

17553

21819

4 Hours / 100 Marks

Seat No.

--	--	--	--	--	--	--	--

- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
 - (8) Use of Design Data Book, logarithmic chart is permitted.

Marks

- 1. a) Attempt any THREE of the following:** **12**
- (i) Designate the following materials as per DS:
 - 1) FG 300
 - 2)) X20Cr18NiZ
 - (ii) Compare rigid and flexible coupling on the basis of purpose, alignments, deflection and cost.
 - (iii) Write the advantages and disadvantages of welded joints.
 - (iv) Define stress concentration. What are its causes?
 - (v) State and explain the types of loads.

P.T.O.

b) Attempt any ONE of the following:

6

- (i) Discuss the design procedure of circumferential lap joint for a Boiler.
- (ii) A wall bracket is attached to a wall by means of four bolts, two at a distance of 50 mm from the lower edge and remaining two at a distance of 450 mm from the lower bolts. It supports a load of 50 kN at a distance of 500 mm from the wall, sketch the arrangements and estimate the diameter of bolts. Assume safe working stress in tension as 80 N/mm^2 .

2. Attempt any TWO of the following:

16

- a) An overhang crank with pin and shaft is shown in Fig. No. 1. A tangential load of 15 kN acts on the crank pin. Determine the maximum principal stress and the maximum shear stress at the centre of the crankshaft bearing.

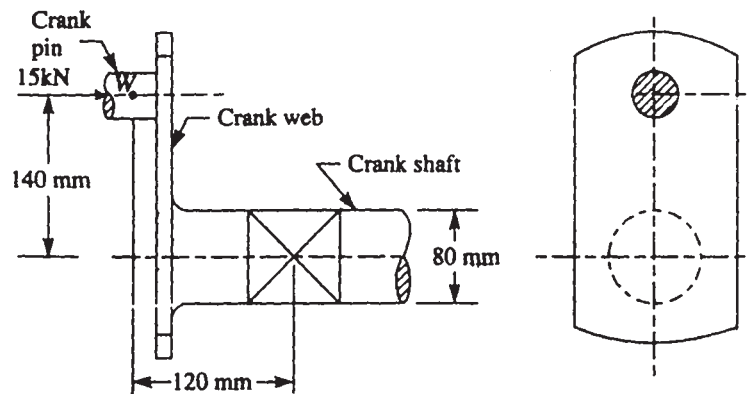


Fig. No. 1

- b) A shaft 800 mm long is supported between two bearings. A 200 mm diameter pulley is keyed to the shaft at a distance of 300 mm from the left bearing. The pulley receives 5 kW at 900 rpm. Take overload of 25%. The angle of contact of pulley and belt is 180° . The pulley weights 300 N the coefficient of friction between the belt and pulley is 0.14. Find suitable diameter of shaft. Assume $K_m = 1.5$ and $K_t = 2.0$.

- c) (i) Explain the procedure for designing an axially loaded unsymmetrical welded section.
- (ii) A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa.

3. Attempt any TWO of the following:

16

- a) Write the design procedure of protected type of flange coupling.
- b) Design an oval 1 flanged pipe joint for a pipe having 50 mm bore. It is subjected to an internal fluid pressure of 7 N/mm^2 . The maximum tensile stress in the pipe material is not to exceed 20 MPa and in the bolts 60 MPa
- c) A cantilever truss of 3m span is loaded as shown in Fig. No. 2. Find the forces in the various members of the framed truss. Use method of joints.

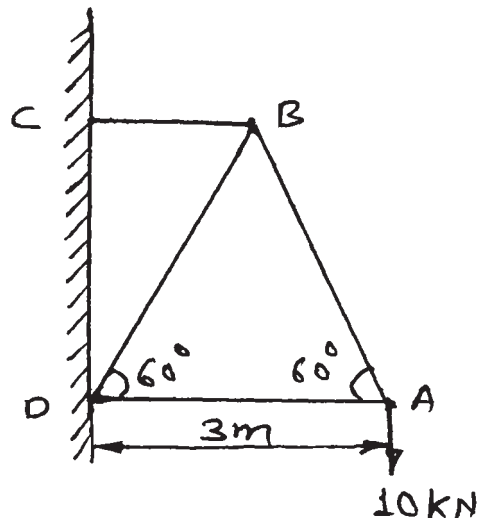


Fig. No. 1

4. a) **Attempt any THREE of the following:** **12**
- (i) Define factor of safety for brittle material. In what cases the value of factor of safety is taken as high?
 - (ii) State the factors that govern the selection of material while designing a machine components.
 - (iii) What is the effect of keyway on the strength of shaft?
 - (iv) A seamless pipe carries 2400 m^3 of steam per hour at a pressure of 1.4 N/mm^2 . The velocity of flow is 30 m/s . Assuming the tensile stress as 40 MPa , find the inside diameter of the pipe and its wall thickness.
- b) **Attempt any ONE of the following:** **6**
- (i) Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kw at 120 rpm . The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3 the shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa .
 - (ii) Determine the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded to another plate by means of:
 - 1) Single transverse weld and
 - 2) Double parallel fillet welds when the joint is subjected to variable loads

5. Attempt any TWO of the following:

16

- a) A steam boiler is to be designed for a working pressure of 2.5 N/mm^2 with its inside diameter 1.6 m. Give the design calculations for the longitudinal joint for the following working

Stresses for steel plates and rivets

In tension = 75 MPa.

In shear = 60 MPa.

In crushing = 125 MPa.

- b) A m.s. cover plate is to be designed for an inspection hole in the shell of a pressure vessel. The hole is 120 mm in diameter and the pressure inside the vessel is 6 N/mm^2 . Design the cover plate along with the bolts. Assuming allowable tensile stress for mild steel as 60 MPa and for bolt material as 40 MPa. Take thickness of pressure vessel = 10 mm.
- c) The truss ABC shown in Fig. No. 3 has a span of 5 meters. It is carrying a load of 10 kN at its apex. Find the forces in the member AB, AC and BC. Use method of joint.

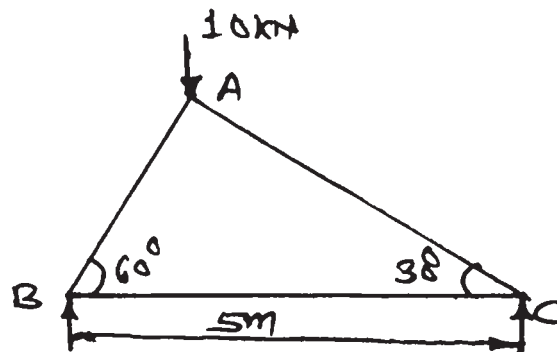


Fig. No. 3

6. Attempt any FOUR of the following:**16**

- a) Explain strength equations for double parallel fillet welds with neat sketch.
 - b) Explain strength equations for transversel fillet welds with sketch.
 - c) Explain the terms used in riveted joints:
 - (i) Caukling
 - (ii) Fullering
 - d) What is meant by bolts of uniform strength and explain?
 - e) What are the assumptions made while finding out the forces in the members of a perfect frame?
 - f) What is a frame and discuss its classification?
-