Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH (INDUSTRIAL & PRODUCTION ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2016

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 suitable assumed.

1A. Sketch and explain the working of Elliptical trammel. Prove that it traces an ellipse.   **5**

1B. Draw the cam profile for the following data

Minimum radius of cam = 30 mm ;   Radius of roller follower = 10 mm

Lift = 30 mm
Axis of the roller is along the straight line with the axis of the cam shaft   **5**

Θ_{rise} = 90^0 with UARM ; Θ_{dwell} = 30^0

Θ_{return} = 120^0 with SHM ; Θ_{dwell} for remaining portion of the cam rotation

Speed of cam = 200 rpm in clockwise direction

2A. A, B, C and D are four masses carried by a rotating shaft at radii 100 mm, 125 mm, 200 mm and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses of B, C and D are 10 kg, 5 kg and 4 kg   **5**
respectively. By graphical method find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance

2B. A pulley is driven by a flat belt 100 mm wide and 6 mm thick. The density of belt material 1000 kg/m^3. The angle of lap is 120^0 and the coefficient of friction is 0.3.   **5**
The maximum stress in the belt is not to exceed 2 MPa. Find the maximum power that can be transmitted and corresponding speed of the belt.

3A. A four bar mechanism ABCD is made up of four links, pin jointed at the ends. AD is a fixed link which is 180 mm long. The links AB (crank), BC and CD are 90 mm, 120 mm and 120 mm long respectively. At certain instant, the link AB makes an angle of 60^0 (in anticlockwise direction) with the horizontal link AD. If the crank AB rotates at a uniform speed of 100 rpm clockwise determine,   **5**
  i) Angular velocity of the link CD
  ii) Angular acceleration of the link CD

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

3C. With reference to the cam profile, explain the following terms and indicate them with a neat sketch,   **2**
  i. Pitch curve   ii. Pressure angle

4A. A Compound epicyclic gear train is shown in figure (a), the gears A, D and E are free to rotate on the axis P. Compound gear B and C rotate together on the axis Q at the end of arm 'F'. All the gears have equal pitch. Number of external teeth on the gear A, B, C are 18, 45 and 21 respectively. The gears D and E are annular gears. Gear A rotates at 90 rpm in anticlockwise direction and gear D rotates at 450rpm in clockwise direction. By tabular method find the speed and direction of rotation of arm F and gear E.   **5**

4B. A pair of spur gears has 16 teeth and 18 teeth, a module of 12.5 mm, an addendum of 12.5 mm and a pressure angle = 14.5^0. Prove that the gears have interference. Determine the minimum number of teeth and the velocity ratio required to avoid interference.   **3**

4C. Distinguish between longitudinal, transverse and torsional vibrations.   **2**

5A. Explain the Whithworth quick return motion mechanism with a neat sketch.   **5**

5B. Derive an expression for minimum number of teeth necessary for a gear to avoid interference.   **5**
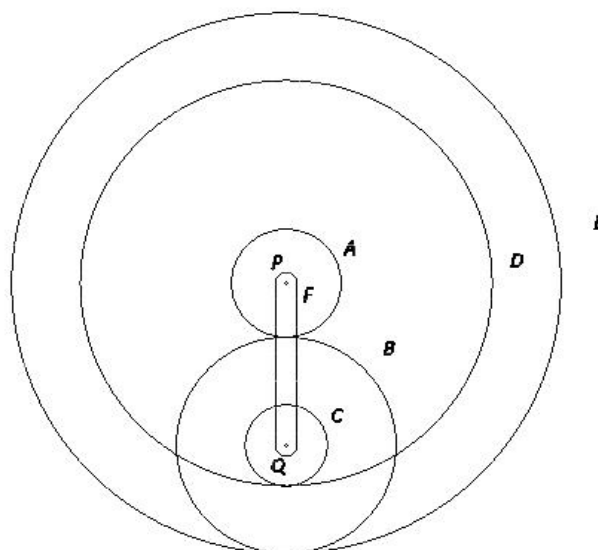

Figure (a)