

Total No. of Questions : 10]

SEAT No. :

P3374

[Total No. of Pages : 3

[5253] - 514

**T.E. (Mechanical Sandwich)
MACHINE DESIGN
(2015 Pattern) (Semester - I)**

Time :3 Hours]

[Max. Marks :70

Instructions to the candidates:

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) *Figures to the right indicate full marks.*

Q1) a) Explain the stress concentration causes and remedies? **[4]**

b) With neat sketch explain the Modified Goodman Approach? **[6]**

OR

Q2) Two rods are connected by Knuckle Joint. The axial force P acting in rod is 25 kN. The rod and pin are made of plain carbon steel 45C8 ($S_{yt} = 380 \text{ N/mm}^2$) and factor of safety is 2.5. The yield strength shear is 57.7% of yield strength in tension. Calculate **[10]**

a) Diameter of rod

b) Diameter of pin

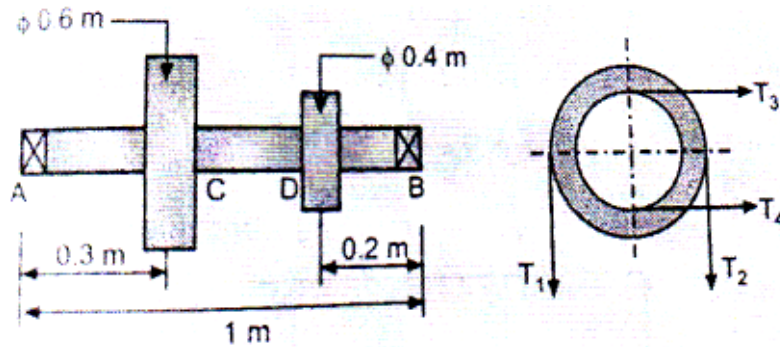
Q3) a) Explain self-locking and Overhauling of power screw. **[5]**

b) Explain in detail springs are in series and parallel. **[5]**

OR

Q4) A shaft is supported by two bearings placed 1m apart. A 600mm diameter pulley is mounted at a distance of 300mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400mm diameter is placed 200mm to the left of right hand bearing is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing stress of 42 MPa in shear for material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. **[10]**

P.T.O.



- Q5) a)** Explain different causes of gear tooth failure with remedial action [4]
- b) The P.C.D of spur pinion and gear are 100mm and 300mm respectively. The pinion is made of plain carbon steel 40C8 ($S_{ut} = 600 \text{ N/mm}^2$) while gear is made of Gr. C.I FG300. The pinion receives 5kW power at 500 rpm through its shaft. The service factor and factor of safety is 1.5 each. The face width of gear is ten times of module. If velocity factor accounts the dynamic load, calculate the module and the number of teeth on pinion and gear. Specify the surface hardness for a gear pair. ($k_m = 1$, 20° full depth involute system) [12]

OR

- Q6) a)** Explain the term effective load with reference of spur gear. How to estimate the effective load of spur gear tooth. [6]
- b) Define formative or virtual number of teeth on a helical gear. Derive the expression used to obtain its value. [6]
- c) What are the various forces acting on worm and worm gears? Explain in brief. [4]
- Q7) a)** Explain failure in rolling contact bearing with causes and remedial action. [4]
- b) A ball bearing operates on work cycle consisting of three parts: a radial load of 3000N at 720 rpm for 30% of the cycle, a radial load of 7000N at 1440rpm for 40% of the cycle and radial load of 5000N at 900rpm for remaining part of the cycle. The dynamic capacity of the bearing is 30700N. [12]

Calculate:

- i) The rating life of bearing in hours.
- ii) The average speed of rotation.
- iii) The life of bearing with 95 % reliability.

OR

- Q8)** a) Derive the stribecks equation for rolling contact bearing. [6]
b) A ball bearing subjected to a radial load of 5 kN, is expected to have a life of 8000 hours at 1450 rpm with a reliability of 99 %. Calculate the dynamic load capacity of the bearing, so that it can be selected from manufacturer's catalogue based on reliability of 90 %. [10]

- Q9)** a) It is stated that the speed at which a belt should be run to transmit maximum power is that at which the maximum allowable tension is three times the centrifugal tension in the belt at that speed. Prove the statement. [4]
b) Explain the different types of stresses induced in the wire ropes. [10]
c) Explain the polygon effect in case of chain drives. [4]

OR

- Q10)** a) Explain the procedure to select the V- belt from manufacturer's catalogue. [6]
b) Two parallel shafts whose centre lines are 4.8 m apart, are connected by an open flat belt drive. The diameter of the larger pulley is 1.5 m and that of smaller pulley 1 m. The initial tension in the belt when stationary is 3 kN. The mass of the belt is 1.5 kg / m length. The coefficient of friction between the belt and the pulley is 0.3. Taking centrifugal tension into account, calculate the power transmitted, when the smaller pulley rotates at 400 r.p.m. [12]

