	Roll No.										
Paper Code: ME-502/EME-502											

B TECH
FIFTH SEMESTER EXAMINATION, 2016-17
THEORY OF MACHINES-I

[Time: 3 Hours]   [Total Marks: 100]

Note: Attempt two questions from Section A and three questions from section B of the question paper in a total of five questions.

SECTION A

1. In the mechanism shown in figure 1, find the velocity of slider D by instantaneous center method. Link OA is rotating at 1000 rpm in clockwise direction. **[20]**
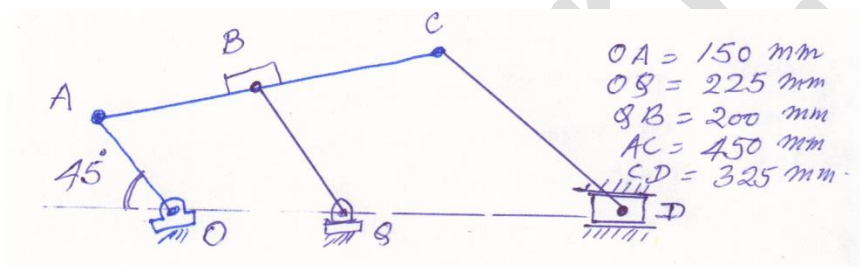

$OA = 150\ mm$
$OB = 225\ mm$
$8B = 200\ mm$
$AC = 450\ mm$
$CD = 325\ mm$

Figure 1

2. Attempt the following:-   **[10x2=20]**

(a) The crank of a reciprocating engine is 10 cm long and it rotates at 20 rad/sec CW. Connecting rod is 40 cm long. Determine, by Klien's construction, the angular velocity and angular acceleration of connecting rod, when crank makes an angle of 90º from IDC.

(b) A universal joint is used to connect two shafts which are inclined at 20º and the speed of driving shaft is 1000 rpm. Draw a polar chart to show velocity/rpm of the driven and driving shafts. What will be magnitude of the major and minor axes of the ellipse representing the rpm of driven shaft?

3. Attempt the following:-   **[10x2=20]**

(a) Calculate the value of the Coriolis component acceleration, f_{PQ}^{cor} for the configuration shown in figure 2. P is on slider and Q is on link AR. Sizes of links are OA = 400 mm, OP = 200 mm, AR = 700 mm. Crank OP rotates in clockwise direction at 210 rpm. Also indicate the direction in which f_{PQ}^{cor} is acting.

(b) A pantograph mechanism shown in figure 3 has following dimensions:
Length BC = AD = 400 mm, Length CD = AB = 600 mm.
This pantograph, as shown, reduces a drawing to half size, when the tracing finger is at P and the pencil is kept at Q. It is required to reduce the size of the given drawing to two-fifth. Draw the revised configuration of the pantograph without changing the lengths of link BC and AB.
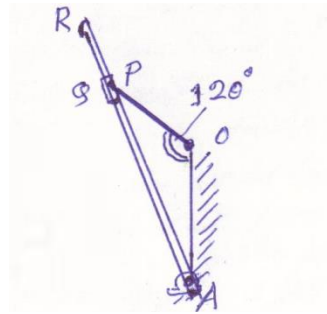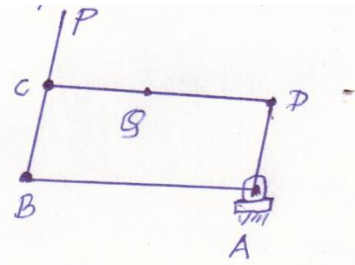
Figure 2   Figure 3

SECTION B

4. The number of teeth on two equal spur gears in mesh is 40. The teeth have 20 ° pressure angle involute profiles. The module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum. **[20]**

5. In the epicyclic gear shown in figure 4, a gear C has internal as well external teeth. It is free to rotate on an arm driven by shaft S_1. It meshes externally with the casing D and internally with the pinion B. If $T_B = 24$, $T_C = 32$ and 40 and $T_D = 48$, find the velocity ratio between (i) S_1 and S_2 when D is fixed and (ii) S_1 and D, when S_2 is fixed. **[20]**
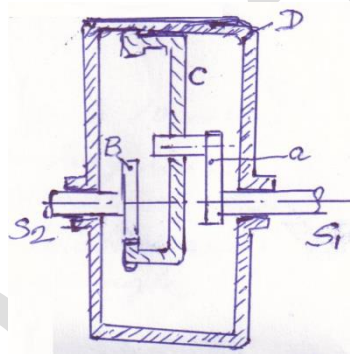

Figure 4

6. Derive expression for velocity and acceleration of a flat foot follower operated by a circular arc cam, for both cases when the follower is on the cam flank as well as when it is on nose of cam. **[20]**

7. A belt drive consists of two v-belts in parallel grooved pulleys of same size. Angle of groove is 30°. Cross sectional area of each belt is 750 mm^2, $\mu = 0.12$. Density of belt material is 1.2 mg/m^3 and maximum stress of the material is 7MN/m^2. Calculate the power that can be transferred between pulleys of 300 mm diameter rotating at 1500 rpm. Find also the speed in rpm at which power transmission would be maximum. **[20]**

8. A single plate clutch has to transmit 8 kW at 1000 rpm. Axial pressure limited to 70 kN/m^2. Mean radius of plate is 4.5 times the radial width of the friction surface. If $\mu = 0.25$ and both sides of plate are effective, find the inner and outer radii and the width of friction lining. **[20]**