Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (MECHANICAL ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: KINEMATICS OF MACHINERY [MME 2102]

REVISED CREDIT SYSTEM
(28 /11/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Explain with a neat sketch Whitworth Quick Return Motion Mechanism stating its applications. Also show that the time of return stroke is less than that of forward stroke. **05**

1B. Distinguish between i) Machine and structure ii) Completely constrained and successfully constrained motion. iii) Lower pair and higher pair. iv) Closed pair and unclosed pair. **05**

2A. In the mechanism shown in fig.Q2A, the crank AB rotates about A at a uniform speed of 120 rpm in the clockwise direction. The link DC oscillates about the fixed point D, which is connected to AB by a coupler BC. The block F moves in the horizontal guides, being driven by link EF. AB = DE = 150 mm, BC = CD = 450 mm, EF = 375 mm **05**

Determine

i. Velocity of block F
ii. Angular velocity of lever DC

2B. In a mechanism as shown in Fig.Q2B, the various dimensions are: OC = 12.5 cm, CP = 50 cm, PA = 12.5 cm, AQ = 25 cm and QE = 12.5 mm. The crank OC rotates uniformly at 120 rpm in the anti-clockwise direction. Determine **05**

i) The acceleration of link AQ
ii) The acceleration of the piston

The velocities of various links are tabulated as

Link	*Velocity (m/s)*
CP	1.15
Slider P	1.30
AP	0.45
AQ	1.25

3A. With a neat sketch derive an expression for the minimum number of teeth on a pinion to avoid interference from gear tooth to pinion tooth. **05**

3B. The following data refers to two mating involute gears of 20° pressure angle. Number of teeth on pinion is 20. Gear ratio = 3. Speed of pinion is 240 rpm. Module =12 mm. if the addendum on each wheel is such that the path of approach and the path of recess on each side are half the maximum permissible length. Find **05**

a) The addendum of pinion and gear
b) The length of path of contact
c) The length of arc of contact

4A. Fig.Q4A shows a compound epicyclic gear which consists of an annular gear D having internal teeth, a compound gear B-C, the sun gear A and the arm E. The compound gear B-C is also known as planet gear as this gear moves around the sun gear A. The sun gear A and annular gear D are co-axial. One shaft is connected to sun gear A and another shaft is connected to the arm. These two shafts are also co-axial. The sun gear A meshes with compound gear C and annular gear D meshes with compound gear B. The gears A, B and C are having 60, 40 and 25 external teeth respectively. If all the gears are having the same module, find the number of teeth on the fixed annular gear D. AIso find the speed of the shaft connected to the arm, if the speed of the shaft connected to sun gear A is 100 rpm. **05**

4B. 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 coefficient of friction equal to 0.05 and assuming intensity of pressure as uniform and equal to 0.3 MPa, find the external diameter of the collar, if the power lost in friction is not to exceed 16 kW. **02**

4C Derive an expression for the ratio of tensions for a flat belt passing over a pulley **03**

5A. Explain Uniform pressure theory. Derive the power loss due to friction in a collar bearing using uniform pressure theory. **03**

5B. A cam with 40 mm minimum radius is rotating clockwise at 250 rpm and imparts the follower motion to a knife edge follower. **05**

i) Lift = 35 mm
ii) Follower rises during 120° cam rotation with simple harmonic motion
iii) Follower dwell is for 60° cam rotation
iv) Follower returns during 90° cam rotation with uniform acceleration and deceleration
v) Follower dwells for the remaining period.
vi) The axis of follower is offset towards the right by 10 mm.

Draw the profile of the cam and determine the maximum velocity and acceleration during rise and return stroke.

5C. Define the following with respect to gears **02**

i) Line of action
ii) Arc of contact

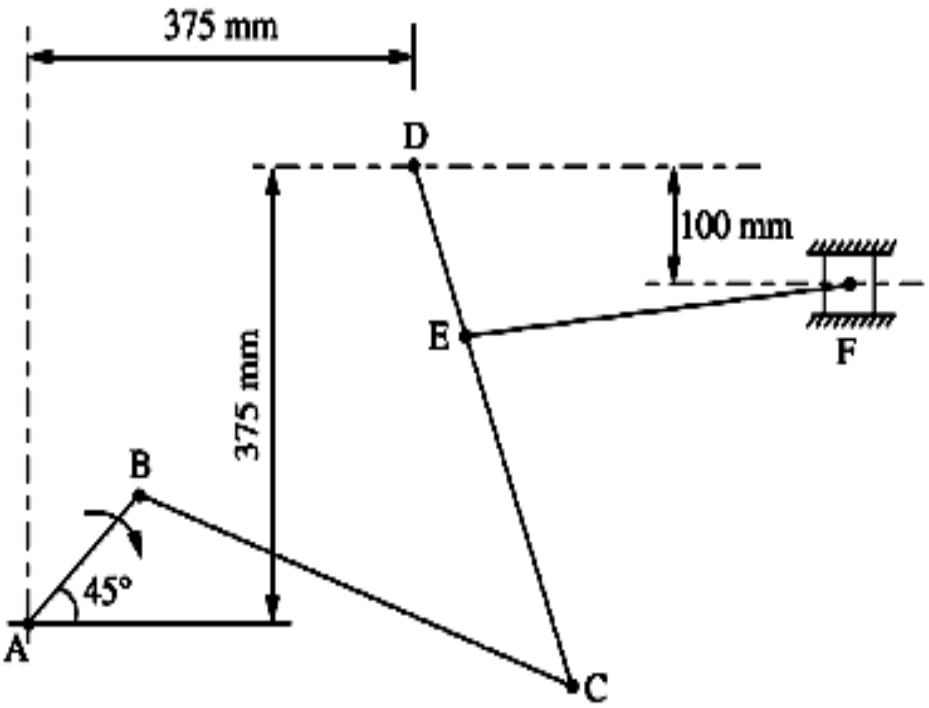

Fig.Q2A
All dimensions are in mm

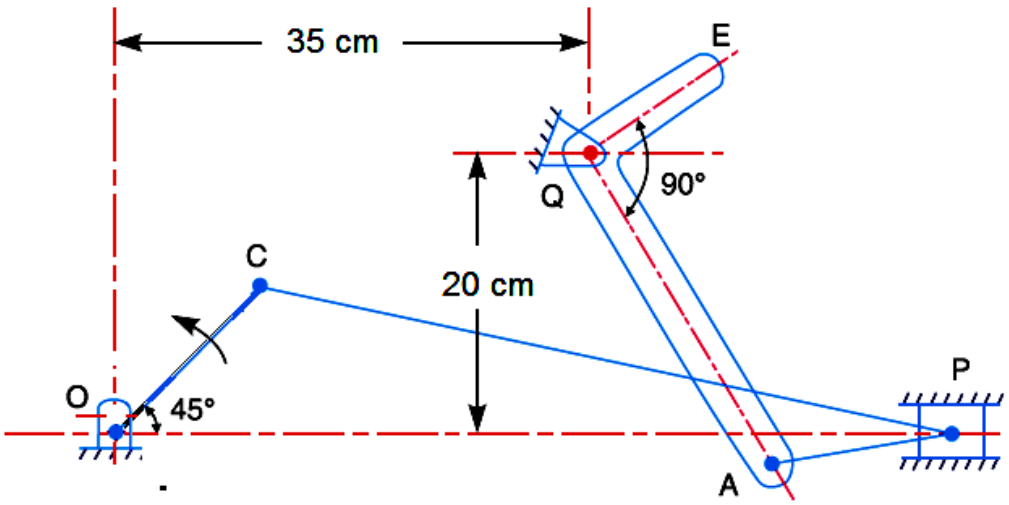

Fig.Q2B

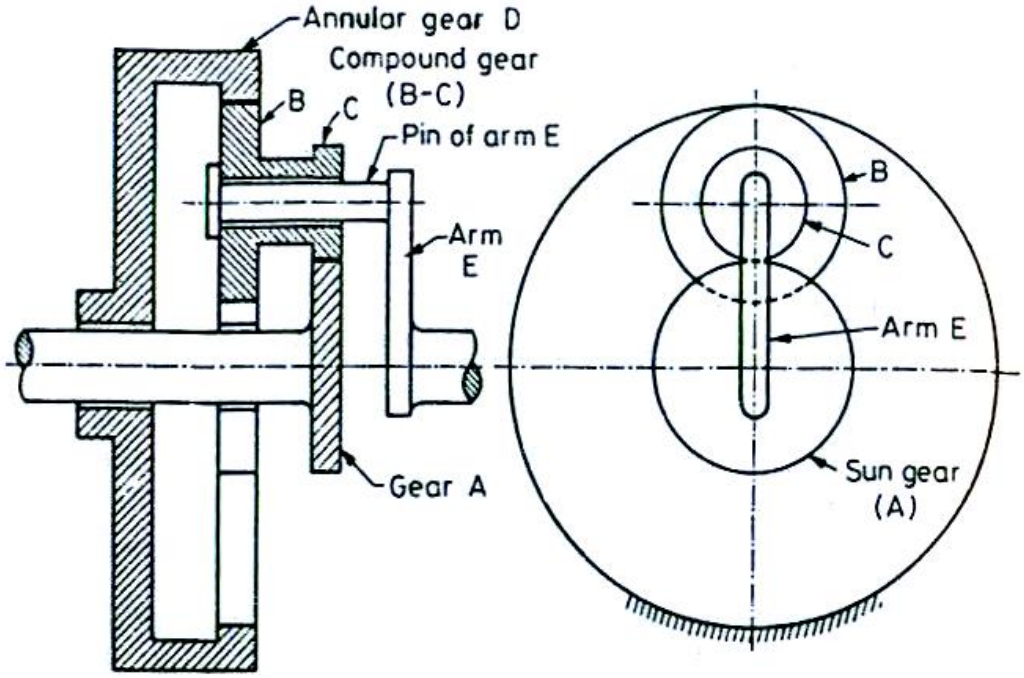
Annular gear D
Compound gear
(B-C)
B
C
Pin of arm E
Arm
E
Gear A
B
C
Arm E
Sun gear
(A)

Fig.Q4A