

Code : 021615

B.Tech 6th Semester Exam., 2018

DESIGN OF MACHINE ELEMENTS

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct option (any seven) 2×7=14

- (a) Steels used for automobile bodies and hoods are
 - (i) medium carbon steel
 - (ii) mild steel
 - (iii) high carbon steel
 - (iv) alloy steel
- (b) Material used for self-lubricated bearing is
 - (i) acetal
 - (ii) polyurethane
 - (iii) polytetrafluoroethylene (Teflon)
 - (iv) Any one of the above

(c) In forged components

- (i) fiber lines are arranged in a predetermined way
- (ii) fiber lines of rolled stock are broken
- (iii) there are no fiber lines
- (iv) fiber lines are scattered

(d) When a circular shaft is subjected to torque, the torsional shear stress is

- (i) maximum at the axis of rotation and zero at the outer surface
- (ii) uniform from axis of rotation to the outer surface
- (iii) zero at the axis of rotation and maximum at the outer surface
- (iv) zero at the axis of rotation and zero at the outer surface and maximum at the mean radius

(e) The thermal stresses are caused due to

- (i) variation in temperature
- (ii) high temperature
- (iii) specific heat
- (iv) latent heat

(3)

- (f) A stress that varies in sinusoidal manner with respect to time from tensile to compressive (or vice versa) and with zero mean is called
- (i) reversed stress
 - (ii) fluctuating stress
 - (iii) repeated stress
 - (iv) varying stress
- (g) In order to find the endurance limit, the rotating beam specimen is subjected to
- (i) repeated stresses
 - (ii) reversed stresses
 - (iii) fluctuating stresses
 - (iv) maximum stress
- (h) In design of screw jack from buckling considerations, the end conditions are assumed as
- (i) both ends are hinged
 - (ii) both ends are fixed
 - (iii) one end fixed and other hinged
 - (iv) one end fixed and other free

(Turn Over)

(4)

- (i) In the running condition, the net force acting on the drum of centrifugal clutch is equal to
- (i) the centrifugal force on shoe
 - (ii) the centrifugal force on shoe minus spring force
 - (iii) the centrifugal force on shoe plus spring force <http://www.akubihar.com>
 - (iv) the spring force
- (j) The maximum shear stress in spring wire is induced at
- (i) inner surface of the coil
 - (ii) outer surface of the coil
 - (iii) central surface of the coil
 - (iv) end coils
2. (a) What are the factors to be considered for selection of engineering materials for a machine component? Discuss the important manufacturing considerations in machine design. 7
- (b) How will you select direction of fiber lines in forged components? 7

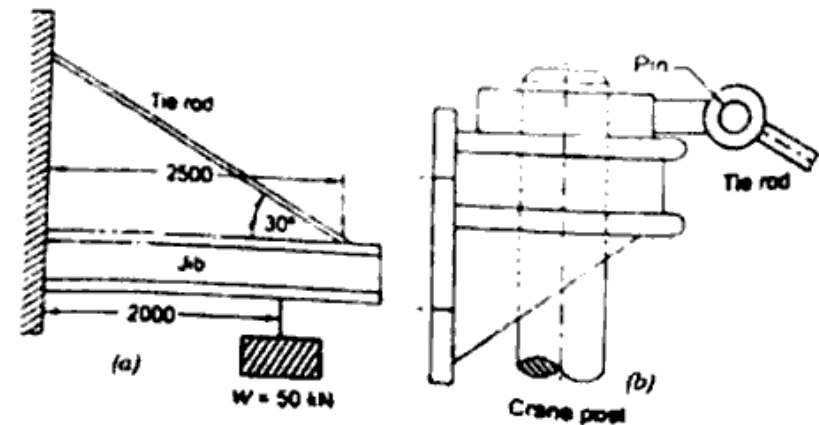
(Continued)

3. The force acting on a bolt consists of two components—an axial pull of 12 kN and a transverse shear force of 6 kN. The bolt is made of steel having $S_{yt} = 310 \text{ N/mm}^2$ and factor of safety is 2.5. Determine the diameter of the bolt using the maximum shear stress theory of failure. 14
4. A rotating bar made of steel having $S_{ut} = 620 \text{ N/mm}^2$ is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 310 N/mm^2 . Calculate the fatigue strength of the bar for a life of 1,00,000 cycles. 14
5. A forged steel bar of 55 mm diameter is subjected to a reversed bending stress of 260 N/mm^2 . The bar is made of 40C8 steel ($S_{ut} = 610 \text{ N/mm}^2$). Calculate the life of the bar for a reliability of 90%. 14
6. A transmission shaft carries a pulley midway between the two bearings. The bending moment at the pulley varies from 200 N-m to 600 N-m, as the torsional moment in the shaft varies from 70 N-m to 200 N-m. The frequencies of variation of bending and

torsional moments of steel FeE 400 ($S_{yt} = 400 \text{ N/mm}^2$ and $S_{ut} = 540 \text{ N/mm}^2$).

The corrected endurance limit of the shaft is 210 N/mm^2 . Determine the diameter of the shaft using a factor of safety of 2.5. 14

7. The layout of a wall crane and the pin-joint connecting the tie-rod to the crane post is shown in the figures (a) and (b) respectively. The tension in the tie rod is maximum, when the load is at a distance of 2 m from the wall. The tie-rod and the pin are made of steel having $S_{yt} = 250 \text{ N/mm}^2$ and factor of safety is 3.0. Determine the diameter of the tie-rod and the pin. 14



8. A gearbox weighing 6 kN is provided with a steel eyebolt for lifting and transporting on the shop floor. The eyebolt is made of 30C8 steel ($S_{yt} = 380 \text{ N/mm}^2$) and factor of safety is 5. Determine the nominal diameter of the eyebolt having coarse threads if $d_c = 0.8d$ where d_c and d are the core and major diameters respectively. 14
9. A cylindrical pressure vessel with a 0.8 m inner diameter is subjected to an internal steam pressure of 2 MPa. The permissible stresses for cylinder plate and rivets in tension, shear and compression are 80, 60 and 120 N/mm^2 respectively. The efficiency of longitudinal joint can be taken as 80% for calculating the plate thickness. The corrosion allowance is 2 mm. The efficiency of circumferential lap joint should be at least 62%. Design the circumferential lap joint and calculate the thickness of plate, diameter of the rivets, number of rivets and pitch of rivets. 14

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