

22484

22232

3 Hours / 70 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Illustrate your answers with neat sketches wherever necessary.
  - (3) Figures to the right indicate full marks.
  - (4) Assume suitable data, if necessary.
  - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

1. Attempt any FIVE of the following :

10

- (a) Enlist inversions of double slider crank chain.
- (b) State the types of followers on the basis of their shape.
- (c) Define angle of lap.
- (d) Draw stress-strain diagram for ductile material and label it.
- (e) Enlist four types of loads acting on machine element.
- (f) Give any four applications of cotter joint.
- (g) Define :
  - (i) Spring stiffness
  - (ii) Free length



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**2. Attempt any THREE of the following : 12**

- (a) Explain construction of crank and slotted quick return mechanism with neat sketch.
- (b) Differentiate between machine and mechanism.
- (c) Explain method of drawing displacement diagram for uniform velocity of follower during its application.
- (d) A pulley is driven by flat belt running at a speed of 600 m/min and transmits 4 kW. The co-efficient of friction between belt and pulley is 0.3 and angle of lap is  $160^\circ$ . Find maximum tension in belt.

**3. Attempt any THREE of the following : 12**

- (a) For a flat belt, prove that  $\frac{T_1}{T_2} = e^{\mu\theta}$ .
- (b) Explain epicyclic gear train with neat sketch.
- (c) State the following material specifications :
  - (i) 45 Cr 20Si2
  - (ii) Fe F230
  - (iii) 35C8
  - (iv) 10 C 8510
- (d) Explain steps involved in general design procedure.

**4. Attempt any THREE of the following : 12**

- (a) State the effect of slip on velocity ratio of belt. Also state the expressions for them.
- (b) Suggest suitable material for the following machine parts :
  - (i) Helical spring
  - (ii) Turbine blade
  - (iii) Lathe bed
  - (iv) Bushes for Knuckle joint

- (c) Prove that, for a square key, crushing stress is twice of shearing stress.
- (d) Define the following terms with respect to spring :
  - (i) Spring index
  - (ii) Spring rate
  - (iii) Free length
  - (iv) Solid height
- (e) Write the procedure for selection of bearing from manufacture's catalogue.

**5. Attempt any TWO of the following :**

**12**

- (a) Explain construction and working of elliptical trammel with neat sketch.
- (b) Draw the profile of cam operating a knife edge follower having a lift of 30 mm. The cam raises the follower with SHM for  $150^\circ$  of its rotation followed by a period of dwell for  $60^\circ$ . The follower descends for the next  $100^\circ$  rotation of one cam with uniform velocity again followed by a dwell period.

The cam rotates at an uniform velocity of 120 rpm and has a least radius of 20 mm.

- (c) Sketch protective type flange coupling and explain it's design procedure.

**6. Attempt any TWO of the following :**

**12**

- (a) A shaft is required to transmit 1 MW power at 240 rpm. The shaft must not twist more than  $1^\circ$  on a length of one metre. If the modulus of rigidity for the material of the shaft is  $80 \text{ kN/mm}^2$ , find diameter of shaft and shear stress induced in it.
  - (b) Write down design procedure of knuckle joint with neat sketch.
  - (c) Enlist the types of theories of elastic failure. State the necessity of theories of failure. Explain maximum principle stress theory.
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