Mechanisms and Machine Theory VTU CBCS Question Paper Set 2018

CBCS Scheme

USN | | | | | | | | | | |

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.

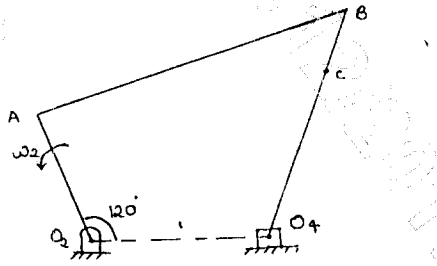

Fig. Q3(b) **(12 Marks)**

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)**

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 8 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels, D ha 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on pin which projects from a disc keyed to a shaft A co- axial with F. If all the wheels have th 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 arc 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 sam place the magnitude of the masses are 6, 5, 9 and 7.5 kg respectively. The C.G of the masse are located at a radial distance of 100, 125, 150 and 75mm from the axis of the shaft. Th angular positions of the masses are 60°, 135° and 270° from M_1. Determine the position an 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 reffered to a single cylinder engine speed = 250 rpn stroke = 350mm. Mass of reciprocating parts = 60kg ; Mass of revolving parts at 175mr radius is 40kg. If 2/3rd of reciprocating parts and all the revolving parts are to be balance find.
i) Balancing mass required at 400mm radius
ii) Residual unbalanced force when the crank has rotated, 60° from T.D.C [Top dea 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 rotation and lower arm arc attached to the sleeve at a distance 35mm from axis. The mass each ball is 7kg and the load on the sleeve is 540N. Determine the equilibrium speed for th 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 arc each 300mm long and arc hinged on the axis of rotatio The mass of each ball is 5kg. the radius of rotation of the ball is 200mm when the governc begins to lift and 250mm at the maximum speed. Determine the maximum and minimu speeds, if the mass of the sleeve is 15kg. Also find the range of speed if the frictional forc at the sleeve is 30N. **(10 Marks**

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15AE44

Fourth Semester B.E. Degree Examination, June/July 2017
Mechanisms and Machine Theory

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Sketch and derive the length of stroke and ratio between time taken during the cutting and return stroke of a crank and slotted quick return motion mechanism. **(08 Marks)**

b. Determine the number of degrees of freedom for the simple mechanisms shown in the Fig.Q1(b)(i), (ii) and (iii). **(08 Marks)**

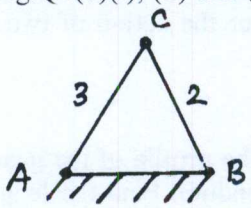

Fig.Q1(b)(i)

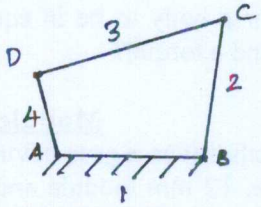

Fig.Q1(b)(ii)

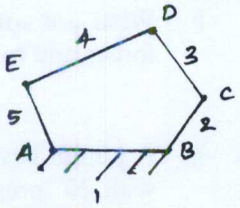

Fig.Q1(b)(iii)

OR

2 a. Sketch and explain the inversions of four bar mechanism. **(08 Marks)**

b. Fig.Q2(b) shows the layout of a quick return mechanism of the oscillating link type, for a special purpose machine. The driving crank BC is 30 mm long and time ratio of the working stroke to the return stroke is to be 1.7. If the length of the working stroke of R is 120 mm, determine the dimensions of AC and AP.

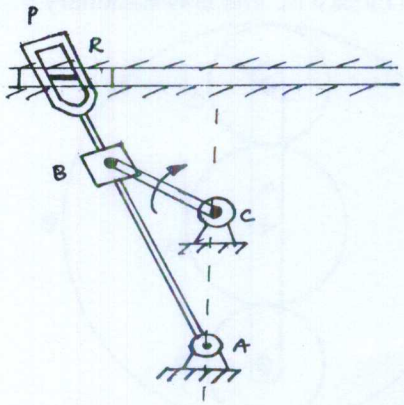

Fig.Q2(b) **(08 Marks)**

Module-2

3 An engine mechanism is shown in Fig.Q3. The crank CB = 100 mm and the connecting rod BA = 300 mm. With centre of gravity G, 100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2.

Find velocity of G and angular velocity of AB, and acceleration of G and angular acceleration of AB.

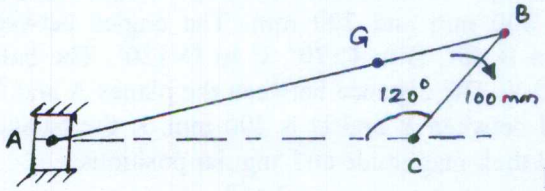

Fig.Q3 **(16 Marks)**

OR

4 a. A four-link mechanism with the following dimensions is acted upon by a force 80 N with an inclination of 150° on the link DC. AD = 500 mm, AB = 400 mm, BC = 1000 mm, DC = 750 mm, DE = 350 mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. [Refer Fig.Q4(a)]

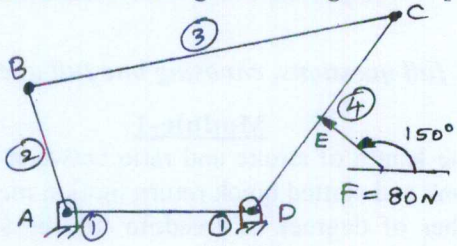

Fig.Q4(a) **(12 Marks)**

b. What are conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque? **(04 Marks)**

Module-3

5 a. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. **(10 Marks)**

b. Write short notes on undercutting in gears. **(06 Marks)**

OR

6 a. An epicyclic gear train is shown in Fig.Q6(a). The number of teeth on A and B are 80 and 200. Determine the speed of the arm a :

i) If A rotates at 100 rpm clockwise and B at 50 rpm counter clockwise.

ii) If A rotates at 100 rpm clockwise and B is stationary.

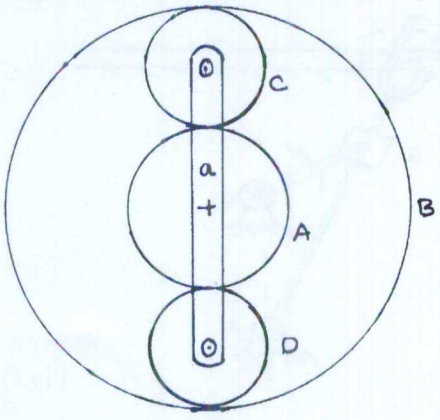

Fig.Q6(a) **(12 Marks)**

b. Briefly explain the types of gear trains. **(04 Marks)**

Module-4

7 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°, 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 magnitude and angular positions. **(16 Marks)**

OR

8 A five cylinder in-line engine running at 750 rpm has successive cranks 144° apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the positions of the central crank at which these maximum values occur. The reciprocating mass of each cylinder is 15 kg. **(16 Marks)**

Module-5

9 a. In an open-arm type governor shown in Fig.Q9(a). AE = 400 mm, EF = 50 mm and angle, θ = 35°. Determine the percentage of change in speed when θ decrease to 30°.

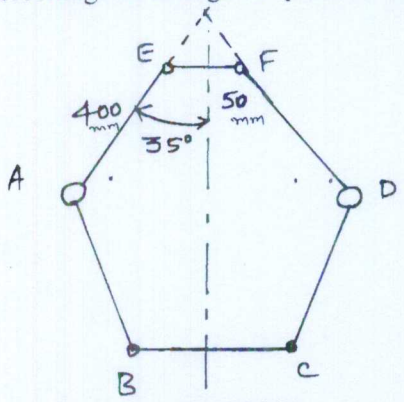

Fig.Q9(a) **(08 Marks)**

b. Each arm of a porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at the minimum and the maximum speeds are 120 mm and 160 mm respectively. The mass of the sleeve is 24 kg and each ball is 4 kg. Find the range of speed of the governor. Also determine the range of speed if the friction at the sleeve is 18 N.

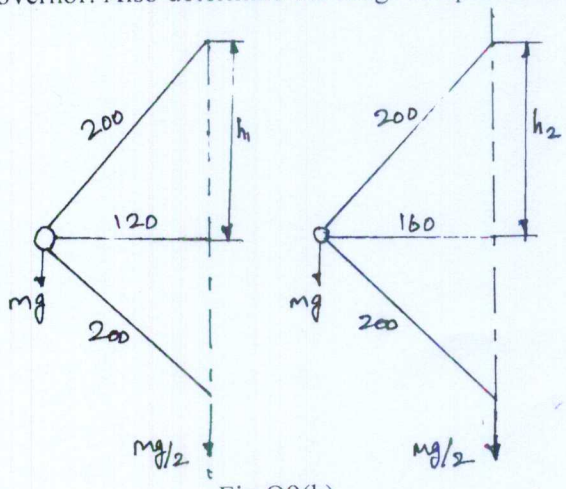

Fig.Q9(b) **(08 Marks)**

OR

10 Explain in detail about the effect of gyroscopic couple on a Naval ship during:
i) Steering
ii) Pitching and
iii) Rolling. **(16 Marks)**

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