

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

III SEMESTER B.TECH. (MECHANICAL ENGINEERING) END SEMESTER MAKE UP EXAMINATIONS, DEC 2016/JAN 2017 SUBJECT: KINEMATICS OF MACHINERY [MME 2102] **REVISED CREDIT SYSTEM**

(30-12-2016)

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 Crank and Slotted Lever Quick Return Motion 05 Mechanism stating its applications. Also show that the time of return stroke is less than that of forward stroke.
- **1B.** What is the condition for Correct Steering? Explain with a neat sketch the 05 working of Davis Steering Gear Mechanism.
- **2A.** A mechanism in which the crank AB is rotating uniformly at 180 rpm in the 05 clockwise direction is shown in Fig.Q2A.The blocks at D and E are working in frictionless guides. The dimensions of the mechanism are: AB = 450 mm; BD = 1500 mm; BC = 900 mm and CE = 900 mm. Draw the velocity diagram and determine the velocities of blocks D and E in their guides
- 2B. The crank of an engine 250 mm long rotates at a uniform speed of 240 rpm. 05 The ratio of connecting rod length to crank radius is 4. Using Klein's construction, Determine:
 - (a) The acceleration of the piston
 - (b) The angular acceleration of the rod and

(c) The acceleration of a point X on the connecting rod at 1/3rd length from crank pin. The crank position is 30° from inner dead center.

- **3A.** With a neat sketch derive an expression for velocity of sliding between a pair 05 of involute teeth
- **3B.** A pinion with 20 teeth is in mesh with a gear with 60 teeth. The pressure 05 angle is 20° and module of 7 mm. Take standard addendum of one module. Determine

i) The number of pairs of teeth in contact.

ii) Angle turned by the larger gear for one pair of teeth in contact.

iii) Sliding velocity at commencement of engagement and at termination of the engagement. The pitch line velocity is 1.4 m/sec

- 4A. The sun and planet gear of an epicyclic gear are shown in figure Q4A. The annular gear D has 100 internal teeth, the sun gear A has 50 external teeth and planet gear B has 25 external teeth. The gear B meshes with D and gear A. The gear B is carried on the arm E, which rotates about the center of annular gear D. If the gear D is fixed and arm rotates at 20 rpm, then find the speeds of gears A and B.
- 4B. A rope drive is to transmit 250kW from a pulley of 1000mm diameter running at a speed of 250 rpm. The semi grove angle is 22.5⁰ and the angle of lap is 180⁰. The ropes used are 50 mm diameter and their mass is 1.3 kg per meter length. Each rope has a safe maximum pull of 2000N. The coefficient of friction between rope and the pulley is 0.3. Find the number of ropes required.
- **5A.** Show that for maximum power transmission the centrifugal tension should **03** not exceed one-third of total tension in the belt drive.
- **5B.** A Cam with 30 mm minimum radius is rotating clockwise at 1200 rpm to give **05** the follower motion to a roller follower of 20 mm diameter.
 - i) Lift = 25 mm
 - ii) Follower rises during 120° cam rotation with simple harmonic motion
 - iii) Follower to dwell for 60° cam rotation
 - iv) Follower to return during 90° cam rotation with uniform acceleration and deceleration
 - v) Follower to dwell for remaining period.

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

5C. What do you mean by gear train? Mention the different types of the gear **02** trains.



Fig.Q2A All dimensions are in mm



Fig. Q4A