **(ii) Internal Assessment:60 marks** [Continuous assessment of class performance and in time submission of assignment :30 marks Viva voce : 20 marks Class attendance **:** 10 marks] **(ii) External Assessment:40 Marks** (End Semester Examination) [Assignment on the day of viva voce: 20 marks Viva voce (before Board of Examiners): 20 marks]
Duration : 17 weeks (2 hours per week)	
Total Practical Class /week : 2	
Credit: 1	
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 Thermal Engineering-I [Code No. – MEPC 209]	

1. Course Outcomes (COs)

The experimental works associated with this course will help the students to demonstrate the following industry oriented Cos.

i. Apply laws of thermodynamics to thermodynamic systems
ii. Use measuring instruments/charts in different thermodynamic processes
iii. Manage the working of steam boilers in different industries.
iv. Manage the operation of boiler mounting and accessories.
v. Use steam calorimeter.

2. Suggested Assignments for Continuous Assessment: (At least Five Practical**)**

Sl.No.	**List of Practical**	**Approx. Teaching Hours**
1.	Observation of the working principle of Burden tube pressure gauge	06
2.	Calculation of characteristics gas constant of air using some practical data	06
3	Measurement of Dryness Fraction of Steam by Dryness Fraction Measuring Instrument.	06
4.	Use of Mollier Chart by plotting different vapour processes on it.	06

5.	Study of Cochran Boiler (fire tube boiler)	06
6.	Study of Lancashire Boilers (fire tube boiler)	06
7.	Study of Babcock and Wilcox Boiler (water tube boiler)	06
8.	Study of La-Mont Boiler (water tube boiler)	06
9	Study the boiler mountings and accessories	06
10	Trace the path of flue gas and water steam circuit of boiler	06
Sub Total: Practical Classes		**30 hrs.**
Preparation for ESE		**04 hrs.**
Grand total :		**34 hrs.**

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 ESE Assessment:	**40**
Pass criterion for ESE Assessment = 16 Marks [Minimum]	

5. Rubrics for the internal assessment of Laboratory practice [30 marks]:

Sl No.	Performance Indicators
1	Awareness about the significance of particular test
2	Understanding working principle of machine / experimental set up
3	Setting and operation of experimental set up
4	Observations and recording data
5	Interpretation of result and conclusion
6	Submission of report in time
7	Answer to sample questions

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

- Follow the safety practices,
- Practice good housekeeping,
- Practice energy conservation,
- Demonstrate working as a leader / team member,
- Maintain tools and equipment to keep them in working condition,
- follow ethical practice

Reference Books:

Title of the Book	Name of the Author(s)	Name of the Publishers
Thermal Power Plant- Pre-Operational Activities	Dipak K. Sarkar	ELSEVIER
Power Plant Engineering.	R.K. Rajput	Laksmi Prakashani
Engineering Thermodynamics (Principles & Practices)	D.S.Kumar	S.K. Kataria & Sons
A text book of Thermal Engineering.	R. S. Khurmi	S. Chand & Co.
A Course in Thermal Engineering.	P. L. Ballaney	Khanna Publishers

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Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester: Third**
Code no.: MEPC217	**Total Marks:100**
Course Title: Manufacturing Processes-I Practice	**Examination Scheme:** **(i)Internal Assessment:60 Marks** [Continuous assessment of class performance and in time submission of Assignments: 30 Marks Viva Voce:20 Marks Class Attendance:10 Marks] **(ii) External Assessment:40 Marks** (End Semester Examination) [Assignment on the day of viva voce :20 marks Viva voce (before Board of Examiners): 20 marks]
Duration : 17 weeks (4 hours per week)	
Total practical class/week: 4	
Credit: 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre requisite: 1. Knowledge of Manufacturing Process-I[**C**ode No – MEPC 207]	

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) Operate the Lathe and Welding machine
b) Create a component by operating the Lathe/ Welding machine
c) Set the tools, jobs and set different parameter to run a machine for produce a job most effectively and economically
d) Perform the work-in process inspection using different measuring tools to produce a job
e) Create a component by using Smithy / Forging tools

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

Sl. No.	**List of Practical**	**Unit No.**(as mentioned in sub code:MEPC207)	**Approx. Teaching Hours**
01*	Study of lathe: Identifying its major components: available spindle speed changing devices, available tool feeding devices, feed reversal devices, change gears, job holding devices, tool holding devices, types of cutting tools used in various lathe operations, setting of job and cutting tools, operate lathe without removal of chips and observe job-tool relative movement.	4	12
02*	Study of different equipment of Electric Arc Welding set-up or gas welding set-up or electric resistance welding set-up, hand tools used, safety items used, connection details, types of welding joints (Lap, Butt, Tee, Corner and Edge joints etc.), different welding positions (Horizontal, Vertical and Overhead positions etc.) and practice on edge preparation, tag welding and stitch welding.	6	12

03	Study the geometry of a single point cutting tool and produce an assignment on tool nomenclature and tool signature of a single point cutting tool.	3	10
04	Practice on making a job involving Lathe operations like facing, plain turning, step turning, grooving, knurling and chamfering.	4	10
05	Practice on making a job involving taper turning by swivelling the compound rest on Lathe as per given drawing.	4	10
06	Practice on making a job involving thread cutting operation on Lathe as per given drawing.	4	10
07	Practice on making welding joint (lap-joint or butt-joint or tee-joint or corner-joint) as per given drawing by utilizing available facilities of welding shop.	6	10
08	Practice on making a solid wooden pattern /split pattern as per given drawing.	5	10
09	Practice on making a mould by using a solid or split pattern as per given drawing.	5	10
10	Study of different tools and machines generally used in Smithy or Forging Shop and practice on different basic smithy or forging operations such as Upsetting, Drawing down, Setting down, Necking, Cutting, Bending, Fullering, Swaging, Punching and Drifting etc.	2	10
11	Practice on making a job on utility items like chain links, door rings, hooks etc. as per given drawing by utilizing smithy or forging shop's facilities.	2	10
Sub Total: Practical Classes		**64 hrs.**	
Preparation for ESE		**04 hrs.**	
Grand total :		**68 hrs.**	

Note: A suggested list of practical is given in the above table. At least 06 nos. practical need to be performed out of which the practical marked as **[*]** are compulsory.

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]	

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 ESE Assessment:	**40**
Pass criterion for ESE Assessment = 16 Marks [Minimum]	

4. Rubrics for the internal assessment of Laboratory practice [30 marks]:

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

Sl. No.	Performance Indicators
01	Interpretation of component drawing, setting up of machine, cutting tool and job

02	Preparing slip for requisition of tools, equipment and measuring instruments (with proper specification) needed for producing the component
03	Operating machine to execute the production process and Inspecting the component during production process using measuring instruments
04	Submission of job and workshop report in time
05	Viva voce

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

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

References:

Sl. No.	Title of Book	Author	Publication
1	Elements of workshop Technology – Volume I & II	S. K. Hajra Chowdhury, Bose, Roy	Media Promoters and Publishers limited, Mumbai,
2	A Course in Workshop Technology - Volume I & II	B.S.Raghuwanshi	Dhanpat Rai Publications, New Delhi,
3	Manufacturing Technology - Volume I & II	P. N. Rao	Tata McGraw-Hill, New Delhi,
4	Manufacturing Science	Amitabh Ghosh, Mallik	East-West Press Pvt. Ltd. New Delhi.
5	Manufacturing Processes	KALPAKJIAN & SCHMID	Pearson Education, New Delhi
6	Materials and Processes in manufacturing	DeGarmo	Wiley
7	Machining & Machine Tool	A.B. Chattopadhyay	Wiley
8	Workshop Technology - Volume I , II & III	W.A.J. Chapman	Viva Books (p) Ltd.

Suggested Learning Websites:

https://nptel.ac.in
www.basicmechanicalengineering.com/lathe-machine-operations-basic-turning-
www.thelibraryofmanufacturing.com/forming-basics.html
www.themetalcasting.com/casting-process.html

WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT
[A Statutory Body under West Bengal Act XXVI of 2013]
(Formerly West Bengal State Council of Technical Education)
"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	**Semester: Third**
Code no.: SI201	**Total Marks:100**
Course Title: Internship 1	**Examination Scheme:** **(i)Internal Assessment:100 Marks** **Internship Report - 60** **Internship Seminar - 40 marks**
Duration :	
Total practical class/week: After 2nd Semester	
Credit: 1	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Suggested Internship Project Work in 3rd Semester

After the **2nd Semester,** for **Internship-I**, students are required to be involved in Inter/ Intra Institutional activities viz; Learning at Departmental Lab/ Institutional workshop; Training and simulation program with different Institutes like Workshop of ITI, Other Polytechnics and other Technical Institutes Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at innovation /entrepreneurship cell of the institute; participation in workshops/ competitions etc.

After completion of Internship I, the student should prepare a comprehensive report to indicate what he/she has observed and learnt in the training 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 training report should be signed by the Industrial Supervisor / Internship Faculty Mentor, TPO and HOD.

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

Sl. No.	Criteria for evaluation of Internship Report[60]
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 [40 marks]
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-I = 40 Marks [Minimum]	