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SE-6261

B. E. - II (Sem. - III) (Mech.) Examination

May/June – 2011

Theory of Machine - I

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

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 2 (SEM. - 3) (MECH.)**

Name of the Subject :

☛ **THEORY OF MACHINE - 1**

☛ Subject Code No. : **6 2 6 1** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Attempt all questions.
(3) Assume suitable data if required.
(4) Fig. to the right indicate full marks.

1 (a) Select the proper choice. **10**

(i) The cam and follower without a spring forms.

(a) lower pair

(b) Higher pair

(c) Self closed pair

(d) Force closed pair

(ii) The lead screw of a lathe with nut forms a

(a) Sliding pair

(b) Rolling pair

(c) Screw pair

(d) Turning pair

(iii) The mechanism forms a structure, when degree of freedom.

(a) 0

(b) 1

(c) 2

(d) -1

(iv) Linear velocity of a point B on a link AB relative to point A is

(a) $W.\ AB$

(b) $W.\ (AB)^2$

(c) $W^2.\ AB$

(d) $(W.\ AB)^2$

(v) Rubbing velocity at pin joint is if both links rotate in clockwise directions.

(a) $W_1.W_2.r$

(b) $(W_1\text{-}W_2).r$

(c) $(W_1+W_2).r$

(d) $(W_1\text{-}W_2).2r$

(vi) The component of acceleration parallel to the velocity of the particle, at the given instant is called _____ component.

(a) Radial

(b) Tangential

(c) Coriolis

(d) None

(vii) Total no. of I Centre can be found

(a) $n/2$

(b) n

(c) $n-1/2$

(d) $n^{(n-1)}/2$

(viii) Radial component of acceleration B with respect to A

(a) $V_{ba} \times AB$

(b) $V_{ba}^2 \times AB$

(c) V_{ba} / AB

(d) $V^2 ba / AB$

(ix) Quarternary joint is equal to ____binary joint.

(a) 1

(b) 2

(c) 4

(d) None

(x) Grubler's criterion is

(a) $n = (l - i) - j$

(b) $n = 2(l - i) - 2j$

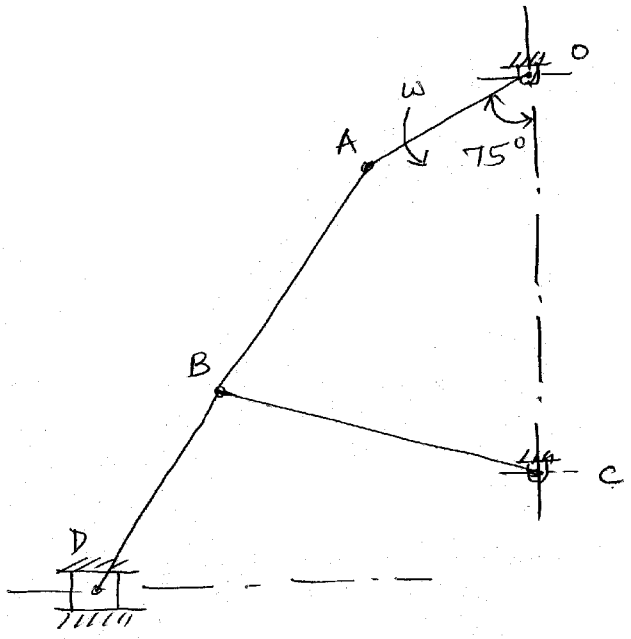
(c) $n = 3(l - i) - 2j$

(d) $n = 4(l - i) - 3j$

(b) Sketch and explain two inversion of a double slider crank chain. **10**

2 Attempt any **three** of the following : **30**

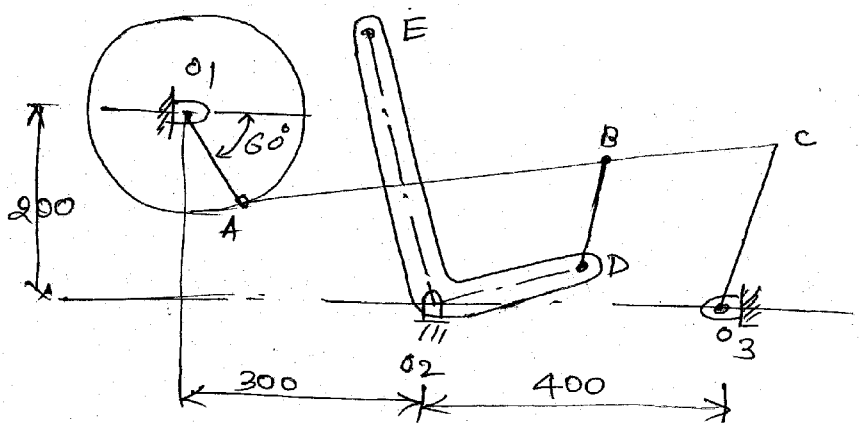
(a) Angular velocity of the crank OA is 600rpm. Determine the linear velocity of the slider D and angular velocity of the link BD when, the crank is inclined 75° to the vertical. OA=28, AB=44, BC=49, BD=46mm, OC=65mm. The path of travel of slider is 11mm. below the fixed point C.



(b) Derive an equation for radial and tangential component of acceleration when particle is moving in circular path with sketch.

(c) Derive the ratio of forward and return stroke of with work QRM mechanism and stroke length. with neat sketch.

(d) Fig. shows the dimension as follows : O_1A=100, AC=700, BC=200, O_3C=200, O_2E=400, O_2D=200, BD=150mm. The crank O_1A rotates at a uniform speed of 100rad/s. Find the velocity of point E by I-centre method.



(e) (i) Explain Kennedy theorem. **3**

(ii) Explain Degree of freedom **4**

(iii) Explain Grashof's law. **3**

3 (a) Attempt the following : **6**

(i) The cam profile and the cam pitch curve are same for

(a) Knife edge follower

(b) Roller follower

(c) Flat foot follower

(d) all of the above

(ii) The size of the cam depends upon

(a) base circle

(b) Prime circle

(c) Pitch circle

(d) Pitch curve

(iii) The term $\omega^3 \frac{d^3y}{d\theta^3}$ in m/sec^3 in cam and follower motion represents

(a) displacement of follower

(b) jerk of follower

(c) acceleration of follower

(d) velocity of follower

(iv) The angular velocities of two pulleys connected by crossed belt or open belt are

(a) Directly proportional to their diameters

(b) Inversely proportional to their diameters

(c) Directly proportional to square to their diameters

(d) Inversely proporsional to square of their diameters

(v) The products of circular pitch and dimetral pitch is equal to

(a) 2π

(b) $\frac{1}{\pi}$

(c) π

(d) $\frac{\pi}{2}$

(vi) For two mating gear, their

(a) Clearance must be same

(b) Dedendum must be same

(c) Number of teeth must be same

(d) Module must be same

(b) Explain the following terms : **4**

(i) Pitch circle for a cam

(ii) Prime circle

(iii) Pressure angle for cam

(iv) Cam angle.

(c) A plate cam with roller follower has the following specifications : **10**

(i) Angular speed of cam-1000rpm

(ii) Cam contour set for SHM

(iii) The stroke of follower-25mm

(iv) Angle of action for out stroke-120°

(v) Angle of action for return stroke-100°

(a) Determine the displacement, velocity and acceleration of the follower at cam angle of 30°.

(b) Determine the configuration i.e. cam angle on return stroke to give the same displacement, velocity and acceleration on return stroke. Do not draw the cam profile.

4 (a) Explain law of gearing with neat sketch and derive the relation for arc of contact. **7**

(b) An involute tooth profile rack is driven by a pinion of 20 involute teeth and 120 mm pitch circle diameter, the addendum of both pinion and rack is 7mm. Determine (i) the least pressure angle which can be used to avoid interference and (ii) the length of arc of contact and the minimum number of teeth in contact at a time with the same pressure angle. **8**

OR

4 (a) Derive an expression for centrifugal tension in Newtons, in terms of linear speed of belt, width of the belt, thickness of the belt and density of the belt for flat belt drive. **7**

(b) The grooves on the pulleys of a multiple rope drive have an angle of 50° and accommodate ropes of 22mm diameter having a mass of 0.8 kg per meter length for which a safe operating tension 1200N has been laid down. The two pulleys are of equal size. The drive is designed for maximum power conditions speed of both the pulleys is 180 rpm. Assuming coefficient of friction as 0.25, determine the diameters of pulleys and the numbers of ropes when the power transmitted is 150 kW. **8**

5 (a) Derive an expression for the length of flat belt between two pulleys for open belt drive. **7**

(b) Two gears in mesh have a module of 8mm and a pressure of angle of 20^{o}. The larger gear has 57 while the pinion has 23 teeth. If the addenda on pinion and gear wheel are equal to one module, find **8**

(i) The number of pairs of teeth in contact

(ii) The angle of action of the pinion and the gear wheel.
