

# College of Engineering, Pune

Second Year B.Tech (Mech)

ILE-20) ME-211- Thermal and Fluid Engineering

Date Nov 2010

Academic Year: 2010-11

Timing: 3 hrs

Max. Marks: 50

**Instructions: 1. All questions are compulsory, 2. Calculator is allowed  
3. Assume suitable data if necessary**

- 1
- a) Explain liquid-in-glass thermometer and the bimetallic thermometer (4)
  - b) Write down the steady flow energy equation and simplify it for an air compressor. (3)
  - c) Give broad classification of steam generators (3)
- 2
- a) What is a thermodynamic property? Explain intensive and extensive Properties. (3)
  - b) Differentiate two stroke and four stroke IC engines based on the following points; Pollution, Power developed per cycle, Valves, flywheel. (3)
  - c) Explain construction and working Bourdon's tube pressure gauge (4)
- 3
- a) Write Fourier's law of heat conduction. What is meant by thermal resistance? Explain the significance of thermal resistance in application. (3)

OR

Write Newtons law of cooling or heating with notations used in convection heat transfer. Write equation for overall heat transfer of compound cylinders.

- b) A furnace wall is made up of 20cm of magnesite brick and 20 cm of common brick. The magnesite brick is exposed to hot gases at 1355°C and common brick outer-surface is exposed to 45°C. The convection heat transfer coefficient on furnace side and outside furnace are respectively 34 and 19 W/m<sup>2</sup>K. The thermal conductivity of magnesite brick and common brick are respectively 4 and 0.65 W/mK. (5)
  - c) Draw a temperature variation along the length of a parallel and counter flow heat exchanger. Write the LMTD equation for counter flow heat exchanger with notations. (2)
- 4
- a) Define Steady & unsteady flow and uniform and non-uniform flow (2)

b) A piston having 100 mm diameter and 150 mm length moves inside a cylinder of 100.4 mm diameter. The weight of the piston is 50N and annular space between piston and cylinder has lubrication of oil  $\mu = 0.5 \text{ NS/m}^2$ . Find the velocity with which the piston will slide inside the cylinder. (3)

c) Draw a neat sketch of a venturi-meter. Derive an expression for the flow through a pipe using venturi-meter. Define coefficient of discharge for the same. (5)

OR

Draw a neat sketch of an orifice-meter. Derive an expression for the flow through a pipe using orifice-meter. Define coefficient of discharge for the same.

Q.5 a) Define iso-thermal efficiency of a compressor. Explain the methods of increasing iso-thermal efficiency. (3)

b) Explain the need of a multi-stage compression with p-v diagram. (2)

c) Write short note on any two (5)

i) Reciprocating pump

ii) Comparison of positive and non-positive displacement pumps

iii) construction and working of Pelton wheel

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# College of Engineering, Pune.

## End Semester Examination

### (ME 240) Machine Drawing & Computer Graphics

Programme : S.Y.B. Tech.  
Course : Mechanical  
Year : 2010-11

Date : 23<sup>rd</sup> Nov 2010  
Max. Marks : 50  
Duration : 03 hr

**Instructions :-**

- 1) Solve **given** questions on the ruled answer sheet paper only.
- 2) Figures to the right indicate full marks.
- 3) Draw neat figures and assume suitable data wherever required.

- Q.1 a) Explain the terms 'Machine Drawing' and 'Production Drawing' in details. Also explain the term "Bill of Material" associated with the assembly drawing. [ 05 ]
- b) Why do we need Tolerancing to the critically performing components? Also explain the term 'interchangeability' essentially required for selection of fit. [ 05 ]

**OR**

- b) Explain the significance of a "Generalised Welding Symbol" used for giving the details of various parameters associated with welding. [ Do not draw the symbols for various types of weld joints] [ 05 ]

- Q.2 a) Draw and explain **any four** FORM type of geometrical tolerancing symbols. Interpret the following drawing ( Fig. 1 ) and explain the tolerance given on it. [ 05 ]

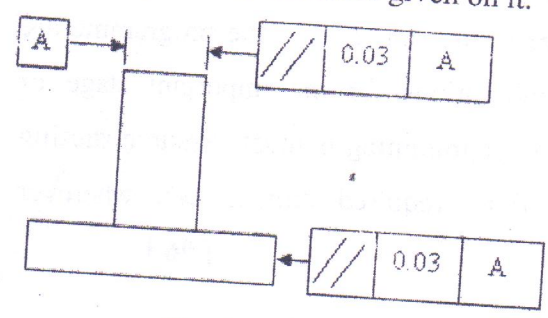


Fig. 1

- b) Write a short note in detail for **any one** of the following. [ 05 ]
- i) Types of Cast Iron Pipe Joints & it's applications
  - ii) Stuffing Box and Glands
  - iii) Various types of control valves and their respective symbols

**OR**

- b) What do you understand by the term Tolerance zone for Shaft and Hole? Explain this with the help of diagram which shows basic size, deviations and tolerances of shaft and hole. Also explain three types of fits in brief, with suitable sketch and appropriate example. [ 05 ]



commands, as displayed in the command prompt area) in logical sequence, required for completion of the following drawing [ Fig 2 ] . Using optimum and more quickly performing commands of AutoCAD write sequential appearance of the commands. Assume suitable proportionate dimensions. Writing the dimensions in the answer is not necessary.

[ 06 ]

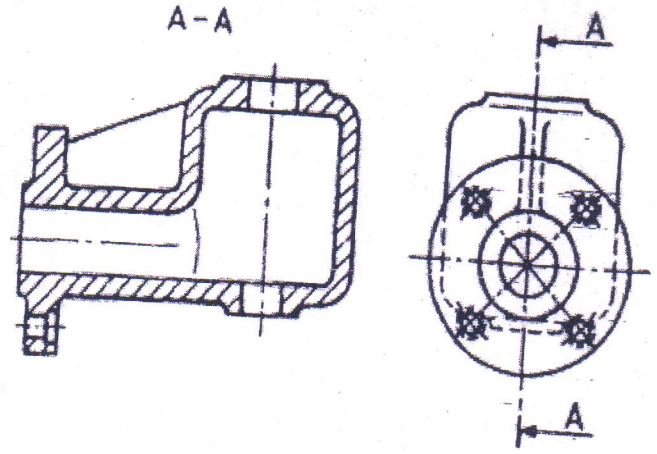


Fig. 2

b) Explain the following figures [ Fig 3 a), b), c) and d) ] **in detail** with all the possible information. (Type of symbol, Meaning of symbol, and its use....etc)

[ 04 ]



Fig. 3 a)

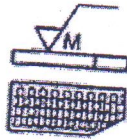


Fig. 3 b)

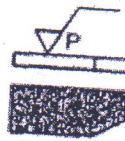


Fig. 3 c)

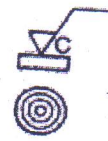


Fig. 3 d)

Q. 4 a) Write the AutoLISP programme required for completion of the sketch given in the following Fig. 4. Minimum inputs from user at the start of the programme are compulsory. Elaborations for the important stage or command in the programming is must. Assume starting point, suitable data, required dim..... etc. wherever necessary.

[ 06 ]

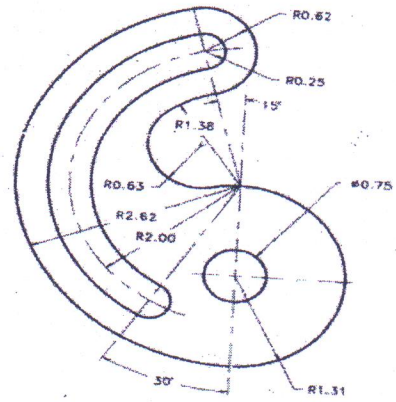


Fig. 4

b) Explain the “Loop” and “Conditional” statements required for repetitive drawing work. Write a small programme to explain the use of these statements.

[ 04 ]

Q. 5 Write a short note on **any two** of the following with suitable examples and essential sketches. [ 10 ]

- i) Write a procedure to derive the tolerance values for given shaft & hole assembly.
- ii) Types of utilities offered by Design Center facility of AutoCAD
- iii) Various data conversions in LISP programming
- iv) Write a single programme to draw three concentric circles appearing in animated mode of display and writing its data for area & circumference in another lisp file.

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College of Engineering, Pune  
End Sem Exam 2010

203 Strength of Materials

Class: S.Y. B.Tech.(Mechanical / Production)

Date : 20.11.2010

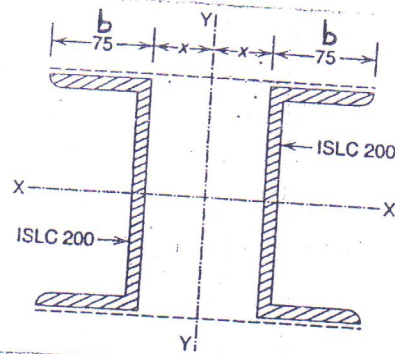
Time: 10 am to 1.00 pm

Max. Marks: 50

- Instructions:**
- 1) All questions are compulsory.
  - 2) Use of non-programmable calculator is allowed.
  - 3) Use of mobile is strictly prohibited.

Q.1	(A)	A compound tube consists of a steel tube 200mm internal diameter and 10 mm thickness and the outer brass tube 220 mm internal diameter and 10 mm thickness. The tubes are of the same length. The compound tube carries an axial compressive load of 1500 kN. Find the stresses and the loads transmitted to the two tubes. Find also the decrease in length of the compound tube, if each tube is of 200 mm long. Take $E$ for steel = $2 \times 10^5 \text{ N/mm}^2$ , $E$ for brass $1 \times 10^5 \text{ N/mm}^2$	03
Q.1	(B)	Explain the Mohr's Circle method for finding normal and tangential stresses when a body is subjected to two mutually perpendicular principal tensile stresses of unequal intensities.	04
Q.2		Derive from the first principle with a neat sketch, the expression for change in volume of thin cylindrical vessel of internal diameter 'd', length 'l', and thickness of wall as 't', subjected to internal pressure 'p'.	06
Q.3		Using the first principles, determine the ratio of maximum to the minimum value of shear stress in the beam of hollow circular cross section whose outside radius is thrice the inside radius. Draw a neat sketch.	07
Q.4	(A)	Prove that Euler's formula is valid only if the bending stress developed during buckling, i.e. the critical stress is within the proportional limit.	03
Q.4	(B)	Show that the stress due to impact on the rod can be reduced by using a material with lower value of modulus of elasticity ( $E$ ) or by increasing the area ( $A$ ) or by increasing the length ( $L$ ) of the rod.	03
Q.4	(C)	Obtain an expression for deformation due to impact loading in terms of strain and hence define and obtain an expression for impact factor.	03
Q.5	(A)	A 2.25 m long tubular steel strut with hinged ends having outer and inner diameters of 37.5 and 32.5 mm, respectively, is subjected to a compressive load which is parallel to its axis and passing through its centroid. The yield stress and modulus of Elasticity ( $E$ ) of the material of the strut are 315 GPa and 200 GPa, respectively. The constant for Rankine's formula is (1/7500). Compare and calculate the ratio of the crippling loads obtained by Euler's and Rankine's formula.	03
Q.5	(B)	For the same problem as in Q. 5 (A), if the elastic limit for the material of the strut is 200 MPa, determine the length of strut beyond which Euler's formula applies.	03
Q.6	(A)	Two rolled steel channels ISLC 200 are latticed (i.e. braced) to form the cross-section of a column as shown in figure 1. How far apart these channels be placed back to back, so that the column may carry the maximum load? (Contd. on Page 2)	03

The properties of one channel are:  
 $b = 75 \text{ mm}$ , Area  $A = 2622 \text{ mm}^2$ ,  $I_{xx} = 1.7255 \times 10^7 \text{ mm}^4$ ;  $I_{yy} = 1.469 \times 10^6 \text{ mm}^4$   
 and the distance of C.G. from back to channel =  $23.5 \text{ mm}$ .

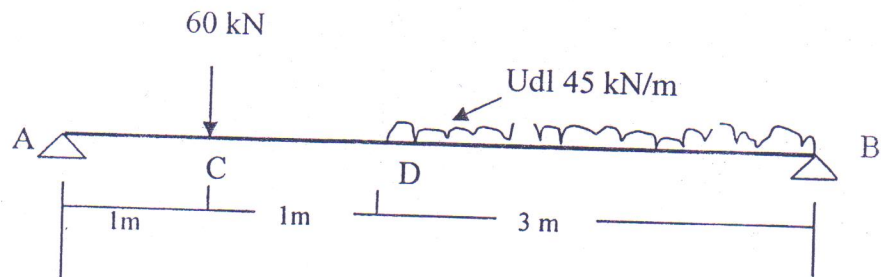


**Figure 1**

**Q.6 (B)** For the same problem as in Q.6 (A), if the channels of column are spaced 150 mm apart back to back; determine the safe load the column can carry with fixed end conditions over a length of 6 m, taking factor of safety 2.5. The constants for Rankines formula are: Compressive stress = 320 MPa, and  $\alpha = (1/7500)$ . **04**

**Q.7 (A)** A simply supported beam of span 6 m is subjected to two point loads 90 kN and 120 kN acting at 2 m and 4 m from left end respectively. Determine slopes at supports, deflection under loads and maximum deflection by moment area method. Take  $E = 200 \text{ GPa}$  and  $I = 3 \times 10^8 \text{ mm}^4$ . **04**

**Q.7 (B)** Find the slope at B and C and deflection at C and D for the beam loaded as shown in the figure 2, by Macaulay's method. Take  $E = 200 \text{ GPa}$ ,  $I = 2 \times 10^8 \text{ mm}^4$ . **04**



**Figure 2**

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**COLLEGE OF ENGINEERING PUNE**  
 Second Year Mechanical  
 Autumn Term (2010/11)  
**Engineering Thermodynamics (ME-201)**

Date- 18/11/2010

Academic Year: 2010-11

Duration: 3 hrs

Max. Marks: 50

**Instructions:**

- 1) Attempt all questions
  - 2) Figures to right indicate full marks.
  - 3) Assume suitable data if necessary.
- Use of Mollier chart, Steam table and property tables is allowed.

Q. 1

Attempt **FIVE** of the following.

- a Distinguish between point function and path function with example.
- b Define with two examples intensive and extensive property. In this regard what is your opinion about entropy and entropy generation.
- c A piece of iron ball of mass 5 kg is heated to 105°C and dropped into a vessel containing 25 kg of water at 20°C. What is the specific heat of iron, if rise in temperature of water is 3.6°C, by the heat from iron.
- d A rigid vessel of volume 0.876 m<sup>3</sup> contains 1 kg of steam at a pressure of 2 bar. Evaluate the temperature and dryness fraction.
- e What is the phase equilibrium criterion for water exposed to air. What is the vapour pressure of air having 10% relative humidity and 25°C temperature.
- f Show that through one point there can pass only one reversible adiabatic.

10

Q. 2

- a Derive expression for entropy change of an ideal gas in term of pressure and temperature. Apply it for polytropic process. 5
  - b Certain gas has  $c_p = 1.968$   $c_v = 1.507$  kJ/kgK. Find its molecular weight and the gas constant. 5
- A constant volume container of 0.3 m<sup>3</sup> capacity contains 2 kg of gas at 5°C. Heat is transferred to the gas until the temperature is 100°C. Find the work done, heat transferred, the change in internal energy, enthalpy and entropy.

**OR**

- b A cylinder of 60 litre contains carbon dioxide at 100 bar and 20°C. Determine mass of gas, specific gas constant, molecular volume, density and specific volume.

Q. 3

- a State Kelvin Planck and Clausius statement of second law of thermodynamics. Represent Carnot cycle on P-V and T-S diagram, explain various processes in it. 5
- b A reversible heat engine receives heat from two sources at 870°K and 580°K. It rejects 3000 kJ/min to a sink at 290°K. The engine develops 85 kW. Determine the heat supplied by each source and the efficiency of the engine. 5

**OR**

- b Prove that COP of heat pump is greater than COP of refrigerator by unity.

A heat pump working on Carnot cycle takes in heat from a reservoir at 5°C and delivers to a reservoir at 60°C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840°C and rejects heat to reservoir at 60°C. The reversible heat engine also drives a machine that absorbs 30 kW. If heat pump extracts 17 kJ/s from reservoir at 5°C. Determine a) rate of heat supply from the 840°C source, b) the rate of heat rejection to the 60°C sink.

- Q. 4 a Derive the expression for Clausius inequality

5

**OR**

- a Prove that availability for closed system is:

$$a = (u + P_0 v - T_0 S) - (u_0 + P_0 v_0 - T_0 S_0)$$

Write equation of second law efficiency for refrigerator and heat pump.

- b Determine the maximum useful work that can be obtained if superheated steam at 3 MPa and 300°C is allowed to undergo a process in which steam is reduced to dry saturated steam 0.2 MPa and the ambient conditions are 0.1 MPa and 300°K. 5

- Q. 5 a Represent the basic ideal, ideal reheat and ideal regenerative Rankine vapour power cycle on T-S diagram. Draw flow diagrams for it. 5

- b In a thermal power plant operating on Rankine cycle, superheated steam at 5 MPa and 450°C enters a reversible adiabatic turbine and leaves at 20 kPa pressure. The low pressure steam is condensed to a saturated liquid at 20 kPa and fed back to the boiler. Estimate the thermal efficiency of the power plant. 5

**OR**

- b Draw P-V diagram of the substance which contracts on freezing showing three phases of pure substance and critical point.

Calculate amount of heat energy required to convert 10 kg of water at 20°C into steam at 300°C and 10 bars.



**PIET's College of Engineering Pune**  
**(An Autonomous Institute of Govt. of Maharashtra)**

**END SEM EXAM**

Manufacturing Engineering-1

Programme: S.Y.BTech. (Mechanical Engineering)

Duration: 3 hr

Year: 2010-2011

Max. Marks: 50

Instructions:

1. Solve any **FIVE** questions.
2. All questions carry equal marks.
3. Draw neat figures wherever required.
4. Assume suitable data if necessary.

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- Q.1 a) List down different quick return mechanisms used in shaper. Explain Crank and slotted link mechanism with neat figure. 5
- b) Problem: Index 69 divisions by Compound Indexing rule, taking index plate hole circles as 23 and 33. 5
- Q.2 a) Explain with neat sketch 'Open & Cross belt table drive' mechanism used in planer. 5
- b) Explain 'Auto feed' mechanism used in shaper with neat sketch. 5
- Q.3 a) Write short note on *any two* of the following: 5
- i) Continuous broaching machines,
  - ii) Internal Centreless grinding,
  - iii) Surface finishing process- Lapping.
- b) Problem: In a shaper work, length of the stroke is 400mm, no. of double strokes per minute is 30 and the ratio of return time to cutting time is 2:3. Find the cutting speed. 5
- Q.4 a) I. Compare AC & DC arc welding with suitable example. 2.5  
II. What do you understand by polarity in arc welding and what is the advantages and disadvantages of polarity. 2.5
- b) According to their use how the moulding sand are classified. 5
- Q.5 a) What do you understand the term gating system? Explain with suitable example. 5
- b) I. What is a core print? Give its purpose. 2.5  
II. Draw a schematic diagram of the principle of thread cutting on a lathe. Show the relation between ratio of change gears to the work pitch and lead screw pitch. 2.5
- Q.6 a) I. A taper pin of length 80mm has a taper length of 48mm. the larger diameter of taper is 80mm and the smaller diameter is 70mm determine the angle to which the compound rest should be set up and the tail stock setting over distance 3
- II. Differentiate between motion of cross slide and compound rest. 2
- b) How drills are classified? Explain. 5

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