

# CBCS Scheme

USN

1	A	Y	1	5	A	E	0	1	7
---	---	---	---	---	---	---	---	---	---

15AE44

## Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Mechanisms and Machine Theory

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions, choosing one full question from each module.**

### Module-1

- 1 a. Define : i) Lower pair      ii) Higher pair      iii) Kinematic chain  
    iv) Mechanism      v) Machine      vi) Degree of freedom. (06 Marks)
- b. Determine DOF of link



Fig. Q1(b)

(10 Marks)

**OR**

- 2 a. Prove the Peaucellier's mechanism traces exact straight line motion. (08 Marks)
- b. Obtain condition for 'correct steering' for a four wheeled vehicle. (08 Marks)

### Module-2

- 3 a. Describe Angular velocity and relative velocity. (04 Marks)
- b. For a four bar mechanism shown in Fig. Q3(b), determine the acceleration of a C and angular acceleration of link 3 when crank 2 rotates at 20 radians per second.

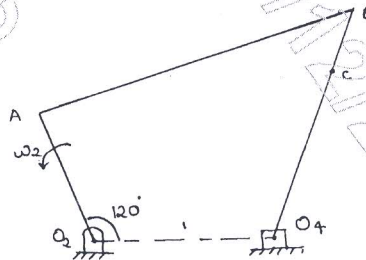


Fig. Q3(b)

(12 Marks)

**OR**

- 4 In a crank and slotted lever mech quick return mechanism, the fixed centre 'O' and 'C' are at distance 200mm. The length of driving crank cp is 100mm and it rotates at 60, the length of the link 'ON' is 400mm and the length of the link NR is 160mm. The line of stroke of ram 'R' is horizontal and 200mm above the fixed center C. At the instant when the angle OCP is 120°. Find the velocity and acceleration of ram R. (16 Marks)

### Module-3

- 5 a. State and prove law of gearing or condition for correct gearing. (06 Marks)
- b. Two gear wheels of module pitch 4.5mm have 24 and 33 teeth respectively. Pressure angle = 20°. Each wheel has a standard addendum of one module. Find :
- i) length of arc of contact and
- ii) Maximum velocity of sliding if the speed of smaller wheel is 120 rpm. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Explain with neat sketches :  
 i) Compound gear train ii) Epicyclic train. (06 Marks)
- b. An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel 'C' with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels, D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A co-axial with F. If all the wheels have the same pitch and shaft A makes 800 rpm, what is the speed of shaft F. (10 Marks)

**Module-4**

- 7 a. Explain balancing of rotating masses, where both the masses are on the same side. (06 Marks)
- b. A shaft carries four masses  $M_1$ ,  $M_2$ ,  $M_3$  and  $M_4$  attached to it. They all revolve in the same plane the magnitude of the masses are 6, 5, 9 and 7.5 kg respectively. The C.G of the masses are located at a radial distance of 100, 125, 150 and 75mm from the axis of the shaft. The angular positions of the masses are  $60^\circ$ ,  $135^\circ$  and  $270^\circ$  from  $M_1$ . Determine the position and magnitude of mass  $M_5$  and 250mm radius to balance the system. (10 Marks)

OR

- 8 a. State the conditions of balance in a multi-cylinder in line engine. (06 Marks)
- b. The following data are referred to a single cylinder engine speed = 250 rpm, stroke = 350mm. Mass of reciprocating parts = 60kg ; Mass of revolving parts at 175mm radius is 40kg. If  $\frac{2}{3}$ <sup>rd</sup> of reciprocating parts and all the revolving parts are to be balanced find.  
 i) Balancing mass required at 400mm radius  
 ii) Residual unbalanced force when the crank has rotated,  $60^\circ$  from T.D.C [Top dead centre or inner dead centre (IDC)]. (10 Marks)

**Module-5**

- 9 a. With a neat sketch, explain the working principle of a simple centrifugal governor. (06 Marks)
- b. A porter governor has all four arms 300mm long, the upper arms are pivoted on the axis of rotation and lower arm are attached to the sleeve at a distance 35mm from axis. The mass of each ball is 7kg and the load on the sleeve is 540N. Determine the equilibrium speed for the two extreme radii of 200mm and 260mm of rotation of governor balls. (10 Marks)

OR

- 10 a. Sketch and explain controlling force, curves of porter governor. (06 Marks)
- b. The arms of a porter governor are each 300mm long and are hinged on the axis of rotation. The mass of each ball is 5kg. the radius of rotation of the ball is 200mm when the governor begins to lift and 250mm at the maximum speed. Determine the maximum and minimum speeds, if the mass of the sleeve is 15kg. Also find the range of speed if the frictional force at the sleeve is 30N. (10 Marks)

\*\*\*\*\*