Total No. of Printed Pages:4

SUBJECT CODE :- 121
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Mech/Prod) Examination Nov/Dec 2015
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 and Q. No 6 are compulsory, Solve any two questions out of the remaining in each section
ii) Draw neat sketches wherever necessary.
iii) Assume suitable data, if required.

Section A

Q.1 Solve the following questions (any five) 10

1) The lead screw of a lathe with nut forms a
a) Sliding pair b) rolling pair c)Screw pair d)turning pair
2) In a mechanism, the fixed instantaneous centers are those centers which
a) remain in the same place for all configurations of the mechanism
b) Vary with the configuration of the mechanism
c) moves as the mechanism moves, but joints are of permanent nature
d) none of the above
3) The two links OA and OB are connected by a pin joint at O. If the link)A turns with angular velocity $w_1$rad/s in the clockwise direction and the link OB turns with angular velocity w_2 rad/s in the anti-clockwise direction, then the rubbing velocity at the pin joint O is
a) $w_1 w_2$ r , b) $(w_1 - w_2)r$, c) $(w_1 + w_2)r$, d) $(w_1 - w_2)2r$
Where r =Radius of the pin at O
4) A point B on a rigid link AB moves with respect to A with angular velocity w rad/s. The total acceleration of B with respect to A will be equal to
a) vector sum of radial component and coriolis component
b) vector sum of tangential component and coriolis component
c) vector sum of radial component and tangential component
d) vector difference of radial component and tangential component
5) A higher pair has_____
a) Point contact b)surface contact c) No contact d) None of the above
6) The component of the acceleration, parallel to the velocity of the particle, at the given instant is called
a) Tangential component b) radial component c) Coriolis component d)none of these
7) The relation between number of pairs (p) forming a kinematic chain and the number of links (1) is
a) 1=2p-3 b) 1=2p-4c) 1=2p-5d) 1=2p-2
8) Which of the following is an inversion of a double slider crank chain?
a) Oldham's coupling b)Elliptical trammel c) Scotch yoke mechanism d)All of these
9) The Coriolis component of acceleration leads the sliding velocity by
a)90^o b)135^o c)45^o d)80^o
10 A combination of kinematic pairs, joined a such a way that the relative motion between the links is completely constrained, is called a
a) Kinematic chain b) Inversion c) Structure d) Mechanism

Q.2 Refer the Fig.1.The mechanism shown has the following dimensions 15
$l\ (OA)$ =200mm,$l\ (AB)$=1.5m,$l\ (BC)$=600mm,$l\ (CD)$=500mm and $l\ (BE)$=400mm.Locate all the instantaneous centers for this mechanism, find i) Velocity of D ii) Angular velocity of the links CD. Assume that crank OA rotates uniformly at 120 rpm clockwise

Q.3 The dimensions of various links in a mechanism, as shown in Fig.2. are as follows: AB=60mm, BC=400mm, CD=150mm, DE=115mm, and EF=225mm Find the velocity of slider F when crank AB rotates uniformly in clockwise direction at a speed of 60rpm. 15

Q.4 Figure3. Shows the mechanism used in two cylinder 60° V-engine. Crank 2 rotates in clockwise direction at speed of 2000 rpm. Determine for the position shown, the velocities and accelerations of the sliders B and D. Given O_2A=20mm, AC=20mm,AB=BC=60mm and CD=50mm 15

Q.5 The following data refer to a steam engine: Diameter of piston=240mm; Stroke=600mm; length of connecting rod=1.5m;mass of the reciprocating parts=300kg; mass of connecting rod=250 kg; speed=125 r.p.m ;centre of gravity of connecting rod from the crank pin= 500 mm; radius of gyration of the connecting rod about an axis through center of gravity=650mm.Determine the magnitude and direction of torque exerted on the crank shaft when the crank has turned through 30° from inner dead centre. 15

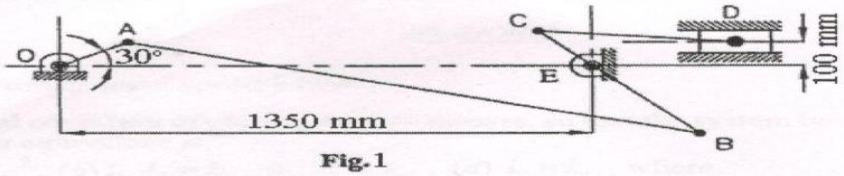

Fig.1

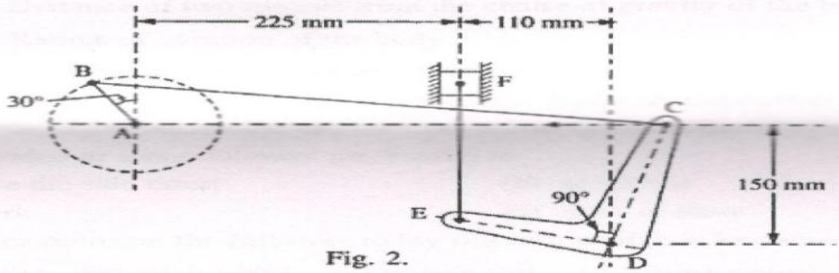

Fig. 2.

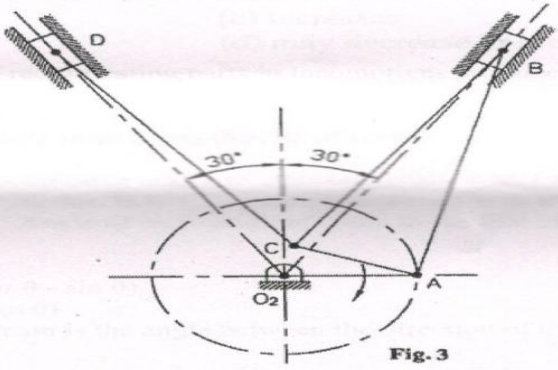

Fig. 3

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Section-B

Q.6 Solve the Following (any five) 10

1) The essential condition of placing the two masses, so that the system becomes dynamically equivalent is
a) $l_1 \,.\, l_2 = {k_G}^2$, b)$l_1 \,.\, l_2 = k_G$, c)$l_1 = k_G$, d)$l_2 = k_G$, Where,

$l_1 \; and \; l_2$ =Distance of two masses from the centre of gravity of the body and k_G =Radius of gyration of the body

2) Which of the following is an absorption type dynamometer?
a) Prony brake dynamometer b) rope brake dynamometer c) epicyclic-train dynamometer d)torsion dynamometer
3) Offet is provided to a cam follower mechanism to
a) minimize the side thrust b) accelerate c) avoid jerk d) none of these
4) The reference point on the follower to lay the cam profile is known as the
a) cam centre b) pitch point c)trace point d) prime point
5) The pressure angle of the cam_____ with increase in the base circle diameter.
a) decreases b)increases c) does not change d) may decrease or increase
6) The partial balancing of reciprocating parts in locomotives produces
a) hammer blow b)swaying couple c) variation in tractive force along the line of stroke d)All of the above
7) The tractive forces in a locomotive with two cylinders is given by (where c=Fraction of reciprocating parts per cylinder, m=Mass of reciprocating parts, w=Angular speed of crank ,r=Radius of crank ,andθ=Angle of inclination of crank to the line of stroke)
a)$m.w^2.r\cos\theta$ b)$c.m.w^2.r\sin\theta$ c) $(1-c)m.w^2.r(\cos\theta - \sin\theta)$ d)$m.w^2.r(\cos\theta - \sin\theta)$
8) The pressure angle of a cam is the angle between the direction of the follower motion and a normal to the
a) pitch circle b) base circle c) pitch curve d) prime circle
9) In order to balance the reciprocating masses,
a)primary forces and couples must be balanced b) secondary forces and couples must be balanced
c)both (a) and (b) d) none of these
10) The brake commonly used in railway trains is
a) shoe brake b) band brake c) band and block brake d) internal expanding brake

Q.7 A simple band brake operates on a drum of 600mm in diameter that is running at 200 rpm;the coefficient of friction is 0.25.The brake band has a contact of 270^o,one end is fastened to a fixed pin and the other end to brake arm 125 mm from the fixed pin. The straight brake arm is 750mm long and placed perpendicular to the diameter that bisects the angle of contact. 15

1. What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull?
2. What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed $50N/mm^2$?

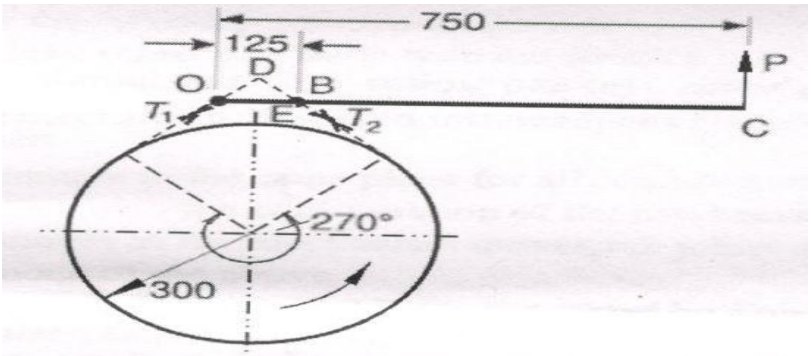

Figure 4.

Q.8 It is required to draw the profile of a cam to give following motion to the follower:- 15
i) follower to move outwards through 31.4 mm during 180^o of cam rotation with cycloidal motion.
ii) follower to return with cycloidal motion during $180^o$of cam rotation
Determine the maximum velocity and acceleration of the follower during the outstroke when the cam rotates at the 3000 r.p.m clockwise .The base circle of the cam is of 30mm radius and follower roller radius is 10mm.The axis of follower is offset by 7.5mm to right

Q.9 A,B,C,D are the four masses carried by a rotating shaft at 100mm,150mm,150mm and 200mm radius respectively. 15
The planes in which the masses rotate are spaced at 500 mm apart and the magnitudes of the masses B, C and D are 9 kg,5kg and 4kg respectively. Find the required mass A and the relative angular setting of the four masses so that the shaft be in complete balance.

Q.10 A two cylinder uncoupled locomotive has inside cylinders 60cm apart. The radius of each crank is 30cm.The cranks 15
are at right angles. The weight of the revolving mass per cylinder is 2452.5N and the weight of the reciprocating mass per cylinder is 2943N.The whole of the revolving and2/3^{rd} of the reciprocating masses are to be balanced and the balanced weights are placed, in the planes of rotation of the driving wheels, at radius of 80cm. The driving wheels are 2m in diameter and 1.5m apart .If the speed of the engine is 80km/hr, find the hammer blow, maximum variation of tractive effort and maximum swaying couple

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