Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

IV SEMESTER B.TECH (I & P ENGG.) END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: THEORY OF MACHINES [MME 2213]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Define the following precisely. **2**

i) Link ii) Machine iii) Higher Pair iv) Mechanism

1B. With the help of a neat sketch explain Whithworth quick return motion mechanism. **5**

1C. Determine the mobility of the mechanisms given in Fig. 1C, **3**

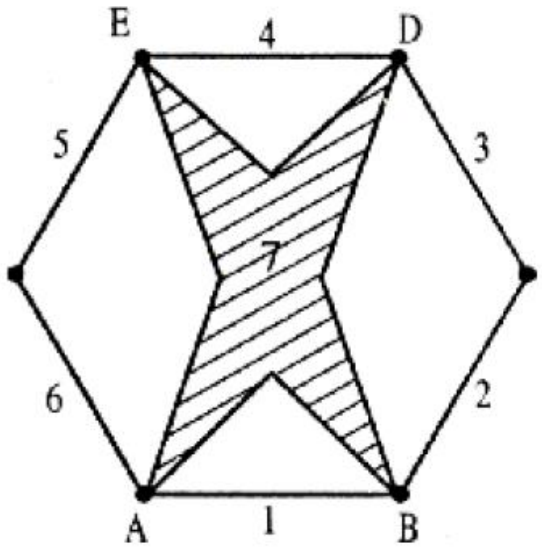

Fig 1C

2A. A belt drive is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 g/mm^3. Safe stress in the belt is not to exceed 2.5 N/mm^2. Diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 220 rpm. The two shafts are 1.25m apart. The coefficient of friction is 0.25. Determine the width of the belt. **4**

2B. State and prove the law of gearing. **3**

2C. State and prove Kennedy's theorem of instantaneous centre. **3**

3A. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. **5**

3B. In the toggle mechanism shown in **Fig. 3B**, the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter-clockwise direction at a speed of 180 r.p.m. increasing at the rate of 50 rad/s^2. The dimensions of the various links are as follows: **5**

OA = 180 mm ; CB = 240 mm ; AB = 360 mm ; and BD = 540 mm.

For the given configuration, find

a. Velocity of slider D and angular velocity of BD, and

b. Acceleration of slider D and angular acceleration of BD.

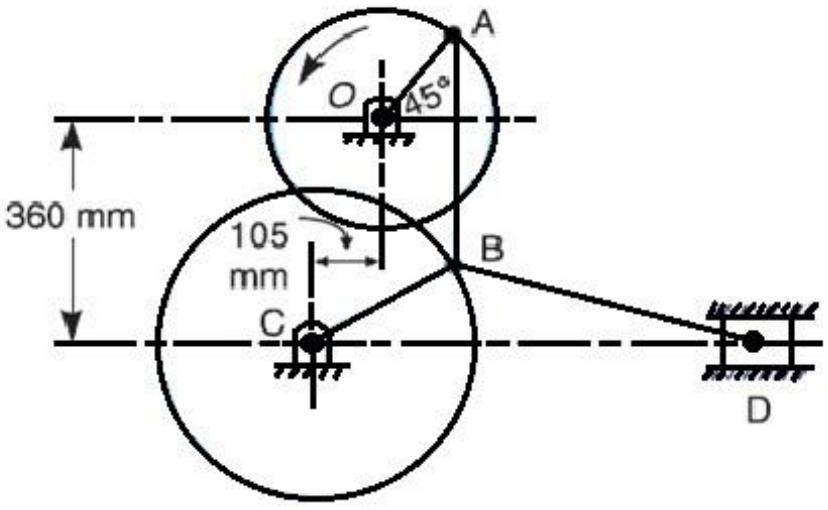

Fig 3B

4A. With a neat sketch derive an expression for the length of path of contact between a pair of spur gears in mesh. **5**

4B. A cam is to be designed for a knife edge follower with the following data : **5**

a. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.

b. Dwell for the next 30°.

c. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.

d. Dwell during the remaining 180°.

Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

5A. In the epicyclic gear train shown in **Fig.5a** the compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to the arm a. All the wheels are of the same module. The number of teeth on the wheels are T_A = 52, T_B =56, T_E= T_F = 36. Determine the speed of C if (a) the wheel D fixed and arm a rotates at 200 rpm clockwise. (b) the wheel D rotates at 200 rpm counter-clockwise and the arm a rotates at 20 rpm counter-clockwise. **5**

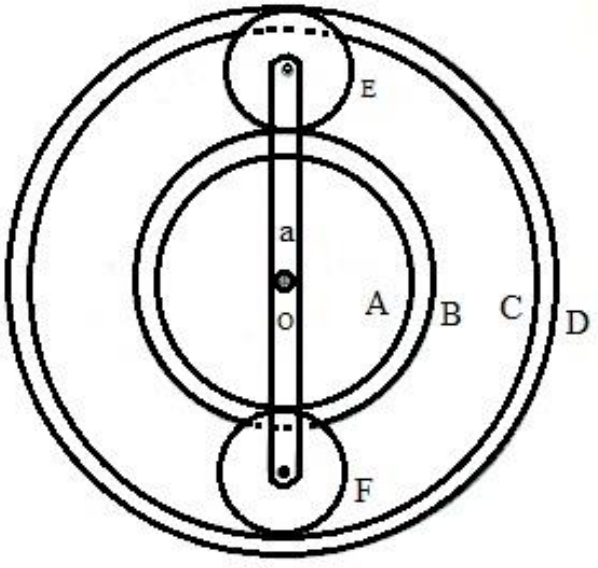

Fig 5a.

5B. Two gear wheels mesh externally and are to give a velocity ratio of 3:1. The teeth are of involute form; module = 6 mm, addendum = 1module, pressure angle = 20°. The pinion rotates at 90 rpm. Determine the number of teeth on the pinion to avoid interference on it. **3**

5C. Briefly explain the resonance and forced vibration. **2**