

TE-VI | Engg. Design / 10-12-14 / PROD



QP Code : 14970

TIME- 3 Hrs

Total Marks - 80

- N.B. :
1. Question No 1 is compulsory
 2. Attempt any **Three** questions from the remaining five questions.
 3. Assume any **suitable data** if necessary with justification.
 4. Figures to the right indicate full marks.
 5. Use of design data books such as PSG, Mahadevan are permitted.
 6. Draw neat sketches to support your answer wherever necessary.

Q.1 Attempt any four of the following questions.

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- a) What is factor of safety? Discuss various factors to be considered while selecting the factor of safety.
- b) Explain Aesthetic and Ergonomic considerations in design.
- c) Explain Prestressing, Relaxation and Surging in springs.
- d) Explain general design methodology with an example.
- e) What are the advantages and disadvantages of riveted joints over welded joints?

Q. 2 a) A line shaft supported on bearings located at 900 mm apart, carries two pulleys 'A' and 'B'. Pulley 'A' weighing 40 N and of diameter 250 mm is mounted in between the bearings, at the centre. Pulley 'B' weighing 75 N and of diameter 450 mm is mounted overhanging at a distance of 250 mm to the right of right hand bearing. Power is supplied to the shaft from a motor by means of a vertical belt drive through pulley 'A' and is subsequently removed through pulley 'B' with the help of a horizontal belt drive. The tensions in the tight and slack sides of the belts on pulley 'A' are 2700 N and 900 N respectively while those on pulley 'B' are 1500 N and 500 N respectively on its tight and slack sides. Selecting suitable material and stresses determine the shaft diameter.

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b) A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm². Calculate the tangential and radial stresses at the inner, middle (radius=125mm) and outer surfaces.

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TURN OVER

Q. 3 a) Design a Socket and spigot type of cotter joint to resist safely a tensile load of 30 KN. Take suitable material and stresses for different parts of the joint 12

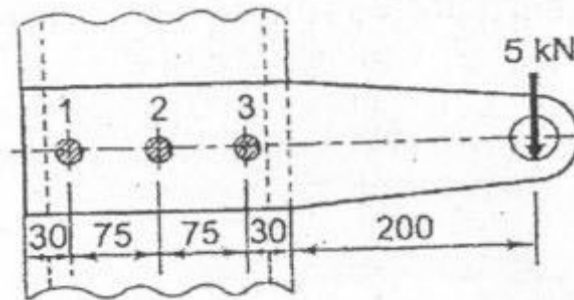
b) A truck spring has 12 numbers of leaves 2 of which are full length leaves. The spring supports are 1 m apart and the central band is 70 mm wide. The central load is to be 6 KN with permissible stress of 200 MPa. Determine the thickness, width and deflection of the spring leaves if the total depth to width ratio of spring is 3, use $E=210$ GPa. 08

Q.4 a) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.6 m in diameter subjected to a steam pressure of 0.92 N/mm^2 . Assume joint efficiency as 80 %, allowable tensile stress in the plate 80 MPa, Compressive stress 130 MPa and shear stress in the rivet 60 MPa. 10

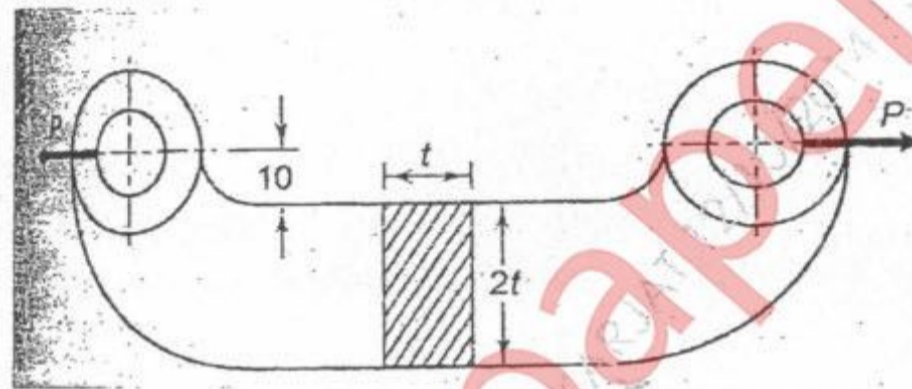
b) The parallel sides of the trapezoidal cross section of a crane hook of capacity 60 KN are 120 mm and 70 mm, the depth of section being 100 mm. The radius of curvature of the inner fiber is 130 mm. Determine the total stresses at the extreme fibers of the cross section. 10

Q.5 a) Design a spur gear pair required to transmit 45 kW at a pinion speed of 900 rpm. The velocity ratio is 3:1. The teeth are 20° full-depth involute with 18 teeth on the pinion. Both the pinion and gear are made of steel with a maximum safe static stress of 180 MPa. Take face width as 10 times the module. Tooth form factor $y = 0.154 - (0.912)/n$, n = Number of teeth
Velocity factor = $3/(3+V)$ where V - The pitch line velocity in m/sec. 10

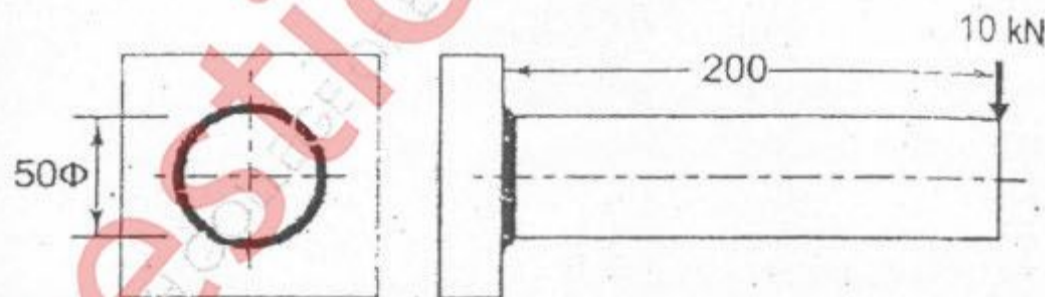
b) A steel plate subjected to a force of 5 KN and fixed to a channel by means of three identical bolts is shown in Fig. The bolts are made of plain carbon steel 45C8 and factor of safety is 3. Find the size of the bolts. 10



Q.6 a) An offset link subjected to a force of 25 kN is shown in figure. It is made of grey cast iron FG300 and the factor of safety is 3. Determine the dimensions of the cross-section of the link. 06



b) A circular shaft, 50 mm in diameter, is welded to a support by means of a fillet weld as shown in Fig. Determine the size of weld, if the permissible shear stress in the weld material is limited to 100 N/mm^2 08



(All Dimensions are in mm)

c) Explain different types of keys with their applications. 06