Total No. of Printed Pages:4

SUBJECT CODE NO:- H-168
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech/Prod)
Theory of Machines - I
(REVISED)

[Time: Three Hours] **[Max.Marks: 80]**

Please check whether you have got the right question paper.

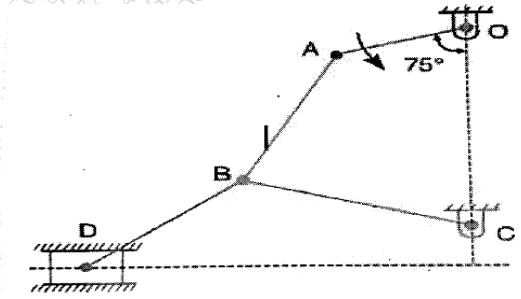
N.B
1. Q.No.1 and Q.No.6 are compulsory.
2. Attempt any two questions out of remaining from each section.
3. Figures to the right indicate full marks.
4. Draw neat sketches wherever necessary.
5. Assume suitable data wherever necessary.

Section A

Q.1 Attempt any five: 10

a) Define Tangential component of Acceleration.
b) Define theory of machine.
c) Define higher pair & Lower pair.
d) Write classification of kinematic pair.
e) Inversion of mechanism.
f) Define Space centrode & body centrode.
g) State Kennedy theorem.
h) Define Grublers' Criterion.
i) What is successfully constrained Motion?
j) Differentiate between single and double slider mechanism.

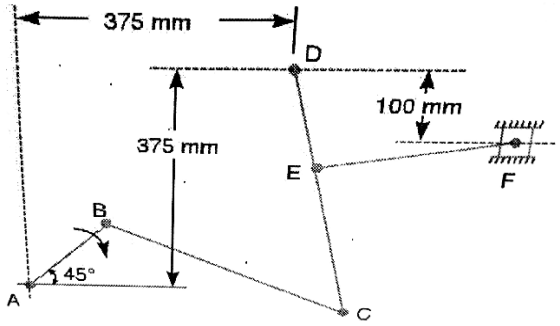
Q.2 In Fig the angular velocity of the crank OA is 600 r.pm. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are: $OA = 28mm; AB = 44mm; BC = 49mm; and\ BD = 46mm$. The center distance between the centers of rotation O and C is 65mm. the path of travel of the slider is 11 mm below the fixed point C. the slider moves along a horizontal path and OC is vertical. Use I-Centre Method. 15



Q.3 The mechanism, as shown in fig. has the dimensions of various links as follows: 15
$AB = DE = 150\ mm; BC = CD = 450mm,; EF = 375\ mm$. The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 r.p.m. determine:

1. Velocity of the block F,
2. Angular velocity of DC, and
3. Rubbing speed at the pin C which is 50 mm in diameter.

Use relative velocity method.



Q.4 a) In an reciprocating engine mechanism crank length is 250mm, connecting rod length is 950 mm. crank rotates at 200 r.p.m clockwise which makes an angle 45° with IDC. Find 10

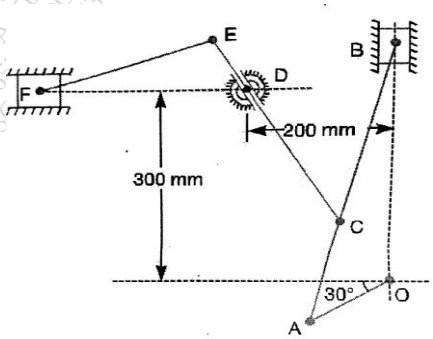
1) Velocity and acceleration of piston
2) Angular velocity and angular acceleration of connecting rod.

(Use Klein's Construction Method)

b) Explain with neat sketch working of Oldham's Coupling. 05

Q.5 Fig. shows a mechanism in which the crank OA, 100 mm long rotates clockwise about O at 130 r.p.m. the connecting rod AB is 400 mm long. The rod CE, 350 mm long, is attached to AB at C, 150 mm from A. this rod slides in a slot in a trunnion at D. the end E is connected by a link EF, 300 mm long, to the horizontally moving slider F. Find 15

1) velocity of slider F.
2) Acceleration of slider F.
3) Angular acceleration of EF.



Section B

Q.6 Attempt any five: 10

a) Explain working principle of brake.
b) Define Pressure angle.
c) Define Prime circle and trace point
d) Define Self Energizing.
e) Define Dynamic Balancing
f) Define Hammer blow.
g) Reciprocating balancing is partial balancing, justify.
h) Define Swaying Couple.
i) Define absorption dynamometer.
j) Write classification of brake.

Q.7 Draw the profile of cam that gives the lift of 40 mm to the rod. Carrying a 20 mm diameter roller. The axis of roller passes through the center of cam. The least radius of cam is 50 mm. the rod is to be lifted with SHM in a 90° Rotation of cam and suddenly returns to its original position during 180° revolution with SHM. Remaining is dwell. 15

Q.8 a) Explain with neat sketch belt transmission dynamometer. 03

b) A band brake acts on the 3/4th of circumference of a drum of 460 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 250 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 510 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the 12
   a) Anticlockwise direction, and
   b) Clockwise direction.

Q.9 Four masses A, B, C and D as shown below are to be completely balanced. 15

	A	B	C	D
Mass (kg)	-	30	50	40
Radius (mm)	180	240	120	150

The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90°. B and C make angles of 210° *and* 120° respectively with D in the same sense. Find: The magnitude and the angular position of mass A; and The position of planes A and D.

Q.10 The following data apply to an outside cylinder uncoupled locomotive: 15

Mass of rotating parts per cylinder = 360 kg; Mass of reciprocating parts per cylinder = 300 kg; Angle between cranks = 90°; Crank radius = 0.3 m; Cylinder centers = 1.75 m; Radius of balance masses = 0.75 m; Wheel centers = 1.45 m.

If whole of the rotating and two-thirds of reciprocating parts are to be balanced in planes of the driving wheels, find:

1. Magnitude and angular positions of balance masses,

2. Speed in kilometers per hour at which the wheel will lift off the rails when the load on each driving wheel is 30kN and the diameter of tread of driving wheels is 1.8m, and

3. Swaying couple at speed arrived at in (2) above.