

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)**

Term-End Examination

June, 2019

00652

BME-024 : MECHANICAL ENGINEERING DESIGN

Time : 3 hours

Maximum Marks : 70

Note : Question no. 1 is compulsory. Answer total five questions. All questions carry equal marks. Assume the missing data, if any. Standard notations and symbols have usual meaning.

1. (a) Name the discrete steps of design.
- (b) Define stress concentration and stress concentration factor.
- (c) Explain endurance limit.
- (d) What types of joints are used in a boiler for longitudinal and circumferential joints ?
- (e) Define equivalent bending moment and equivalent torque. State upon which theories of failure they depend.
- (f) Describe interference in gears.
- (g) What are the various functions to be performed by CAD ? 7×2=14

2. (a) List the assumptions made in simple theory of bending.
- (b) How is bending moment at a section of beam related to the stress on that section ? Show the distribution of bending stress on a section.
- (c) A circular shaft of 80 mm diameter is simply supported over a span of 3 m. A concentrated load acts upon the beam at a distance of 750 mm from the centre towards left of the centre. Calculate bending stress in the middle section at a distance of 40 mm and 80 mm along vertical diameter. 4+4+6
3. (a) For a screw of $d_1 = 17$ mm, $p = 5$ mm, $d = 22$ mm, subjected to axial compression of 6000 N, calculate the maximum shearing stress and bearing pressure between the thread of screw and nut. Also calculate the factor of safety in compression of screw, shearing of screw and bearing pressure if $\sigma_{ult} = 320$ N/mm², $\tau_{ult} = 120$ N/mm², maximum pressure = 15 N/mm². Take $\mu = 0.15$. There are 5 threads in the nut.

- (b) What do you understand by eccentric loading of a riveted joint ? Explain with the help of sketch.

10+4

4. (a) How is the buckling of spring checked ? Discuss in brief.

- (b) A helical torsion spring with short hook ends is required to twist through half turn under application of a torque of 0.08 N-m. The spring is made of steel wire in which permissible bending stress is 1200 MPa. Assume a spring index of 12 and modulus of elasticity of 200 GPa to calculate wire diameter, mean diameter of spring, number of turns and spring constant in N-mm/turn.

4+10

5. (a) Mention the factors that will affect power to be transmitted by leather belt. How are the factors considered in selection of the belt ?

- (b) A shaft is required to transmit a power of 40 kW at 300 rpm. The force analysis due to attached parts results in BM of 900 N-m at a section between bearings. If permissible stresses in the shaft are 50 N/mm² in bending and 30 N/mm² in shear, calculate the diameter of the shaft.

5+9

6. (a) Comment upon materials of which gears are made. Which material is commonly used and why ?

(b) A pinion of 150 mm pitch running at 1200 rpm transmits 8 kN of power to a gear whose pitch diameter is 450 mm. For straight tooth the angle of pressure is

(i) 20°

(ii) $14\frac{1}{2}^\circ$

Determine the tangential force, the transverse or bending force on the shaft and torques on driver and driven shafts for

(i) and (ii). 4+10

7. (a) Explain the two types of sliding contact bearings.

(b) A full journal bearing 200 mm in diameter and 300 mm long is to support a radial load of 40 kN at an operating speed of 900 rpm. It is to operate at Sommerfeld number of 0.08 when radial clearance is 0.2 mm. Determine the viscosity of oil to be used. Determine the coefficient of friction and power loss. 4+10