MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

IV SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, JULY 2019

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. Explain with a neat sketch Whitworth Quick Return Motion mechanism and state its applications. **5**

1B. Derive the condition for correct steering for a four wheel automobile system. **3**

1C. Determine the mobility of the mechanisms given in Figure 1C **2**
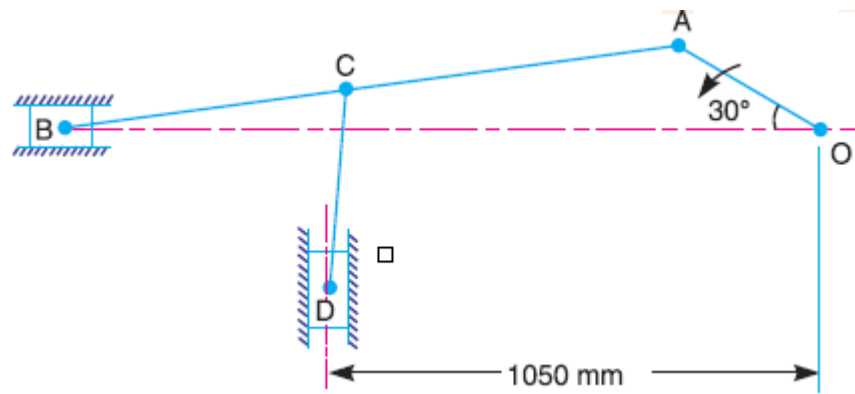

Figure 1C

2A. Explain instantaneous centre method of computing the velocity of slider in a slider crank mechanism. **3**

2B. List any two advantages and disadvantages of involute gear tooth profile. **2**

2C. In the mechanism, as shown in Figure 2C, the crank OA rotates at 20 rpm anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm and CD = 450 mm. For the given configuration, determine: **5**

    a. Velocities of sliding at B and D
    b. Angular velocity of CD

All dimensions are in mm

Figure 2C

3A. State and prove the law of gearing.   **3**

3B. With the help of a neat sketch derive an expression for the length of path of contact   **4**
between a pair of spur gears in mesh.

3C. A pinion and rack are in mesh. The rack is driven by a pinion of 125 mm pitch circle   **3**
diameter. The number of involute teeth on the pinion is 20. The addendum of both
pinion and rack is 6.25 mm. If the interference is to be avoided, determine the least
pressure angle.

4A. In an epicyclic gear of the 'sun and planet' type shown in Figure 4A , the pitch circle   **4**
diameter of the internally toothed ring is to be 224 mm and the module 4 mm. When
the ring D is stationary, the spider A, which carries three planet wheels C of equal
size, is to make one revolution in the same sense as the sun wheel B for every five
revolutions of the driving spindle carrying the sun wheel B. Determine suitable
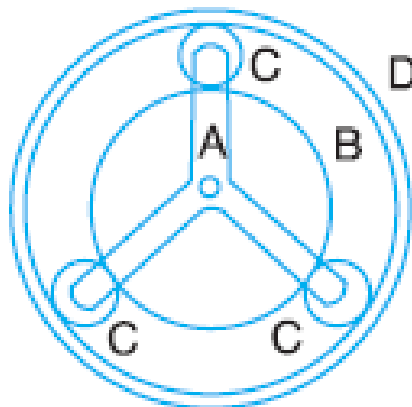numbers of teeth for all the wheels.

Figure 4A

4B. Determine the maximum power transmitted by a V belt drive having the included V   **3**
groove angle of 35^0. The belt used is 18 mm deep with 18 mm maximum width and
weighs 300 g per metre length. The angle of lap is 145^0 and the maximum
permissible stress is 1.5 N/mm^2. Take coefficient of friction to be 0.2.

4C. Briefly explain the following with respect to a vibrating system   **3**

    a. Natural frequency of vibrating system
    b. Free vibration.
    c. Resonance condition

5A. The details of a system of revolving masses attached to a shaft are given below   **5**

Plane	Mass(kg)	Radius of rotation (mm)	Distance from A(mm)	Angular position(measured in anticlockwise direction)
A	12	40	0	0
B	10	50	65	60^0
C	18	60	160	135^0
D	15	30	240	270^0

Find the magnitude and angular position of two balancing masses revolving at 50mm radius in planes L and M. The plane L is in between A and B and at a distance of 30mm from A. The plane B is in between C and D and at a distance 70 mm form C.

5B. Design a cam profile for operating a roller follower in a hydraulic circuit with the following data.   **5**

Minimum radius of cam = 50mm, Lift=30mm, Roller diameter=15mm

It is required to lift the follower for 120^0 with SHM followed by a dwell period of 30^0. Then the follower has to be lowered during 150^0 of the cam rotation with uniform acceleration and deceleration followed by a dwell period. Find the maximum velocity and acceleration of the follower during the lift of the follower.