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Question Paper Code : 90363

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Third/Fourth Semester
Mechanical Engineering
ME 8492 : KINEMATICS OF MACHINERY
(Common to Mechanical Engineering (Sandwich)/Mechatronics Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Write the different types of kinematic pairs based on the relative motion between them.
2. Differentiate machine and structure.
3. What are the types of instantaneous centres ?
4. Define rubbing velocity at a pin joint.
5. Define prime circle and pitch curve of a cam.
6. List the methods used to reduce the pressure angle of a cam.
7. What do you mean by spiral gears and hypoid gears ?
8. Distinguish cycloid and involute profiles of gear tooth.
9. Define lead and pitch of a screw thread.
10. State the two assumptions based on which the bearings are designed.

PART – B **(5×13=65 Marks)**

11. a) State whether the following links shown in fig. 11 (a, b, c and e) are mechanisms with one degree of freedom. If not make suitable changes but the number of links should not be varied more than one **(13)**

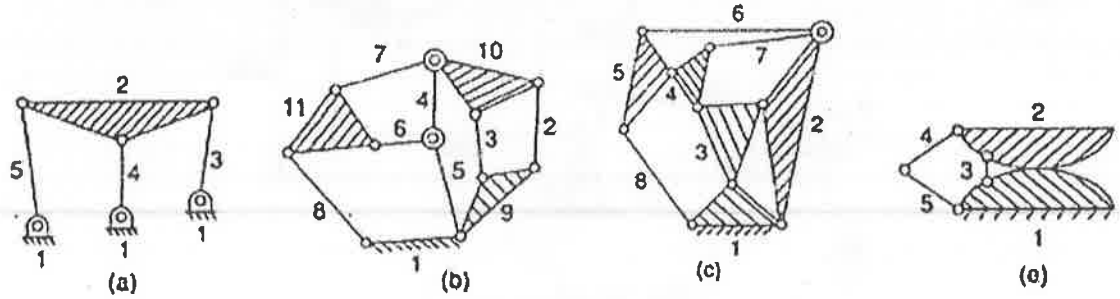

Fig.11

(OR)

b) i) For the kinematic linkage shown in Fig. 11 (b) (i) calculate the (i) total number of binary, ternary and quaternary links (ii) total number of links (iii) total number of joints or pairs (iv) the number of degrees of freedom. Comment on the kinematic linkage based on mobility. **(8)**

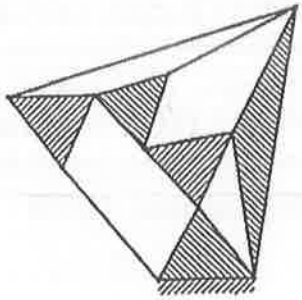

Fig.11 (b)(i)

ii) Explain how are the Whitworth quick return mechanism and Crank and slotted lever mechanism different from each other. **(5)**

12. a) i) State and explain angular velocity ratio theorem. **(5)**

ii) In a slider crank mechanism, the lengths of the crank and connecting rod are 200 mm and 800 mm respectively. Locate all the I-centers of the mechanism for the position of the crank when it has turned 30° from the inner dead centre. Also find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/s, clockwise. **(8)**

(OR)

b) Fig.12(b) shows a mechanism in which OA = QC = 100 mm, AB = QB = 300 mm and CD = 250 mm. The crank OA rotates at 150 rpm in the clockwise direction. Determine the (i) velocity of the slider at D (ii) angular velocities of links QB and AB (iii) rubbing velocity at the pin B which is 40 mm in diameter. **(13)**

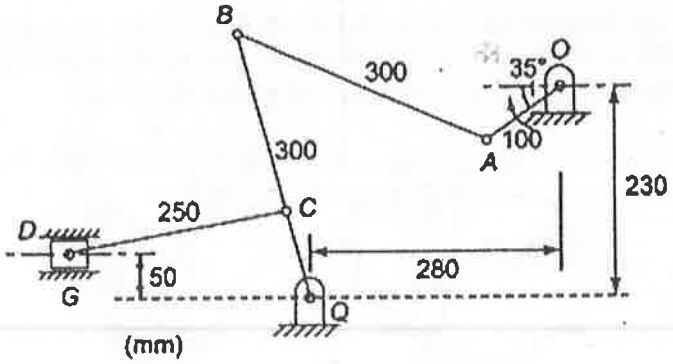

Fig.12 (b)

13. a) i) The following data relate to a cam profile in which the follower is a knife edge follower and moves with SHM during the accent and decent. Minimum radius of cam = 25 mm, lift = 30 mm, angle of ascent = 120°, angle of descent = 100°, angle of dwell between ascent and descent = 80°, speed of cam = 200 rpm. Draw profile of the cam and determine the maximum velocity and maximum acceleration during out stroke and the return stroke. **(10)**

ii) Why cycloidal cams are suitable for high speed applications ? **(3)**

(OR)

b) i) A radial cam, operating a roller follower, rotates at 200 rpm. The follower rises through 20 mm with S.H.M. during 120° of cam rotation. it dwells for 30° of cam rotation and returns to the initial position by S.H.M. in next 150° of cam rotation. Assuming a minimum radius of cam to be 25 mm, and roller diameter as 10 mm draw the cam profile. **(10)**

ii) Determine V_{max} and A_{max} during outstroke. **(3)**

14. a) Calculate (i) length of path of contact (ii) arc of contact (iii) the contact ratio, when a pinion having 23 teeth drives a gear having 57 teeth. The profile of the gears is involute with pressure angle 20°, module 8 mm and addendum equal to one module. **(13)**

(OR)

b) In a reduction gear shown in Fig. 14 (b), the input S has 24 teeth. P and C constitute a compound planet having 30 and 18 teeth respectively. If all the gears are of same pitch, find the ratio of the reduction gear i.e., ratio of speed of gear S to speed of gear D. Assume A to be fixed. **(13)**

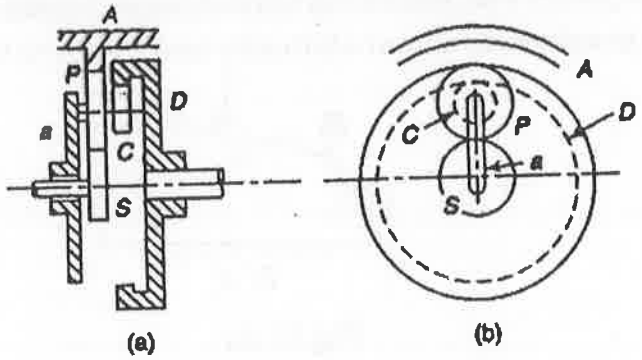

Fig.14 (b)

15. a) A screw jack is used to raise 50 kN of load. The spindle of the screw jack moves in a fixed nut and has a single start square threads of 60 mm mean diameter having a pitch of 20 mm. The coefficient of friction between the screw and nut is 0.12. Effort is applied at the end of a single lever having an effective length of 0.75m. The load is prevented from revolving and it is carried on a swivel seat, the bearing surface of which has a mean radius of 4/3 times that of threads. The coefficient of friction between the seat and spindle is 0.10. Find the force applied at the end of the lever when the load is raised. Also, find the mechanical efficiency of the screw jack. Check whether the screw jack is self locking or not ? **(13)**

(OR)

b) A pulley used to transmit power with rope drive has diameter of 3 m and has 15 grooves of 45°. The angle of contact is 160° and the co-efficient of friction between ropes and the groove sides is 0.3. The maximum possible tension in the ropes is 1000 N and the mass of the rope is 1.5 kg per meter length. What is the speed of the pulley in rpm and the power transmitted if the condition of maximum power exists ? **(13)**

PART – C **(1×15=15 Marks)**

16. a) In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate (i) the principal dimensions of the cam (ii) the accelerations of the follower at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent.

(OR)

b) i) Identify the type of inversion of the four bar mechanism shown in Fig 16. (b) stating the reasons for your answer. The figure indicates the dimensions in standard units of length is a = 1 unit b = d = 3 units c = 2 units. **(4)**

ii) Find the maximum and minimum transmission angles for the same mechanism graphically and analytically and compare them. **(11)**

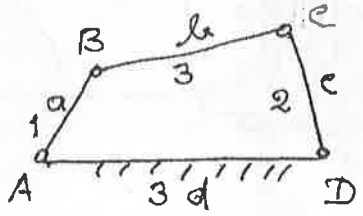

Fig.16 (b)