

12089

11122

3 Hours / 100 Marks

Seat No.

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- 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. a) Attempt any **SIX** of the following:

12

- (i) Define -
- (1) Completely constrained motion
- (2) Successfully constrained motion
- (ii) State the relationship between linear and angular velocity and acceleration.
- (iii) Why roller follower is preferred to knife edge follower?
- (iv) State the inversions of four bar chain.
- (v) State any four limitations of rope drive.

P.T.O.

- (vi) Define coefficient of fluctuation of energy and coeff. of fluctuation of speed.
- (vii) State the types of brakes used in railways. Comment on the material of the block of the brake.
- (viii) What are the conditions under which uniform wear theory is adopted for design and analysis of clutch and bearing.

b) **Attempt any TWO of the following:**

8

- (i) Differentiate between machine and structure.
- (ii) Draw a neat sketch of foot operated air pump and explain its working.
- (iii) Explain with a neat sketch of Rotary I.C. engine mechanism.

2. **Attempt any FOUR of the following:**

16

- a) Define kinematic pair. Classify it.
- b) Explain bicycle free wheel sprocket mechanism with a sketch.
- c) Explain the Klein's construction to determine velocity and acceleration of a link in a I.C. Engine mechanism.
- d) Classify cam and follower.
- e) State the advantages and disadvantages of a chain drive.
- f) Differentiate between simple, compound and epicyclic gear train by giving one point. What is the special advantage of epicyclic gear train.

3. Attempt any FOUR of the following: 16

- a) State law of Gearing. Define -
 - (i) Module
 - (ii) Addendum
- b) Compare between flywheel and Governor
- c) State the principle of operation of an eddy current dynamometer with a neat sketch.
- d) Define following terms relating to Governor :
 - (i) Stability
 - (ii) Sensitiveness
 - (iii) Isocronism
 - (iv) Hunting
- e) Explain in brief with a neat sketch Disc Brake
- f) Discuss in brief the phenomenon of slip and creep in a belt drive.

4. Attempt any TWO of the following: 16

- a) PQRS is a four bar chain with link PS fixed. The length of the link are $PQ = 62.5 \text{ mm}$; $QR = 175 \text{ mm}$; $RS = 112.5 \text{ mm}$; and $PS = 200 \text{ mm}$. The crank PQ rotates at 10 rad/sec clockwise. Draw the velocity and acceleration diagram when angle $QPS = 60^\circ$ and Q and R lie on the same side of PS. Find angular velocity and angular acceleration of link QR.

- b) Draw the profile of a cam to raise a valve with S.H.M. through 40 mm in 1/4th of revolution, keep it fully raised through 1/10th revolution and to lower it with uniform acceleration and retardation in 1/6th revolution. The valve remains closed during the rest of the revolution. The diameter of roller is 20 mm and minimum radius of cam to be 30 mm. The axis of the valve rod passes through the axis of cam shaft.
- c) Power is transmitted using a v-belt drive. The included angle of v-groove is 30° . The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg per meter length and maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140° . $\mu = 0.15$.

5. Attempt any FOUR of the following:

16

- a) What are the causes of vibrations in a machine? Mention their harmful effects.
- b) Compare block brakes and band brakes on the basis of -
- (i) Braking force
 - (ii) Braking Torque
- c) Draw a Turning moment diagram for single cylinder 4 stroke I.C. engine.

- d) A band brake acts on the $\frac{3}{4}$ th of circumference of a drum of 400 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 200 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 600 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in a -
- (i) Clockwise direction
 - (ii) Anticlockwise direction
- e) What is the difference between centrifugal and Inertia Governor? Why the centrifugal governor is preferred to the inertia governor.
- f) Four masses m_1 , m_2 , m_3 and m_4 are 200 kg, 300 kg, 240 kg, and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively, and the angles between successive masses are 45° , 75° and 135° . Find the position and magnitude of the balance mass required, if its radii of rotation is 0.2 m. Solve Graphically.

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

16

- a) Explain in brief with a sketch scotch Yoke mechanism.
- b) Name the materials used in belts. State the formula for the length of belt for cross belt drive.

- c) In a slider crank mechanism the length of crank and connecting rod are 100 mm and 400 mm respectively. The crank rotates uniformly at 600 r.p.m. clockwise. When the crank has turned through 45° from inner dead centre, find analytically velocity and acceleration of slider.
 - d) Draw neat sketch of multiplate clutch and explain in brief its working.
 - e) What is the f^n of clutch. State its types and one application of each.
 - f) A flat foot step bearing 225 mm in diameter supports a load of 7500 N. If the coefficient of friction is 0.09 and the shaft rotates at 600 r.p.m. Calculate the power lost in friction.
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