

# 22370

**22223**

**3 Hours / 70 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. Attempt any FIVE of the following:**

**10**

- a) State inversion of four bar chain.
- b) Define term 'Dwell' w.r.t. cam profile.
- c) With respect to gears define -
  - i) Module
  - ii) Addendum
- d) Classify governor in details.
- e) Define kinematic link and classify it.
- f) Define
  - i) Radial follower
  - ii) Off-set follower
- g) With respect to belt drives define the term -
  - i) Slip
  - ii) Creep

P.T.O.

- 2. Attempt any THREE of the following:** **12**
- a) Define the following mechanical properties.
    - i) Stiffness
    - ii) Toughness
    - iii) Hardness
    - iv) Malleability
  - b) Define composite material and state its two properties and applications.
  - c) State formulae to calculate length of open belt drive and cross belt drive. State meaning of each term by drawing suitable diagrams in both cases.
  - d) Define the following terms
    - i) Stability
    - ii) Hunting of governor
    - iii) Sensitivity
    - iv) Isochronism
- 3. Attempt any THREE of the following:** **12**
- a) Define inversion of kinematic chain and state the inversion of single slider crank chain.
  - b) Draw a neat sketch of radial cam with roller follower and show the following on it.
    - i) Pitch point
    - ii) Pressure angle
    - iii) Prime circle
    - iv) Trace point
  - c) Explain laminated composite and fibre reinforced composites.
  - d) List different properties and applications of stainless steel.
  - e) Compare cross belt drive and open belt drive on the basis of
    - i) Velocity ration
    - ii) Application
    - iii) Direction of driven pulley
    - iv) Length of belt drive.

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

- a) Suggest suitable steel for the following applications-
  - i) Crankshaft of I.C. engine
  - ii) Propeller shaft of a truck.
  - iii) Car bodies
  - iv) Household utensils
- b) Define thermoplastics and state its properties.
- c) Explain with neat sketch the working of scotch yoke mechanism.
- d) Classify follower on basis of
  - i) As per shape
  - ii) As per motion
- e) Explain with neat sketch the turning moment diagram of 4 stroke I.C. engine.

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

- a) A cam is to be designed for a knife edge follower with the following data:
  - i) Cam lift = 40 mm, during  $90^\circ$  of cam rotation with simple harmonic motion.
  - ii) Dwell for next  $30^\circ$ .
  - iii) During the next  $60^\circ$  of cam rotation, the follower returns to its original position with simple harmonic motion.
  - iv) Dwell during the remaining  $180^\circ$ . Draw the profile of the cam when the line of stroke of the follower is offset by 20 mm from the axis of the cam shaft, the radius of the base circle of the cam is 40 mm.
- b) Explain with neat sketch the working of Elliptical Trammel.
- c) An I.C. engine developing 10 kw of power is to be transmitted to a machine by flat belt. A 0.8 m diameter pulley is fitted on engine shaft and rotates at 300 rpm. The angle of lap is  $175^\circ$  and coefficient of friction in belt and pulley is 0.25. Determine tensions in the belt.

6. Attempt any TWO of the following:

12

- a) Two pulley one 450 mm diameter and other 200 mm diameter are on parallel shaft is 1.95 m apart and are connected by cross belt drive. Find the length of belt required and angle of contact between the belt and smaller pulley. Find the power can be transmitted by belt, when larger pulley rotated at 200 rpm, if maximum permissible tension in the belt is 1000 N and  $\mu = 0.25$ .

- b) Four masses attached to a shaft and their respective radii of rotation are given as :

$m_1 = 180 \text{ kg}$	$m_2 = 300 \text{ kg}$	$m_3 = 230 \text{ kg}$	$m_4 = 260 \text{ kg}$
$r_1 = 0.2 \text{ m}$	$r_2 = 0.15 \text{ m}$	$r_3 = 0.25 \text{ m}$	$r_4 = 0.3 \text{ m}$

The angle between successive masses are  $45^\circ$ ,  $75^\circ$  and  $135^\circ$ . Find the position and magnitude of the balance mass required, if it's radius of rotation is 0.2 m. The masses revolve in same plane.

- c) Explain with neat sketch, the different phases in iron-carbon equilibrium diagram.

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