Total No. of Printed Pages:4

SUBJECT CODE NO:- P-387
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Mech/Prod) Examination MAY/JUNE-2016
Theory of Machines-I
(Revised)

[Time: Four Hours] **[Max Marks:80]**

"Please check whether you have got the right question paper."

N.B i) Q.No.1 from section A and Q.No.6 from section B are compulsory; attempt any two questions out of Remaining from each section.
ii) Figures to right indicate full marks
iii) Draw neat sketches wherever necessary.
iv) Assume suitable data, if necessary.

Section A

Q.1 Attempt **any five** : 10

a) Define kinematic chain.
b) Define lower pair with one example.
c) List the types of kinematic pairs according to the relative motion between its elements.
d) Calculate degree of freedom for four bar mechanism with all turning pairs?
e) Sketch any two inversion of double slider crank chain.
f) State the 'Kennedy's Theorem' of three instantaneous centers.
g) Explain, with the help of a neat sketch, the body centrode.
h) What will be the rubbing velocity at pin joint when the two links move in the opposite directions?
i) What is velocity image?
j) Formulate two components of acceleration.
k) What is coriolis component of acceleration?

Q.2 A toggle mechanism is shown in fig 1. Along with dimensions of the links in mm. Find the velocities of point B and C and the angular velocities of the links AB, BQ and BC. The crank OA makes an angle of 45^0 with the horizontal and rotates at 50 rpm the clockwise direction. 15

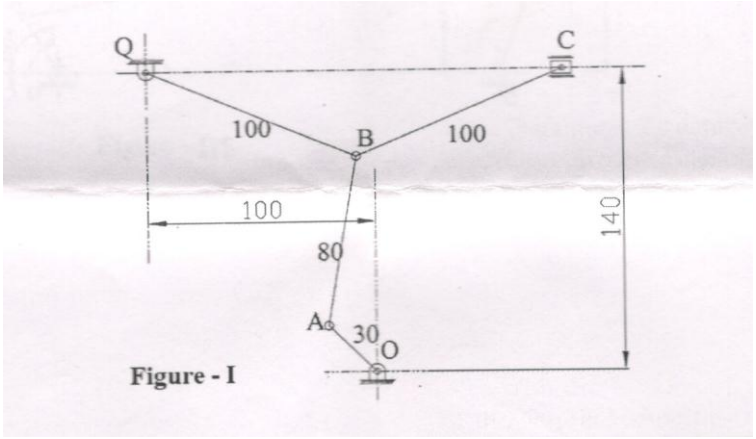

Figure - I

Q.3 The lengths of various links of mechanism, as shown in fig 2, are: OA = 300 mm; AB = 1000 mm; CD = 800 mm; and AC = CB. Determine, for the given configuration, the velocity of the slider D if the crank OA rotates at 60 rpm in the clockwise direction. Also find the angular velocity of the link CD. Use instantaneous centre method. 15

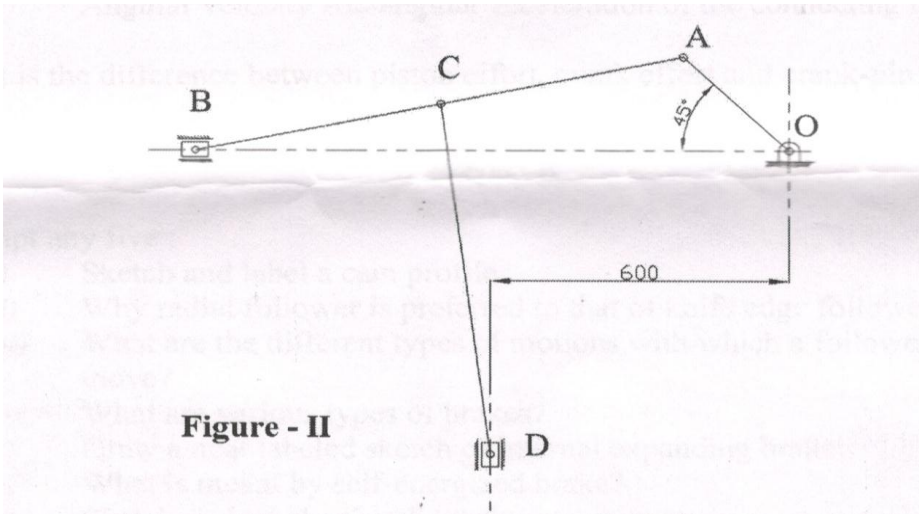

Figure - II

Q.4 In a swiveling joint mechanism shown in figure 3, OA is the driving crank rotating at 200 rpm clockwise. The length of various links are – OC = 650 mm, OA = 100mm, AB = 800 mm, BC = 250mm, AD = DB, EF = 400 mm, QE = 240 mm, DE = 400 mm. For the given configuration, determine- 15

1. Velocity of slider block F
2. Angular velocity of link DE
3. Velocity of sliding of link DE in the swivel block
4. Acceleration of sliding of link the DE in the trunnion

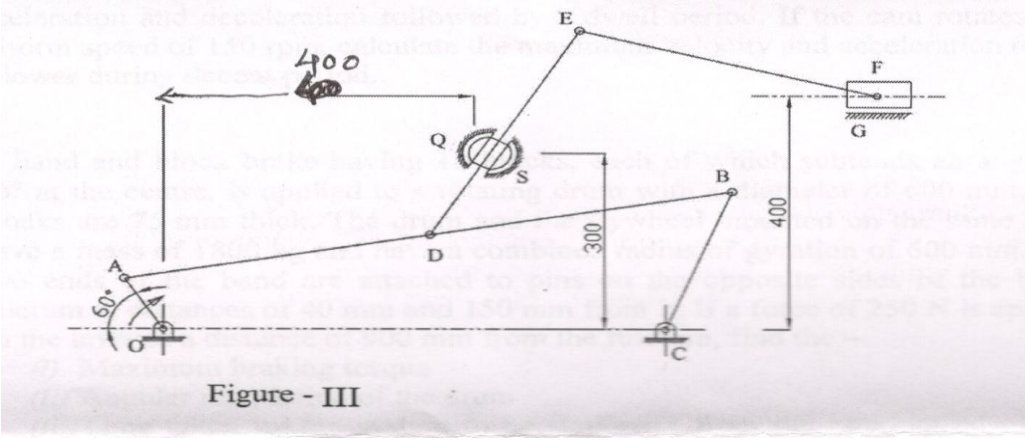

Figure - III

Q.5 a) In a slider crank mechanism, the length of crank and connecting rod are 100 mm and 400 mm respectively. The crank rotates uniformly at 600 rpm clockwise. When the crank has turned through 45^0 from the inner dead centre, find by Ritterhaus construction – 08

1. Velocity and acceleration of the slider
2. Angular velocity and angular acceleration of the connecting rod

b) What is the different between piston effort, crank effort and crank-pin effort? 07

Section B

Q.6 Attempt any five. 10

1. Sketch and label a cam profile.
2. Why radial follower is preferred to that of knife edge follower?
3. What are the different types of motions with which a follower can move?
4. What are various types of brakes?
5. Draw a neat labeled sketch of internal expanding brake.
6. What is meant by self-energized brake?
7. Sketch and label epicyclic-train dynamometer.
8. What is meant by static and dynamic unbalance in machinery?
9. Deduce expression for variation in tractive force.
10. What do you mean by primary and secondary unbalance in reciprocating engines?

Q.7 Draw the profile of a cam operating a roller reciprocating follower and with the following data: 15

Minimum radius of cam = 25mm, lift = 30mm, roller diameter = 15mm.

The cam lifts the follower for 120^0 with SHM followed by a dwell period of 30^0. Then the follower lowers down during 150^0 of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed at 150 rpm, calculate the maximum velocity and acceleration of the follower during decent period.

Q.8 A band and block brake having 12 blocks, each of which subtends an angle of 16^0 at the centre, is applied to a rotating drum with a diameter of 600 mm. The blocks are 75 mm thick. The drum and the flywheel mounted on the same shaft have a mass of 1800 kg and have a combined radius of gyration of 600 mm. The two ends of the band are attached to pins on the opposite sides of the brake fulcrum at distance of 40 mm and 150 mm from it. If a force of 250 N is applied on the lever at a distance of 900 mm from the fulcrum, find the – 15

1. Maximum braking torque
2. Angular retardation of the drum
3. Time taken by the system to be stationary from the rated speed of 300 rpm

Q.9 A rotating shaft carries three unbalanced masses of 4 kg, 3kg, and 2.5kg at radial distances of 75mm, 85 mm and 50 mm and at the angular positions of 45^0, 135^0 and 240^0 respectively. The second and the third masses are in the planes at 200 mm and 375 mm from the planes of the first mass. The angular position are measured counter clockwise from the reference line along X-axis and viewing the shaft from the first mass end. The shaft length is 800 mm between bearings and the distance between the plane of the first mass and the bearing at that end is 225 mm. Determine the amount of the counter mass in planes at 75 mm from the bearings for the complete balance of the shaft. The first counter mass is to be in a plane between the first mass and the bearing and the second mass in a plane between the third mass and the bearing at that end. 15

Q.10 The following data refer to a two cylinder uncoupled locomotive : 15

Rotating mass / cylinder = 280 kg; Reciprocating mass / cylinder = 300 kg;
Distance between wheels = 1400mm; Distance between cylinder centre = 600 mm
Diameter of trades of driving wheels = 1800 mm Crank radius = 300 mm
Radius of centre of balance mass = 620 mm Locomotive speed = 50 km/hr
Angle between cylinder cranks = 90^0 Dead load on each wheel = 3.5 tone
Determine the :-

1. Balancing mass require in the planes of driving wheels if whole of the revolving and two third of the reciprocating mass are to be balanced
2. Swaying couple
3. Variation in the tractive force
4. Maximum and minimum pressure on the rails
5. Maximum speed of locomotive without lifting the wheels from the rails.