

17412

21415

3 Hours / 100 Marks

Seat No.

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

(2) Attempt **6** questions including Question No. 1 which is compulsory.

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

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

(5) Figures to the right indicate full marks.

(6) Assume suitable data, if necessary.

(7) Use of Non-Programmable Electronic Pocket Calculator is permissible.

(8) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any **SIX** :

12

(a) Define kinematic link and kinematic chain.

(b) Enlist the different type of follower motion.

(c) Define angle of lap and slip in belt drive.

(d) State four conditions under which the 'V' belt drive is selected.

(e) State the function of Governor in an I.C. engine.

(f) State four applications of flywheel.

(g) Give the classification of dynamometer. State the function of it.

(h) Why is balancing of rotating parts necessary for high speed engines ?

P.T.O.

(B) Attempt any TWO :**08**

- (a) Define completely constrained motion and successfully constrained motion with neat sketch. State one example of each.
- (b) Explain working principle of clutch. State its location in transmission system of an automobile.
- (c) Compare cross belt drive and open belt drive on the basis of
 - (i) velocity ratio
 - (ii) application
 - (iii) direction of driven pulley
 - (iv) length of belt drive

2. Attempt any FOUR :**16**

- (a) Differentiate machine and structure on any four points.
- (b) Explain with neat sketch working principle of Oldham's coupling.
- (c) Define linear velocity, angular velocity, absolute velocity and state the relation between linear velocity and angular velocity.
- (d) Describe stepwise procedure for determination of velocity and acceleration by Klein's construction with suitable data.
- (e) 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
- (f) The central distance between two shaft is 4 m having two pulleys with diameter having 500 mm and 700 mm respectively. Find length of belt required
 - (i) for open belt drive
 - (ii) for cross belt drive

3. Attempt any FOUR :**16**

- (a) Draw a neat labelled sketch of "Multiplate Clutch".
- (b) Why roller follower is preferred over a knife follower ? State two advantages and application of roller follower.
- (c) Write the procedure for balancing of a single rotating mass by single masses rotating in the same plane.
- (d) State the type of power transmission chains. Describe any one with its sketch.

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- (e) PQRS is a four bar chain with PS fixed length of links are $PQ = 62.5$ mm, $QR = 175$ mm, $RS = 112.5$ mm, $PS = 200$ mm. The crank PQ rotate at 10 rad/sec. in clockwise direction. Determine the angular velocity of point R, graphically by using relative velocity method.
- (f) Crank OA of a mechanism is hinged at 'O' and rotates at an angular velocity of 20 rad/sec. and angular acceleration of 25 rad/sec^2 . If crank OA is 50 mm long determine linear velocity, centripetal acceleration and tangential acceleration of a point A.

4. Attempt any FOUR :

16

- (a) Explain the phenomenon of slip and creep in a belt drive. State its effect on velocity ratio.
- (b) Explain with the diagram working of crank and slotted lever quick return mechanism.
- (c) Explain with sketch working of hartnell governor.
- (d) Explain working of hydraulic brake dynamometer with sketch.
- (e) Three masses 10 kg, 20 kg and 15 kg are attached at a point at radii of 20 cm, 25 cm and 15 cm respectively. If the angle between successive masses is 60° and 90° . Determine analytically the balancing mass to be attached at radius of 30 cm.
- (f) A thrust shaft of a ship has 6 collar of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller shaft is 100 kN. If the coefficient of friction is 0.12 and speed of engine 90 rpm. Find power absorbed in friction at the thrust block using uniform pressure intensity condition.

5. Attempt any TWO :

16

- (a) In reciprocating engine the crank is 250 mm long and connecting rod is 1000 mm long. The crank rotate at 150 rpm. Find velocity and acceleration of piston and angular velocity and angular acceleration of connecting rod when the crank makes an angle of 30° to IDC. Use analytical method.

P.T.O.

- (b) Construct a cam profile with knife edge follower having an offset of 10 mm for the following data :
- Outstroke = 60° with SHM
Dwell = 30°
Return = 60° with uniform velocity and remaining is dwell period.
Minimum radius of cam = 50 mm
Lift of follower = 25 mm
Consider the rotation of cam in clockwise direction.
- (c) A belt is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density 0.001 gm/mm^3 . Safe stress in the belt is not to exceed 2.5 N/mm^2 , diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 200 rpm. The two shafts are 1.25 m apart. The coefficient of friction is 0.25, determine
- (1) Angle of contact at driving pulley
 - (2) The width of the belt

6. Attempt any TWO :

16

- (a) (i) Define 'Gear Train'. State its purpose and types of gear train.
(ii) Explain the concept of fluctuation of energy related with turning moment diagram with sketch.
- (b) A simple band brake is operated by lever 40 cm long. The brake drum diameter is 40 cm and brake band embrace $\frac{5}{8}$ of its circumference. One end of band is attached to a fulcrum of lever while other end attached to pin 8 cm from fulcrum. The coefficient of friction 0.25. The effort applied at the end of lever is 500 N. Find braking torque applied if drum rotates anticlockwise and acts downwards.
- (c) An engine of a car has a single plate clutch developed maximum torque 147 N-m. External diameter of clutch plate is 1.2 times its internal diameter. Determine the dimension of clutch plate and axial force provided by the spring. The maximum pressure intensity of the clutch facing 98 kN/m^2 and coefficient of friction is 0.3. Assume uniform wear condition.
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