C 1159 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. [ENGINEERING] (09 SCHEME) DEGREE EXAMINATION, APRIL 2016

ME/PTME/AM 09 603—MACHINE DESIGN—I

Time : Three Hours Maximum : 70 Marks

(Use of design data book permitted, assume data wherever necessary)

Part A

Answer **all** *questions.*

1. Defme the term transition fit.
2. What is meant by hole basis system ?
3. Differentiate chain riveting and zigzag riveting.
4. Define the terms: (i) spring index ; (ii) free length.
5. Classify shaft couplings.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. A rectangular plate 70 mm wide with the semicircular groove of 12 mm radius is subjected to a tensile load 10 kN. Determine the thickness taking allowable stress as 120 MPa.
2. A bar of rectangular cross section 30 mm × 50 mm and 300 mm long is resting on the ground in an upright position. It is subjected to an impact load of 1.5 kN that falls on to it from a height of 10 mm. Determine the maximum stress induced.
3. A bolt in a steel structure is subjected to a tesile load of 9 kN and the initial tightening load on bolt is 5 kN. Determine the size of the bolt taking allowable stress as 80 MPa for the bolt.
4. A railway car weighing 20 kN and moving with a velocity of 15 kmph is stopped by a buffer consisting of 4 helical springs having mean coil diameter 160 mm and a spring index of 8. Find the compression of thc spring.
5. Derive the deflection equation for helical spring.
6. A rectangular cross-section key 8 × 7 × 36 is used to transmit 6 kW at 1200 rpm. The shaft diameter is 30 mm. If the allowable shear stress and crushing stress for key material are 60 MPa and 135 MPa respectively, find whether key is safe or not.

(4 × 5 = 20 marks)

Turn over

Part C

Module I

1. An MS shaft having yield stress as 232 MPa is subjected to the following stress σ_x = 120 MPa, σ_y = –60 MPa and τ_{xy} = 36 MPa. Find the factor of safety using (i) Rankine theory of failure ; (ii) Guest's theory of failure ; and (iii) Von — Mises theory of failure.

Or

2. A steel rod with Ultimate stress 1090 MPa, Yield stress 428 MPa and endurance limit 428 MPa is subjected to a tensile load that fluctuates between 40 Mpa and 120 MPa. Find the safe diameter of the rod using Soderberg's criterion. Adopt a factor of safety = 2. Stress concentration factor = unity. The load, size and surface factors may be taken as 0.75, 0.85 and 0.91 respectively.

Module II

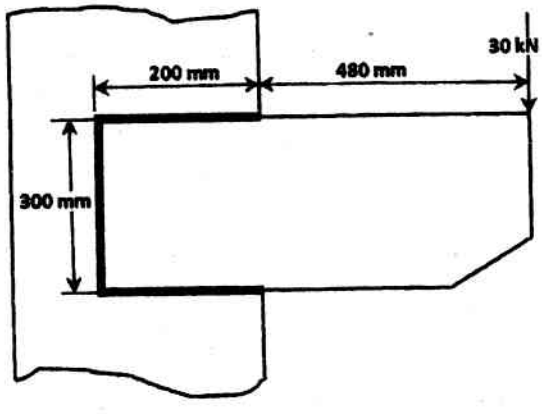
3. A 100 kN screw jack with a maximum extension of 200 mm has single start square threads. Allowable compressive stress is 35 MPa, allowable bearing pressure on the threads is 17.5 MPa. Find (i) The size of the screw ; (ii) Size of collar and nut ; (iii) Torque required to raise the load ; and (iv) Efficiency of screw jack.

Or

4. Design a Lozenge joint to connect two MS plates of 12 mm thick and to carry a load of 400 kN. The allowable stresses are : tensile stress = 100 MPa, shear stress = 60 MPa and compressive stress = 160 MPa.

Module III

5. Determine the size of the weld for a bracket loaded as shown in fig. below. The allowable shear stress in the weld is 60 MPa.



Or

6. Design a helical compression spring for a spring loaded safety valve for the following data :

Operating pressure	=	1MPa.
Maximum pressure when the valve blows off freely	=	1.1 MPa.
Maximum lift of valve when the pressure is 1.1 MPa	=	6 mm.
Diameter of valve seat	=	100 mm
Maximum shear stress	=	360 MPa.
Modules of rigidity	=	84 GPa
Spring Index	=	5.5

MODULE IV

7. A machine shaft turning at 600 rpm is supported on bearings 0.75 m apart. 15 kW is supplied to the shaft through a 0.45 m pulley located 0.25 m to the right of the right bearing. The power is transmitted from the shaft through a 0.2 m spur gear located 0.25 m to the right of the left bearing. The belt drive is at an angle of 60° above the horizontal. The pulley weighs 900 N. The ratio of belt tension is 3. The gear has 20° pressure angle and meshes with another gear located directly above the shaft. Design the shaft.

Or

8. Design a solid flange coupling for connecting turbine shafts, transmitting 4 MW power at 2400 rpm. The permissible shear stresses for shafts and bolts are 90 MPa and 80 MPa respectively. Assume the other stresses suitably.

(4 × 10 = 40 marks)