22484

12425

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) 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) Define Kinematic chain.

(b) List various applications of Cam and Followers.

(c) State any two conditions under which V-belt drive is selected.

(d) Define (i) Yield point (ii) Ultimate stress.

(e) State any four factors that govern Factor of Safety.

(f) State two advantages of Knuckle joint over other joints.

(g) State two methods for elimination of surge of spring.

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

(a) Represent with neat sketch a whith worth quick return mechanism and explain its working principle.

(b) Explain with neat sketch Scotch Yoke mechanism.

(c) Define the following terms related to cam and follower terminology :

(i) Base circle

(ii) Pressure angle

(iii) Stroke of the follower

(iv) Trace point

(d) In a flat belt drive initial tension is 2000 N. The coefficient of friction (μ) between the belt and pulley is 0.3 and the angle of lap on smaller pulley is 150°. The smaller pulley has a radius of 200 mm and rotates at 500 rpm. Find the power in kW transmitted by the belt.

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

(a) State the effect of slip on velocity ratio of the belt. Derive the expression of velocity ratio in terms of total percentage slip.

(b) In a compound gear train, the driving gears have 20 and 30 teeth respectively. If the driven gears have 50 and 60 teeth and t be driving shaft is rotating in clockwise direction at 400 rpm. Determine the speed and direction of rotation of driven shaft.

(c) State the importance of 'Theories of failure'. Explain maximum principal stress theory and maximum shear stress theory.

(d) Define stress concentration. Explain any four methods to reduce it with neat sketches.

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

(a) For a flat belt drive,

prove that,

$$\frac{T_2}{T_1} = e^{\mu\theta}, \text{ where}$$

T_2 = Tension on tight side of belt

T_1 = Tension on slack side of belt

μ = Coefficient of friction

θ = Angle of contact in radians.

(b) In a reciprocating steam engine, the following data observed :

Diameter of piston = 300 mm

Maximum steam pressure = 0.7 N/mm^2

Compressive stress = 40 MPa.

Find the diameter of piston rod.

(c) Design a rectangular key for a shaft of 50 mm diameter. The permissible stresses for key material are 40 N/mm^2 in shear and 70 N/mm^2 in crushing. (Assume width and thickness of key as 16 mm and 10 mm respectively).

(d) Compare between rolling contact bearing and sliding contact bearing on basis of :

(i) size

(ii) life

(iii) coefficient of friction

(iv) damping performance

(e) In lieu of spring terminology, define :

(i) solid length

(ii) free length

(iii) spring index

(iv) spring rate

5. Attempt any TWO of the following : **12**

(a) Explain construction and working of Oldham's coupling. State its advantages, disadvantages and applications.

(b) Draw a Cam Profile for knife edge follower :

(i) minimum radius of cam = 5 cm

(ii) stroke of follower = 3 cm

(iii) outstroke 90° with uniform velocity.

(iv) Dwell next

(v) Follower return to original position during 90° of cam rotation with uniform velocity. The axis of knife edge passes along with axis of cam and cam rotates in clockwise direction.

(c) Explain with neat sketches the design procedure for different types of flange coupling.

6. Attempt any TWO of the following : **12**

(a) Determine the diameter of hollow shaft having inside diameter 0.6 times of outside diameter. The shaft is driven by 900 mm diameter overhung pulley placed vertically. The weight of pulley is 600 N. The overhung is 250 mm, the tension in tight and slack sides are 2900 N and 1000 N respectively.

(Assume $\tau = 85$ N/mm^2)

(b) Explain step by step design procedure for cotter joint with neat sketch.

(c) Explain the following aspects of design :

(i) Designation of materials as per Indian Standard (any two designation examples.)

(ii) Standardization

(iii) Preferred Number series.
