Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[4062]-137

S.E. (Production/Production S/W) (II Sem.) EXAMINATION, 2011

DESIGN OF MACHINE ELEMENTS

(2008 PATTERN)

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*) Use of electronic pocket calculator is allowed.

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

SECTION I

1. (*a*) Explain need of standards in design and list down various standards. [6]

(*b*) What are the requisites of Design Engineer ? [4]

(*c*) A cantilever beam of rectangular cross-section is used to support a pulley as shown in Fig. 1. The tension in the wire rope is 5 kN. The beam is made of CI FG200 and the factor of safety is 2.5. The ratio of depth to width of the cross-section is 2.

Determine the dimensions of the cross-section of the beam. [8]

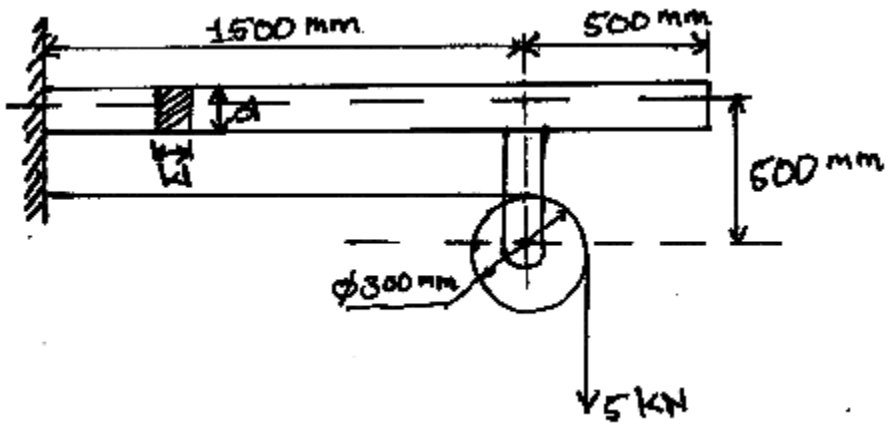

Fig. 1

Or

2. (*a*) What is factor of safety ? Why is it necessary to use ? [4]

(*b*) Design a cotter joint to transmit a load of 100 kN in tension or compression. Assume the following stresses for socket, spigot and cotter :

(1) Allowable tensile stress = 90 N/mm^2

(2) Allowable crushing stress = 170 N/mm^2

(3) Allowable shear stress = 60 N/mm^2. [14]

3. (*a*) A steel shaft made of 40C8 is used to drive a machine. The pulleys X, Y and bearing A and B are located as shown in Fig. 2. Belt tensions are also shown in Fig. 2. Determine the diameter of the shaft using A.S.M.E. code. Yield strength of shaft material is 330 N/mm^2 and ultimate tensile strength is

600 N/mm^2. Take K_b = 1.5 and K_t = 1.2. If the rectangular key is made of the same material, design the key. [12]

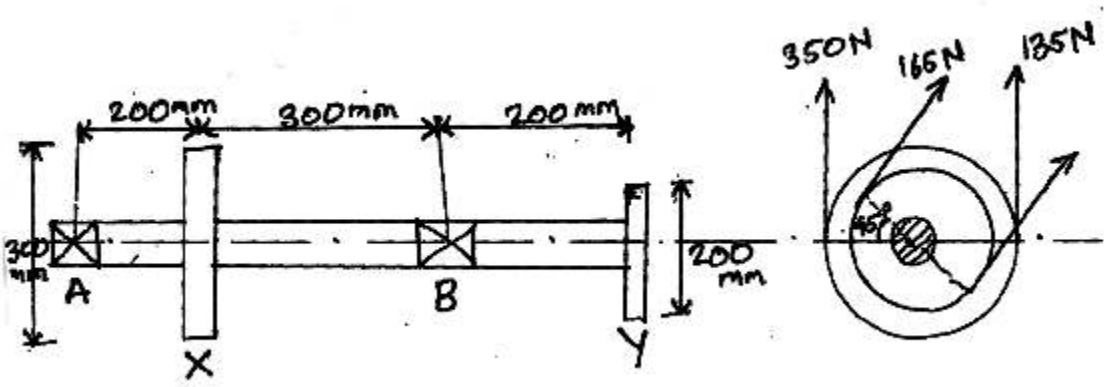

Fig. 2

(*b*) Explain design of shaft based on torsional rigidity. [4]

Or

4. (*a*) It required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. The service factor for the application is 1.5 i.e. The design torque is 1.5 times of rated torque, design the coupling and specify the dimensions of its components also. Material is given by :

(1) Shafts 40C8 (S_{yt} = 380 N/mm^2) FOS 2.5

(2) Key and bolts 30C8 (S_{yt} = 400 N/mm^2) FOS – 2.5

(3) Flanges FG200 (S_{ut} = 200 N/mm^2) FOS – 6. [12]

(*b*) Write a short note on Muff coupling. [4]

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

(*b*) A steel plate is subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts is shown in Fig. 3. The bolts are made of plain carbon steel 45C8 with yield strength 380 N/mm^2. If the required factor of safety is 2, determine the diameter of bolts. [10]

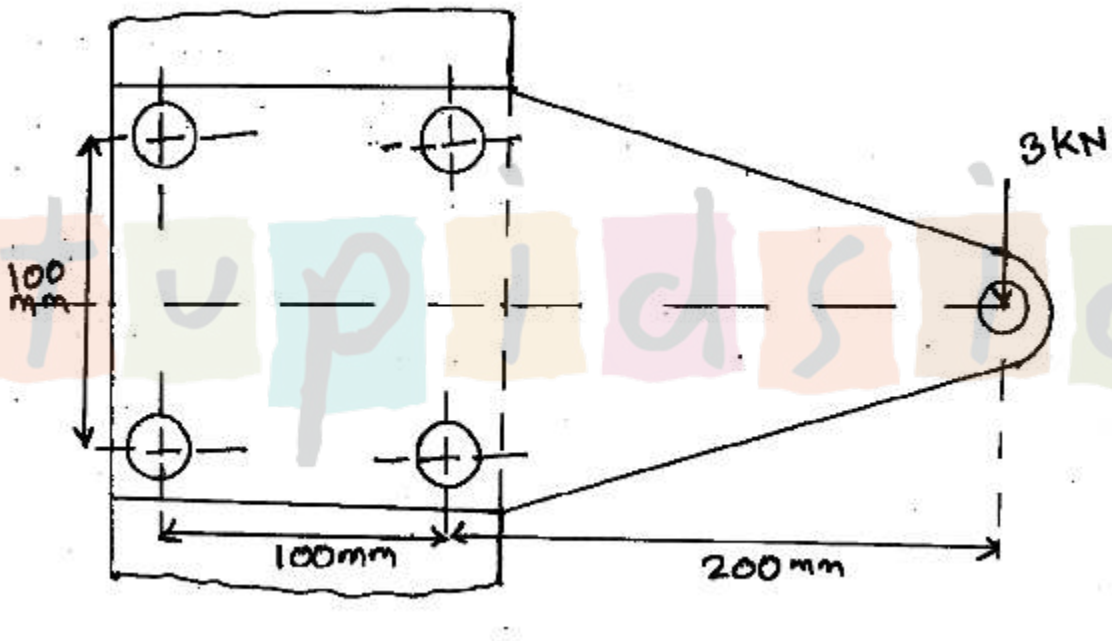

Fig. 3

Or

6. (*a*) State advantages and limitations of the welded joints over threaded joints. [4]

(*b*) A welded connection as shown in Fig. 4. is subjected to an eccentric load of 25 kN. The welding is only on one side. If the permissible shear stress for the weld material is 55 MPa, determine the weld size. [12]

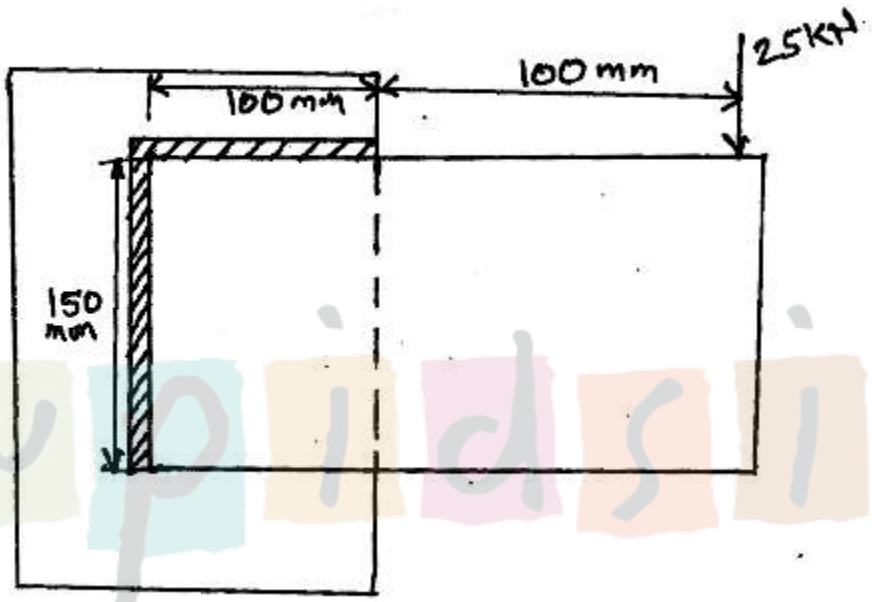

Fig. 4

SECTION II

7. (*a*) Derive the expression for :

(1) Torque required to raise the load against thread friction.

(2) Torque required to lowering the load against thread friction. [6]

(*b*) A steel screw driving a bronze nut is to develop an axial load of 300 kN in an extrusion press. The screw is having single start square threads with an outside diameter of 100 mm and a lead of 16 mm. Determine the nut length if the bearing pressure between screw and nut threads is not to exceed 16 N/mm^2 and shear stress in the nut threads is not be exceed 28 N/mm^2. [10]

Or

8. A 26 × 5 square threaded, single start power screw is used to support a load of 12 kN. The effective diameter of the collar is 46 mm and the coefficient of friction is 0.15. The nut is made of phosphor bronze having 0.12 as coefficient of friction and 6 MPa as allowable bearing pressure. The length of the handle is 300 mm. Calculate :

(1) The force required to raise the load.

(2) The force required to lower the load.

(3) The yield strength of material for a factor of safety of 4.

(4) The overall efficiency of the screw, and

(5) The number of threads in nut. [16]

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

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

– Design shear stress = 680 N/mm^2

– Modulus of rigidity = 8×10^4 N/mm^2.

Determine :

(1) The initial shear stress in the wire.

(2) The spring rate, and

(3) The maximum force the spring can take. [10]

Or

10. Design a helical compression for a spring operated pressure relief valve with the following data :

(1) Operating pressure = 1.25 N/mm^2

(2) Valve lift = 3.5 mm at 10% pressure rise over operating pressure

(3) Diameter of valve = 25 mm

(4) Limiting mean coil diameter = 40 mm

(5) Permissible shear stress for spring = 500 N/mm^2

(6) Modulus of rigidity for spring material is = 834 Pa

(7) The available standard spring wire diameters are :

2, 3, 4, 5, 6, 7, 8 and 10 mm. [16]

11. (*a*) What is design for appearance ? [6]

(*b*) Explain the role of the following aspects in the aesthetic design :

(1) Symmetry

(2) Colour

(3) Contrast

(4) Balance

(5) Material

(6) Variety. [12]

Or

12. (*a*) What is concurrent engineering ? What is its significance in the product design ? [6]

(*b*) What is design for manufacturing ? Explain the general principles to be followed while designing the parts for manufacturing. [6]

(*c*) What design for Assembly ? Explain general principles to be followed while designing the parts for Assembly. [6]