

Roll No.

Total No. of Questions : 09]

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Paper ID [ME203]

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B.Tech. (Sem. - 3rd)

THEORY OF MACHINES - I (ME - 203)

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Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

(10 × 2 = 20)

Q1)

- a) What is meant by inversion of a mechanism?
- b) Derive the expression for Coriolis component of acceleration.
- c) What are the desirable properties of the belt materials?
- d) Why should we use double block shoe brakes as compared to single shoe brake?
- e) Draw Davis steering mechanism for taking a right turn.
- f) What is the function of flywheel? Explain by taking an example of 4 stroke IC engine.
- g) With the help of neat sketches discuss the salient features of roller chain.
- h) Draw a neat sketch of Hartnell governors.
- i) What is the use of dynamometer?
- j) Why is cam profile important? Explain with a suitable example.

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P.T.O.

Section - B

(4 × 5 = 20)

- Q2) Explain two inversions of slider crank mechanism which are used in quick return mechanism.
- Q3) Power of 15 kW is to be transmitted at 900 rpm using a single plate clutch. The maximum pressure intensity between the plates is 85 kN/m^2 and the coefficient of friction is 0.25. The outer diameter of the plate is 360 mm. Both the sides of the plates are effective. Determine the inner diameter and the axial force to engage the clutch.
- Q4) Explain the working of any dynamometer with neat sketch.
- Q5) A cross belt connects two shafts which are 2.4 meters apart and transmit 7 kW power. Sizes of the driver and the driven pulley are 520 mm and 350 mm respectively. The larger pulley is rotating at 320 RPM. The belt material can safely withstand a tension of 20 N/mm of its width. Calculate the following:
(a) Length of the belt required
(b) Required width of the belt
(c) Necessary initial tension
Take value of μ as 0.28.
- Q6) A cam is to operate an offset roller follower. The least radius of the cam is 50 mm, roller diameter is 30 mm, and offset is 20 mm. The cam is to rotate at 360 rpm. The angle of ascent is 48° , angle of dwell is 42° , and angle of descent is 60° . The motion is to be SHM during ascent and uniform acceleration and deceleration during descent. Draw the cam profile.

Section - C

(2 × 10 = 20)

- Q7) The driving shaft of a Hook's joint runs at a speed of 300 rpm. The angle between the shafts is 20° . The driven shaft with attached masses has a mass of 60 kg at a radius of gyration of 200 mm. If a steady torque of 500 N.m resists rotation of the driven shaft, find the torque required at the driving shaft, when angle turned through by the driving shaft is 45° .

Q8) A governor of the Hartnell type has each ball of weight 15 N and the lengths of vertical and horizontal arms of the bell crank lever are 120 mm and 60 mm respectively. The fulcrum of the bell crank lever is at a distance of 100 mm from the axis of rotation. The maximum and minimum radii of rotation of the balls are 120 mm and 80 mm and the corresponding equilibrium speeds are 325 rpm and 300 rpm respectively. Find the stiffness of the spring and the equilibrium speed when the radius of rotation is 100 mm.

Q9) A punching press is required to punch 30 holes per minute of 20 mm diameter in a steel plate of 13 mm thick. The actual punching takes place $\frac{1}{6}$ th of the interval between punches. The shear strength of the plate is 310 N/mm². The driving motor runs at 900 rpm with a velocity reduction through gear to give the desired speed of 30 punching operations per minute. Find the mass of the flywheel required if its mean diameter is 900 mm. Take 10% fluctuation of speed.

