Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 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. A customer has ordered for 100 cast iron components having dovetail slots. The manufacturing company looks to fulfill this order by reducing the cycle idle time of the cutting tool. Suggest the machine that needs to be used, sketch the mechanism that needs to be incorporated and describe its working. **4**

1B. Power plant engineers working in night shift while moving around the plant cooling system have observed two broken shafts connected to two flanges seems to be rigidly fastened at their ends by forging. Upon verification the team found that two parallel shafts with axes separated by a small distance were to be replaced. Suggest the mechanism to connect the shafts and describe its functionality. **3**

1C. Define the following precisely. **3**

i. Inversion. ii. Machine iii. Lower pair

2A. Draw the velocity diagram for the mechanism shown in Fig. Q2A. Determine the velocity of ram E for the given position, if crank OA rotates uniformly at 150 rpm in the anticlockwise direction. The dimensions of various links are: **5**
OA = 150 mm; AB = 550; AC = 450 mm; DC = 500 mm; BE = 350 mm.

2B. The lengths of the crank and connecting rod of a reciprocating engine are 200 mm and 800 mm respectively. The crank is rotating at a uniform speed of 480 rpm. Using Klein's construction find **5**

i. the velocity and acceleration of the piston and connecting rod.
ii. the acceleration of the middle point of the connecting rod and
iii. angular acceleration of the connecting rod when the crank has turned through 45^0 from the inner dead centre.

3A. With a neat sketch state and prove Kennedy's three center inline theorem. **3**

3B. Derive the equation to determine minimum number of teeth on the gear to avoid interference. **4**

3C. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. **3**

4A. A pair of spur gear wheels with involute teeth is to give a gear ratio 3:1. Maximum length of arc of approach is not to be less than circular pitch and the smaller wheel is the driver rotating clockwise. Pressure angle = 20^0. What is the least number of teeth that can be used on each wheel? What is the addendum of wheel in terms of circular pitch? **5**

4B. Fig. Q4B shows an epicyclic gear train with the following details: **5**
Gear 'A' has 40 teeth external (fixed gear); gear 'B' has 80 teeth internal; gears 'C - D' is a compound wheel having 20 and 50 teeth (external) respectively, gears 'E-F' is a compound wheel having 20 and 40 teeth (external) respectively, and gear 'G' has 90 teeth (external). The arm runs at 100 rpm. in clockwise direction. Determine the speeds for gears B, C, E, and G.

5A. The thrust of a propeller shaft in a marine engine is taken up by a number of collars integral with the shaft which is 300 mm in diameter. The thrust on the shaft is 200 kN and the speed is 75 rpm. Taking the coefficient of friction as constant and equal to 0.05 and assuming intensity of pressure as uniform and equal to 0.3 N/mm^2, find the external diameter of the collars and the number of collars required, if the power lost in friction is not to exceed 16 kW. **5**

5B. Draw the profile of a cam operating a roller reciprocating follower and with the following data: Minimum radius of cam = 25 mm, Lift = 30 mm, Roller diameter = 16 mm. The cam lifts the follower for 150^0 with SHM followed by a dwell period of 30^0. Then the follower lowers down during 120^0 of the cam rotation with uniform acceleration and deceleration followed by a dwell period for the rest of the cam rotation. **5**

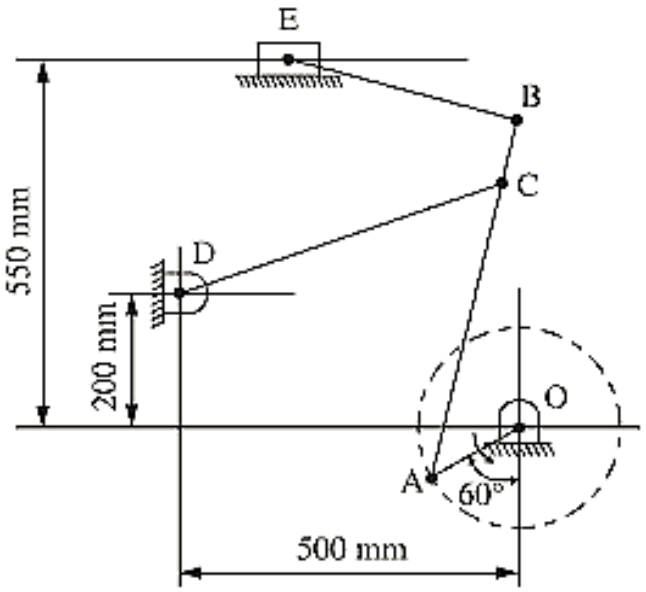

Fig. Q2A

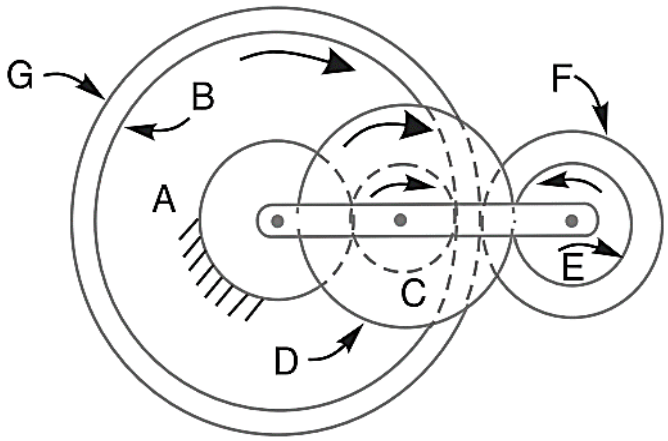

Fig. Q4B