MORNING

[Total No. of Questions: 9]
Uni. Roll No. ....

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[Total No. of Pages: 2]

Program: B.Tech. (Batch 2018 onward)
Semester: 4TH
Name of Subject: Theory of machines
Subject Code: PCME-106
Paper ID: 16195
A scientific calculator is Allowed

Detail of allowed codes/charts/tables etc.....   NA
Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions, Q8 and Q9. Both are compulsory but with internal choice
3) Any missing data may be assumed appropriately.

Part – A   [Marks: 02 each]

Q1.
a) What are the different kinds of kinematic pairs?

b) Sketch quick return whitworth mechanism.

c) What do you understand by 'gear train'?

d) State the laws of (i) Static friction ; (ii) Dynamic friction

e) Differentiate creep and slip.

f) Write short notes on cams and followers.

Part – B   [Marks: 04 each]

Q2. Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, the angle of lap160°, and the maximum tension in the belt is 2500 N.

Q3. Define couple. What are the engineering applications of couple?

Q4. What is the meaning of inversions of four bar Chain? Explain any one four-bar inversion mechanism with a diagram.

Q5. In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module, and the number of teeth are: $T_C = 28$; $T_D = 26$; $T_E = T_F = 18$.

1. Sketch the arrangement ; 2. Find the number of teeth on A and B

Q6. A cam is to give the following motion to a knife-edged follower : 1. Outstroke during 60° of cam rotation ; 2. Dwell for the next 30° of cam rotation ; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when (a) the axis of the follower passes through the axis of the cam shaft

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P.T.O.

Q7. The following data refer to two cylinder locomotive with cranks at 90° Reciprocating mass per cylinder = 300 kg ; Crank radius = 0.3 m ; Driving whee diameter = 1.8 m ; Distance between cylinder centre lines = 0.65m ; Distance between the driving wheel central planes = 1.55 m. Determine : 1. the fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km. p.h. ;2. the variation in tractive effort ; and 3. the maximum swaying couple.

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Part – C   [Marks: 12 each]

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Q8. In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B ?

<div align="center">OR</div>

Construct the profile of a cam to suit the following specifications :

Cam shaft diameter = 40 mm ; Least radius of cam = 25 mm ; Diameter of roller = 25 mm; Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm ; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam.

Q9. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.

<div align="center">OR</div>

In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.

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