Total No. of Questions—12] [Total No. of Printed Pages—7

**[3762]-217**

**S.E. (Production/Production S/W/Industrial Engineering)**

**(Second Semester) EXAMINATION, 2010**

**DESIGN OF MACHINE ELEMENTS**

**(2008 COURSE)**

**Time : Three Hours** **Maximum Marks : 100**

***N.B.*** :— (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

## SECTION I

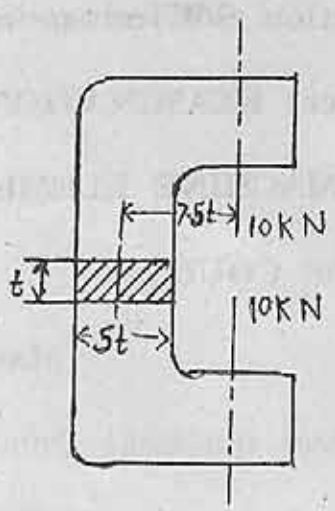
**1.** (*a*) What are the different design consideration used in design of any component ? [6]

(*b*) Write a short note on sources of design data. [4]

(*c*) A 'C' frame subjected to a load of 10 kN is as shown in Fig. It is made of Gray cast iron with allowable stresses of

P.T.O.

120 kN/mm$^2$. Determine the dimensions of cross-section of frame. [8]




*Or*

**2.** (*a*) Draw the neat sketch of cotter joint. [4]

(*b*) Write a short note on factor of safety. [4]

(*c*) A right-angle bell-crank lever is designed to raise a load of 5 kN at the short arm end. The length of short and long arm are 100 and 450 mm respectively. The lever pin and the pins are made up of steel 30C8 ($S_{yt}$ = 400 N/mm$^2$) and the factor of safety is 5. The permissible bearing pressure on the pin is 10 N/mm$^2$. The lever was rectangular cross-section the ratio of width to thickness is 3 : 1. The length to diameter ratio of fulcrum pin is 1.25 : 1.

Calculate :

(*i*) Diameter and length of fulcrum pin.

(*ii*) The shear stress in pin.

(*iii*) The dimensions of the boss of lever at the fulcrum.

(*iv*) The dimensions of the cross-section of lever.

Assume that the arm bending moment on the lever extends up to the axis of fulcrum. [10]

**3.** (*a*) Explain the A.S.M.E. code for the design of shaft. [4]

(*b*) Design a muff coupling to connect two mild steel shaft to transmit 35 kW at 1440 r.p.m. The C.I. sleeve connects the shafts through two mild steel sunk keys. The maximum torque transmitted is 25 percentage greater the torque. Material properites are :

(*i*) Allowable shear stress for cast iron is 15 $N/mm^2$.

(*ii*) Allowable shear stress for mild steel is 65 $N/mm^2$.

(*iii*) Allowable crushing stress for mild steel is 160 $N/mm^2$.

Assume the necessary data if required. [12]

*Or*

**4.** A mild steel shaft transmits 23 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearing 2.5 m apart. Determine the size of shaft if allowable shear stress is 42 MPa and the maximum tensile and compressive stress not exceed 56 MPa. What is size of shaft required, if it is to be required to gradually applied load. Assume the gradually applied load, $k_b = 1.5$, $k_t = 1$. [16]

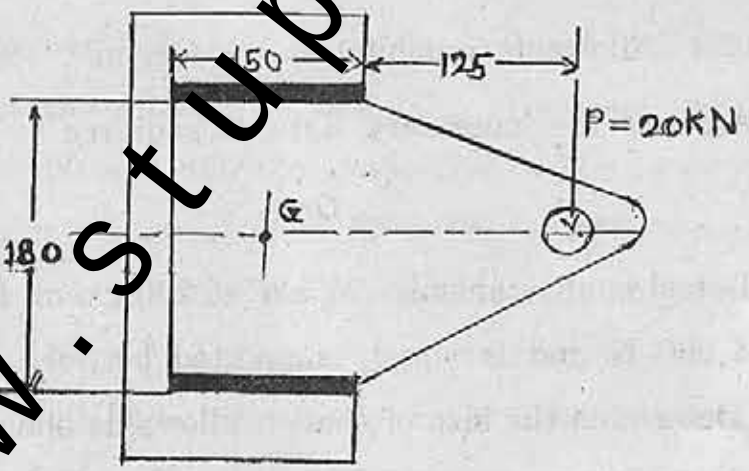
5. (*a*) Draw the basic types of screw fasteners. [6]

(*b*) An M20 bolt with coarse thread is used in pressure vessel to make a joint fluid tight the coefficient of friction is 0.15. Determine the initial tension required in the bolt to make the joint fluid tight and the torque to be applied on wrench to required initial tension. [10]

*Or*

6. (*a*) Compare the threaded and welded joints. [6]

(*b*) A bracket is welded to a column is as shown in fig. Determine the size of weld if permissible shear stress in the weld is 80 N/mm$^2$. [10]



## SECTION II

7. (*a*) With a neat sketch describe different forms threads. [6]

(*b*) The lead screw of lathe has acme threads of 60 mm outside diameter and 8 mm pitch. It supplies drive to a tool carriage which needs an axial force of 2000 N. A collar bearing with inner outer radius as 30 mm and 60 mm respectively is provided The coefficient of friction for screw threads is 12 and for collar it is 0.1. Find the torque required drives the screw and the efficiency of the screw. If the lead screw rotate at 30 r.p.m., find the power required to drive the screw. [10]

*Or*

8. (*a*) Draw the neat sketch of the screw jack. [6]

(*b*) A steel screw driving the bronze nut is to develop an axial load of 300 kN in an extrusion press. The screw is having single starts square threads with an outside diameter 100 mm and a lead of 16 mm. Determine the nut length if the bearing pressure between screw and nut thread is no exceed 16 N/mm$^2$. The shear stress in the nut threads is not to be exceed 28 N/mm$^2$. [10]

**9.** (*a*) What are the different types of spring used in machine design along with application. [6]

(*b*) It is required to design a helical compression spring with plan end, for carrying a maximum static force of 1000 N. The allowable shear stress and modulus of rigidity for spring material is 400 N/mm$^2$ and 85 N/mm$^2$ respectively. The spring rate is 48 N/mm$^2$. If the spring index is 5, determine wire diameter, total number of coils, free length and pitch. [10]

*Or*

**10.** (*a*) Write a short note on Wahl stress factor. [6]

(*b*) A mechanism used in printing machinery consists of tension spring assembled with pre load of 30 kN. The wire diameter of spring is 2 mm with spring index of 6. The following spring has 18 active coils. The spring wire is hot drawn and hot tempered having the following properties :

(*i*) Design shear stress = 680 N/mm$^2$

(*ii*) Modulus of rigidity = $8 \times 10^4$ N/mm$^2$, determine initial shear stress in the wire.

The spring rate and the maximum spring force that can take. [10]

**11.** (*a*) Define the ergonomics and state its objectives. [4]

(*b*) State the general guidelines in designing control panels and layout display. [6]

(*c*) Design the dash board if Luxury car considering ergonomics and aesthetic consideration. [8]

*Or*

**12.** (*a*) Write a short note on design for manufacturing. [6]

(*b*) What are the guidelines followed in design of the parts for the following processes :

(*i*) Casting

(*ii*) Forging

(*iii*) Welding

(*iv*) Powder metallurgy

(*v*) Machining. [12]