Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, June-2018

SUBJECT: THEORY OF MACHINES [MTE 2201]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed with justification.

1A. What do you mean by inversion of a mechanism? Enumerate the inversions of double slider crank chain with examples. **(03)**

1B. Elaborate on the operation of a reverted gear train, with the aid of neat sketch. **(03)**

1C. Why are parallel-crank four-bar linkage and deltoid linkage considered special cases of four-link mechanism? Support your answer with Grashof's law. **(04)**

2A. In bar link mechanism, the dimensions of the links are as under: **(06)**

AB=50 mm, BC=66 mm, CD=56 mm and AD=100mm and is a fixed link. At the instant when angle DAB=60°, the link AB has an angular velocity of 10.5 rad/sec in the counterclockwise direction. Determine the velocity of offset points F and G on the link BC and CD respectively, if BF=45 mm, CF= 30 mm, CG=24mm, DG= 44mm and BCF and DCG are read in clockwise. Also determine the velocity of rubbing at Pins A and D when the radii of the pins are 30 and 35 mm respectively.

2B. For the Mechanisms shown in the Fig Q2B(i) and Q2B(ii). Calculate the number of links, joints, and degrees of freedom. **(04)**

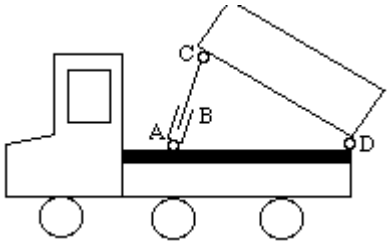
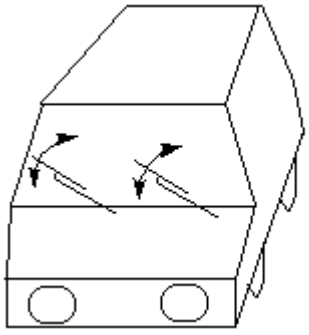


Fig Q2B (i)



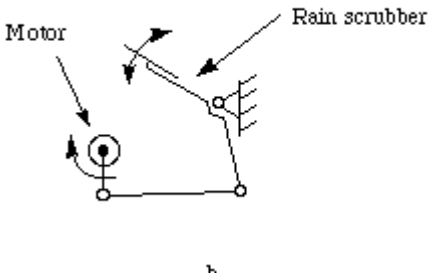


Fig Q2B(ii)

3A. In a reduction gear shown in the Fig. Q3A, 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 the same pitch, find the ratio of the reduction gear. Assume A to be fixed **(05)**

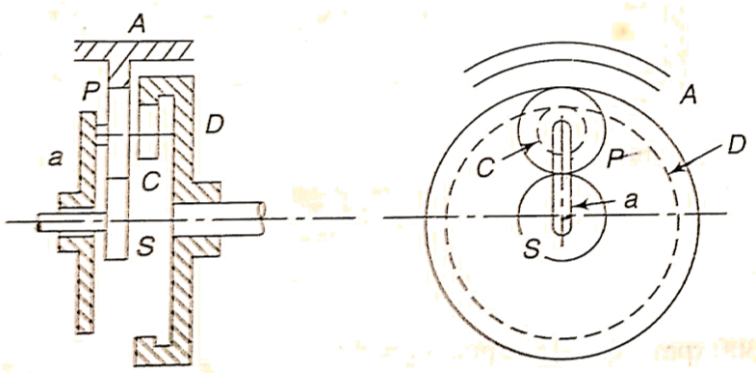


Fig Q3A. Epicyclic Gear Train

3B. Four masses M_1=100kg, M_2=175kg, M_3=200kg and M_4=125kg are fixed to the crank of 200mm radius and revolve in planes 1, 2, 3, and 4 respectively. The angular position of the planes 2, 3 and 4 w.r.t. 1 are 75°, 135° and 240° taken in the same sense. Distances of the planes 2, 3 and 4 from 1 are 600mm, 1800mm and 2400mm. Determine the magnitude and position of the balancing masses at radius 600mm in planes *L* and *M* located in the middle of 1 and 2, and in the middle of 3 and 4, respectively. **(05)**

4A. Demonstrate that in involute profile gears, 'Arc of contact' can be in turn related to 'Path of contact'. **(04)**

4B. Elucidate on the positive drive cams. Cite an example of the same. **(03)**

4C. Illustrate the mechanism that allows intermittent rotary motion in only one direction while preventing motion in the opposite direction and enumerate the applications of this mechanism. **(03)**

5A. A cam is to give the following motion to a knife edge follower: **(05)**

- → To raise the follower through 30mm with uniform acceleration and deceleration motion during 120° rotation of the cam.
- → Dwell for next 30° rotation of the cam.
- → To lower the follower with simple harmonic motion during next 90° rotation of the cam
- → Dwell for the rest of the cam rotation

The cam has a minimum radius of 30mm and rotates counterclockwise at a uniform angular velocity of 92.15 rad/sec. Draw the profile of the cam for this cam follower arrangement, if the line of stroke of the follower passes through the axis of the cam shaft. Also, calculate the maximum acceleration of the follower during its decent.

5B. What is Kutzback's criterion for degree of freedom of plane mechanisms? In what way is Grubler's criterion different from it? **(03)**

5C. How is the angular acceleration of the output link and the coupler found? **(02)**