KUMARAGURU
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Register Number: ……..

B.E DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2009)

Third Semester

MECHATRONICS ENGINEERING

MCT101: Kinematics of Machinery

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. The lead screw of a lathe with nut is a
   a) Rolling pair b) Screw pair
   c) Turning pair d) Sliding pair
2. Which of the following is an inversion of double slider crank chain?
   a) Whitworth quick return mechanism b) Reciprocating compressor
   c) Scotch yoke mechanism d) Rotary engine
3. The linear velocity of a point B on a link rotating at an angular velocity ω relative to another point A on the same link is
   a) Intersecting b) Parallel
   c) Perpendicular d) Co-axial
4. Coriolis acceleration component is taken into account for a mechanism
   a) Double slider crank b) Four – link mechanism
   c) Beam engine mechanism d) Quick return mechanism
5. The cam follower used in air- craft engine is
   a) Roller b) Flat- faced
   c) Spherical- faced d) Knife- edged
6. The most suitable follower motion for high speed engine is
   a) Uniform acceleration motion b) Uniform velocity
   c) Simple harmonic motion d) Cycloidal
7. The module of spur gear is the ratio of
   a) The number of teeth to the pitch diameter b) The pitch diameter to the number of teeth
   c) The circumference of pitch circle to number of teeth d) The circumference of pitch circle to diameter of pitch circle

8. If the axes of first and last gear of a compound gear train are co-axial, the gear train is known as

a) Simple b) Epicyclic

c) Reverted d) Compound

9. Centrifugal tension in the belt is given by

a) $T_c = mv^3$ b) $T_c = mv^2$

c) $T_c = mv$ d) $T_c = mv/2$

10. The efficiency of a screw jack increases with

a) Decrease in load b) Increase in load

c) Decrease in pitch d) Increase in pitch

PART B (10 x 2 = 20 Marks)

11. What is drag link mechanism?
12. What is meant by indexing mechanism? Where do we use it?
13. Define rubbing velocity. What will be the expression for rubbing velocity at a pin joint when the two links rotate in opposite direction?
14. State the uses of kinematic analysis.
15. Differentiate derived and specified contour cams.
16. Define dwell period of cam.
17. Sate the law of gearing.
18. How epicyclic gear train differ from other type of gear train.
19. What is the condition for self- locking in screw?
20. What is creep? How does it affect the strength of the belt drive?

PART C (5 x 14 = 70 Marks)

21. a) Define double slider crank mechanism. With the neat sketches, explain any three inversion of double slider crank mechanism.

(OR)

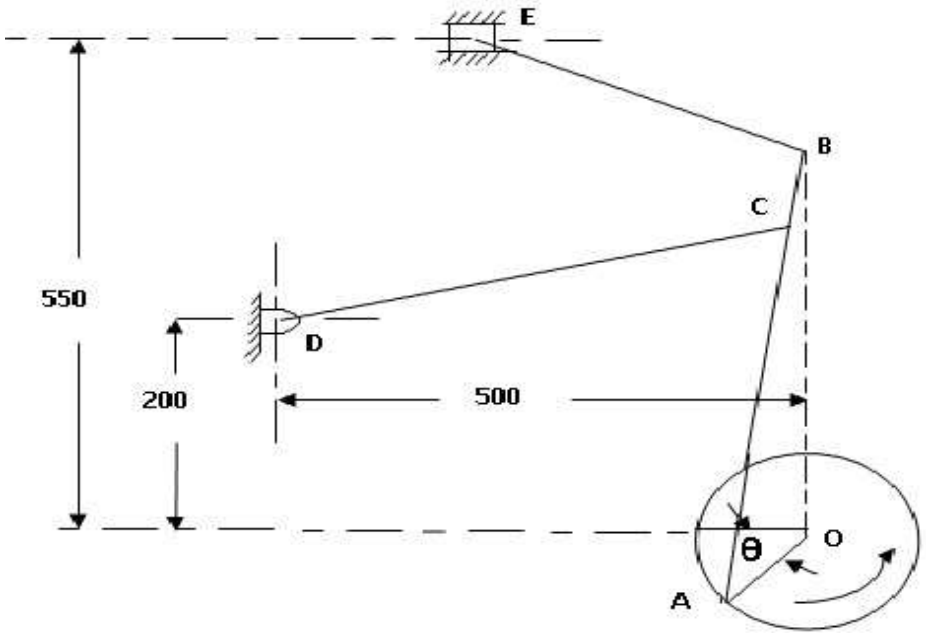
b) Sketch and describe the working of any one quick return mechanism. Derive an expression for the ratio of times taken in forward and return stroke for quick return mechanism.

22. a) A four bar linkage has following dimensions Crank AO_2= 150mm, Link AB= 350mm, Link BO_4=300mm, Link O_2O_4=200mm, Link O_2O_4 is fixed. Find the angular velocity and angular acceleration of the links AB and BO_4 when the

crank is rotating with a constant velocity of 200rad/sec counter clockwise and also positioned of 45^0 to horizontal.

(OR)

b) Figure shows the mechanism of a radial valve gear. The crank OA turns uniformly at 150 rpm and is pinned A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are OA = 150 mm, AB = 550 mm, AC = 450 mm, DC = 500 mm, BE = 350 mm. Determine velocity and acceleration of the ram E for the given position of the mechanism. (In the figure, All Dimensions are in mm and $\theta = 30^0$)



23. a) Draw the profile of a cam operating a roller reciprocating follower and with the following data.

Minimum radius of the cam = 25mm, lift = 30mm, roller diameter = 15mm The cam lifts the follower for 120^0 with SHM followed by a dwell period of 30^o. Then the follower lowers down during 150^o of the cam rotation with uniform acceleration and retardation follower by a dwell period.

(OR)

b) In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30mm and roller radius is 17.5mm.The angle of ascent is 75^o and the total lift is 17.5mm.The speed of the cam shaft is 600rpm.Assume that here is no dwell between ascent and descent. (i) Calculate the principle dimension of the

cam. (ii) Find the acceleration of the follower at the beginning of the lift. (iii) Draw the profile of the cam.

24. a) A pair of 20^0 full depth involute spur gears having 30 and 50 teeth respectively of module 4mm is in mesh. The smaller gear rotates at 1000rpm Determine (i) sliding velocities at engagement and at disengagement of a teeth (ii) Contact ratio.

(OR)

b) A compound gear train using spur gears is required to give a total reduction ratio of 250 to 1 in four steps. The modules of the gear are 5mm for the first step, 7 mm for the second, 10mm for the third and 16mm for the fourth.(i) Arrive at the individual speed ratios, if a tolerance of ± 0.2% is allowed in the total reduction ratio. (ii) Find the number of teeth of all gears, if the minimum number of teeth for any pinion is 20 (iii) Find the pitch circle diameters of all gears and the centre distances. (iv) Sketch a line diagram showing the gear train.

25. a) A single plate clutch, with both sides effective, has outer and inner diameters 300mm and 200mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed $0.1N/mm^2$. If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500rpm for two types of assumptions that is, for uniform pressure and for uniform wear.

(OR)

b) A compressor requiring 90KW is to run at 250 rpm. The drive is by V- Belt from an electric motor running at 750r.p.m. The diameter of the pulley on the compressor shaft must not be greater than 1 meter while the centre distance between the pulley is limited to 1.75 mete. The belt speed should not exceed 1600m/min. Determine the number of V – Belts required to transmit the power if each belt has a cross sectional area of $375mm^2$, density is $1000Kg/m^3$ and an allowable tensile stress of 2.5MPa. The groove angle of the pulley is 35^o. The coefficient of friction between the belt and the pulley is 0.25. Calculate also the length of the belt required.

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