Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B. TECH (MECHANICAL ENGG.) END SEMESTER MAKE UP EXAMINATIONS, DECEMBER - 2018

SUBJECT: KINEMATICS OF MACHINERY [MME 2102]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. An automobile spare part manufacturing company makes use of punch presses has obtained an order for producing 500 number of parts used for assembling the front and rear seat panel frames. This requires to make use of a mechanism which uses a large force acting through a short distance. Suggest the mechanism that needs to be used and elaborate its working to end users. **4**

1B. With neat sketch explain the working of a mechanism used to connect two shafts whose axes intersects. **3**

1C. Differentiate between the following with examples: **3**

i. Lower and Higher pairs
ii. Turning and Rolling pairs
iii. Screw pair and Spherical pair

2A. In Fig.Q2A, the angular speed of the crank OA is 600 rpm. Determine the linear velocity of slider D and angular velocity of link BD. OA = 28 mm. AB = 44 mm, BC = 49 mm, BD = 46 mm. **5**

2B. The mechanism of a sewing machine needle box is shown in fig. Q2B. For the given configuration, find the velocity of the needle fixed to the slider D when the crank OA rotates at 40 rad/s using instantaneous center method. $\angle QBC = 90^0$ **5**

3A. The lengths of the crank and connecting rod of a horizontal reciprocating engine are 100 mm and 150 mm respectively. The crank is rotating at 400 rpm. When the crank has turned 30^0 from inner dead center. Using Klein's construction, find: **3**

i) Velocity of piston
ii) Acceleration of piston
iii) angular velocity of connecting rod

3B. Derive the equation to determine length of path of contact on a pair of meshing gears and relate it with length of arc of contact. **4**

3C. A pair of spur gears has 16 teeth and 18 teeth, a module 12.5 mm, an addendum 12.5 mm and a pressure angle 14.5^0. Prove that the gears have interference; determine the minimum number of teeth to avoid interference. **3**

4A. Two gears in mesh have a module of 8mm and a pressure angle of 20^0. The larger gear has 57 teeth while the pinion has 23 teeth. If the addendum on pinion and gear wheel are equal to one module, find **5**

i. The number of pairs of teeth in contact and
ii. The angle of action of the pinion and the gear wheel.

4B. In the epicyclic gear train arrangement shown in the fig.Q4B all the gears have the same module, pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B is of same size as gear A and it meshes with both gears A and also with the annular fixed wheel E. Pinion C has 8 teeth and is integral with B (B, C being a compound gear wheel). Gear C meshes with annular wheel D, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B, C. If the motor runs at 1000 rpm, find the speed of the machine shaft. Find the torque exerted on the machine shaft, if the motor develops a torque of 100 Nm. **5**

5A. A single dry plate clutch transmits 7.5 kW at 900 rpm. The axial pressure is limited to 0.07 N/mm2. If the coefficient of friction is 0.25, find **5**

i. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and
ii. Outer and inner radii of the clutch plate.

5B. A cam is to give the following motion to a knife-edged follower: **5**

- To raise the follower through 30 mm with uniform acceleration and deceleration during 120^0 rotation of the cam.
- Dwell for next 30^0 of the cam rotation
- To lower the follower with simple harmonic motion during the next 90^0 rotation of the cam
- Dwell for the rest of the cam rotation

The cam has a minimum radius of 30 mm and rotates counter clockwise at a uniform speed of 800 rpm. Draw the profile of the cam if the line of stroke of the follower passes through the axis of the cam shaft.

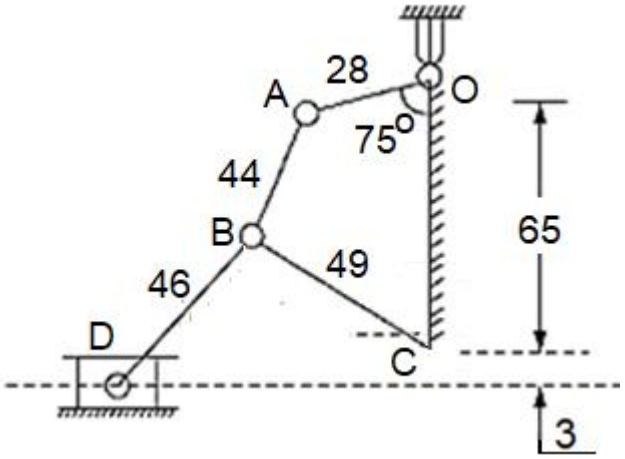

Fig. Q2A : All dimensions are in mm

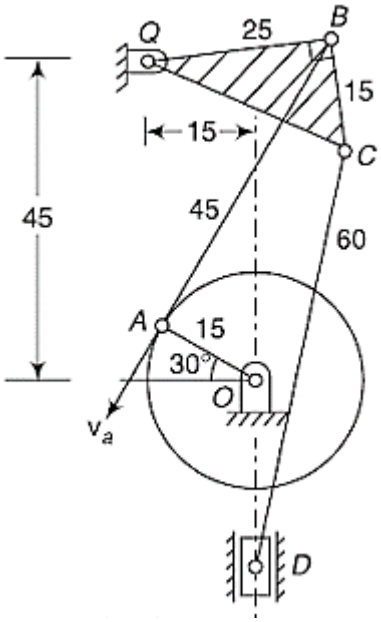

Fig. Q2B : All dimensions are in mm

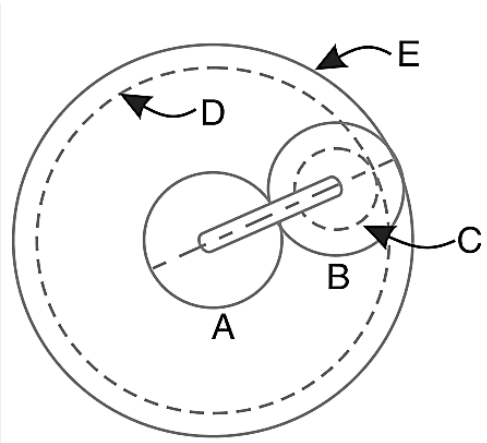

Fig. Q4B