Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

III SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, NOV 2017

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. In the mechanism shown in figure Q1A, the crank AB rotates about point A at uniform speed of 240 rpm in clockwise direction. The link CD oscillates about the fixed point D, which is connected to link AB by a coupler link BC. The slider F moves in horizontal guides, being driven by the link EF. Determine: **(5)**

i) velocity of slider F ii) angular velocity of link CD using relative velocity method

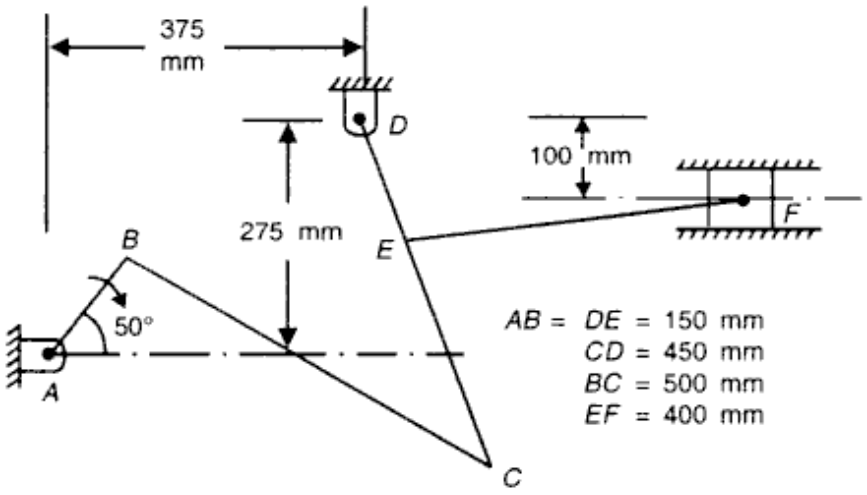

Figure Q1A

1B. With a suitable neat sketch explain the working of a mechanism which is used to connect two parallel shafts whose axes are a small distance apart. **(3)**

1C. Classify various types of cams on the basis of follower movement. **(2)**

2A. Figure Q2A shows a toggle mechanism in which the crank OA rotates uniformly at 120 rpm (clockwise). Find acceleration of the slider at D. The velocities of various links are given as follows: **(5)**

ab = v_{ba} = 0.46 m/s

qb = v_b= 0.26 m/s

bd = v_{db} = 0.25 m/s

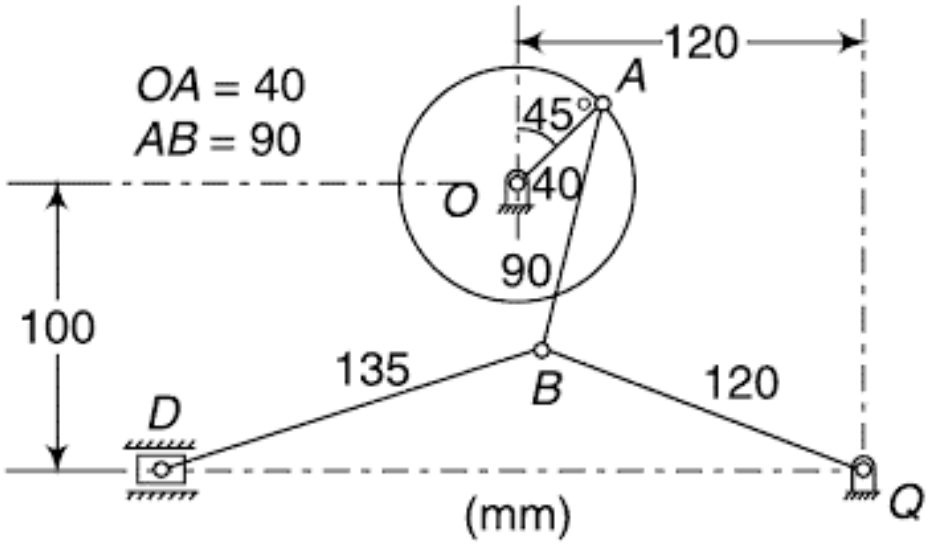

Figure Q2A

2B. Derive the expression for minimum number of teeth on the wheel in order to avoid interference. **(3)**

2C. Derive an expression for total frictional torque for flat collar bearing considering uniform pressure theory with a clear description of the notations used. **(2)**

3A. The following data relate to a pair of 20^0 involute gears in mesh: **(5)**
Module is 6 mm, no. of teeth on pinion is 17, no. of teeth on the gear is 49, addendum on pinion and gear is 1 module. Find the following:

i) The number of pairs of teeth in contact
ii) The angle turned by the pinion and gear when one pair of teeth is in contact
iii) The ratio of sliding to rolling velocity when the tip of the tooth on larger wheel is just leaving contact with its mating tooth.

3B. With neat sketches explain the various types of kinematic pairs based on the type of relative motion between the elements. **(3)**

3C. Explain working of Reverted gear train arrangement with neat sketch. **(2)**

4A. An epicyclic gear is shown in figure Q4A. The shaft Z is driven by an arm B which is keyed to it. The two gears C and E which are cast in one piece, rotate on a pin carried on the arm B. The pinion C gears with the fixed annular wheel D and E is driven by the gear F on the shaft Y. The number of teeth are: D=60, C=16, E=24, F=20. The shaft Y runs at 600 rpm and transmits a torque of 120 Nm. Calculate: **(5)**

i) The speed and direction of rotation of the shaft Z.

ii) The brake torque on gear D to prevent it from rotation.

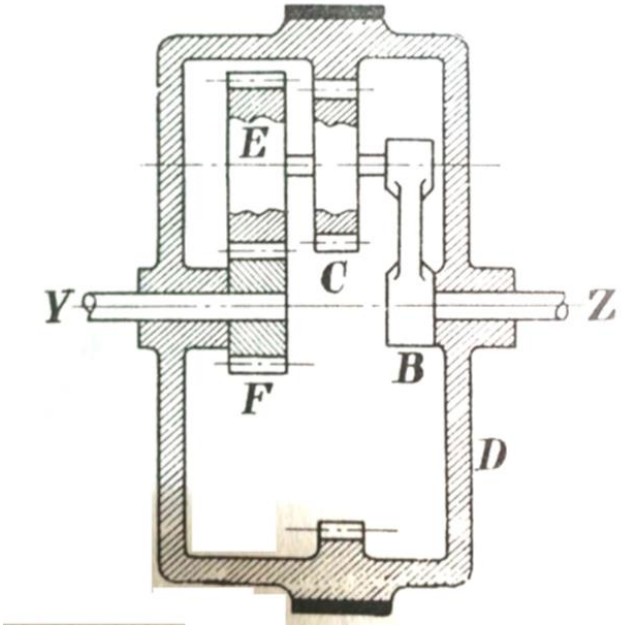

Figure Q4A

4B. An open belt drive connects two parallel shafts 1.2 m apart. The driving and driven shafts rotate at 375 rpm and 150 rpm respectively. The driven pulley is 45 cm in diameter, the belt is 5 mm thick and 8 cm wide. The coefficient of friction between belt and pulley is 0.3 and maximum permissible stress in the belt is 137 N/cm^2. Determine the following: **(3)**

i) the diameter of driving pulley,

ii) maximum power in kW that maybe transmitted by the belt and

iii) the required initial tension in the belt.

4C. Define the following gear terminologies: **(2)**

i) Circular pitch

ii) Pitch circle

5A. Using the following data draw the profile of a cam in which the roller follower moves with simple harmonic motion during ascent, while it moves with uniform acceleration and retardation motion during descent: **(5)**

Lift of follower= 4 cm

Angle of ascent = 60^0

Angle of descent = 60^0

Least radius of cam = 5 cm

Angle of dwell between ascent and decent =40^0

The diameter of roller = 3 cm

Distance between line of action of the follower and the axis of cam = 2 cm. The cam rotates in clockwise direction.

5B. A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine is 90 rpm, find the power absorbed in friction at the thrust block, assuming **(3)**

i) Uniform pressure theory

ii) Uniform wear theory.

5C. With neat sketches explain any two types of constrained motions of a kinematic pair. **(2)**