

12089

21314

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 the terms kinematics and dynamics.
 - ii) What is meant by constrained motion? State its types.
 - iii) Define kinematic link? Give examples of flexible link.
 - iv) State inversions of single slider crank chain.
 - v) State applications of cam.
 - vi) Give classification of follower on the basis of line of stroke of follower.

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vii) What is slip? Write the expression for velocity ratio for belt drive by considering slip.

viii) State the causes of vibrations.

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

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i) With the help of neat sketch describe working of Geneva Mechanism.

ii) State the inversions of double slider crank chain. Describe any one.

iii) What is kinematic chain? How many links are required to form a constrained kinematic chain? State different types of basic kinematic chain.

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

16

a) With the help of neat sketch describe working of whitworth quick return mechanism. State its application.

b) Describe Kleins construction to determine velocity and acceleration in a single slider crank chain.

c) A casting weighing 9 kN hangs freely from a rope which makes 2.5 turns round a drum of 300 mm diameter revolving at 20 rpm. The other end is pulley by a man. The coefficient of friction is 0.25. Determine

i) The force required by the man and

ii) Power to raise the casting.

d) Draw the neat sketch of open belt drive. Write expression for length of belt, Angle of contact for it. State meaning of each term used in expression.

e) Describe working of centrifugal Governor with neat sketch.

f) State the basic kinematic chain used in Ackerman's steering gear mechanism. Also describe its working.

3. Attempt any FOUR of the following:**16**

- a) What is centrifugal tension in a belt drive? State the effect of centrifugal tension on power transmission.
- b) Compare flat belt with V belt on the basis of
 - i) space required
 - ii) speed
 - iii) velocity ratio
 - iv) slip
- c) State the advantages and disadvantages of chain drive over belt drive.
- d) Draw the neat schematic sketch of compound gear train. Derive the equation for velocity ratio of compound gear train.
- e) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160° and the maximum tension in the belt is 2500 N.
- f) Define following terms in relation to radial cam
 - i) Base circle
 - ii) Trace point
 - iii) Prime circle
 - iv) Pitch circle

4. Attempt any TWO of the following:**16**

- a) In a slider crank mechanism, the length of the crank and connecting rod are 150 mm and 600 mm respectively. The crank position is 60° from the inner dead centre. The crankshaft speed is 450 rpm clockwise. Using relative velocity method, determine
- Velocity and acceleration of slider
 - Angular velocity and angular acceleration of connecting rod.
- b) Design a cam profile for operating the exhaust valve of an oil engine. The follower is required to execute the simple harmonic motion during opening and closing the valve. The valve opens during the cam rotation of 60° , remains open for 25° and closes during the next 60° of cam rotation and remains closed for remaining period. The lift of valve is 3 cm and the minimum radius of the cam is 4 cm. The follower is provided with 2 cm diameter roller whose line of stroke passes through the cam axis.
- c) A multiple disc clutch has five plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed 0.127 N/mm^2 , find the power transmitted at 500 rpm. The outer and inner radii of friction surface are 125 mm and 75 mm respectively. Assume uniform wear and take coefficient of friction = 0.3.

5. Attempt any FOUR of the following:**16**

- a) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m. assuming
 - i) uniform pressure and
 - ii) uniform wear.
- b) Compare flywheel with governor.
- c) Draw the neat labelled turning moment diagram for single cylinder 4-stroke cycle I.C. engine.
- d) What is the difference between centrifugal and inertia type governors? Why is centrifugal governor preferred over inertia governor?
- e) What is meant by self locking and self energizing brakes?
- f) A band brake acts on the $\frac{3}{4}$ th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 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 500 mm from the fulcrum and the coefficient of friction is 0.25. Find the operating force when the drum rotates in the anticlockwise direction.

6. Attempt any FOUR of the following:**16**

- a) Describe working of Rope brake dynamometer. Also write expression for brake power of engine using rope brake dynamometer.
 - b) Describe construction and working of internal expanding shoe brake with neat schematic sketch.
 - c) A simple band brake operates on a drum of 600 mm in diameter that is running at 200 rpm. The coefficient of friction is 0.25. The brake band has a contact of 270° , one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact. What is the pull necessary on the end of brake arm to stop the wheel if 35 KW is being absorbed.
 - d) Define the terms used in vibration
 - i) Longitudinal vibration
 - ii) Transverse vibration
 - e) State the applications of vibration. What are the ill effects of vibration?
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