CBCS Scheme

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15ME42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain:
i) kinematic pair,
ii) Types of links,
iii) Grashof's criterion. **(06 Marks)**

b. Explain with neat sketches:
i) Ratchet and pawl mechanism
ii) Toggle mechanism. **(10 Marks)**

OR

2 a. What is quick return motion? Explain with neat sketch crank and slotted lever mechanism. **(08 Marks)**

b. Draw a neat sketch of Peacellier straight line mechanism. Explain with proof how the tracing point describes a straight line path. **(08 Marks)**

Module-2

3 A four bar mechanism ABCD is pin jointed at ends and the link AD is fired of length 600 mm. The links AB, BC and CD are 300 mm, 360 mm and 360 mm respectively. At certain instant the link AB makes an angle of 60° with link AD. If the link AB rotates at an angular velocity of 10 rad/s and an angular acceleration of 30 r/s^2 both clockwise. Determine angular velocity and angular accelerator of links BC and CD by graphical method. **(16 Marks)**

OR

4 a. Define Coriol's component of acceleration. Derive an expression for the same. **(08 Marks)**

b. Determine the velocity and acceleration of the piston by Klein's construction for a steam engine to the following specifications:
Stroke of piston = 300 mm
Ratio of length of connecting rod to crank radius = 4
Speed of engine = 300 rpm
Clockwise position of crank = 45° with inner dead centre. **(08 Marks)**

Module-3

5 a. Derive analytical expressions for the determination of velocity and acceleration of piston of a reciprocating engine. **(12 Marks)**

b. If the crank and connecting rod are 150 mm and 600 mm long respectively and the crank rotates at a constant speed of 100 rpm, determine the velocity and acceleration of piston. The angle which the crank makes with the inner dead centre is 30°. **(04 Marks)**

OR

6 a. Derive Freudenstein's equation for slider crank mechanism. **(10 Marks)**

b. Explain function generation for four bar mechanism. **(06 Marks)**

Module-4

7 a. State and prove the law of gear tooth action for constant velocity ratio. **(08 Marks)**

b. Two mating spur gears with module of 6.5 mm have 19 and 47 teeth of 20° pressure angle, and 6.5 mm addendum. Determine the number of pairs of teeth in contact. Also determine the sliding velocity at the instant (i) engagement commences, (ii) engagement terminates. The pitch line velocity is 1.2 m/s. **(08 Marks)**

OR

8 a. Define: (i) Interference in gears, (ii) Epicyclic gear train. **(04 Marks)**

b. Fig.Q8(b) shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular fixed wheel D. Pinion C has 15 teeth and is integral with B (B, C being a compound gear wheel), gear C meshes with annular wheel E, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed, and carries the compound wheel B, C. If the motor runs at 1000 rpm, find the speed of the machine shaft. Find the torque exerted on the machine shaft if the motor develops a torque of 100 Nm.

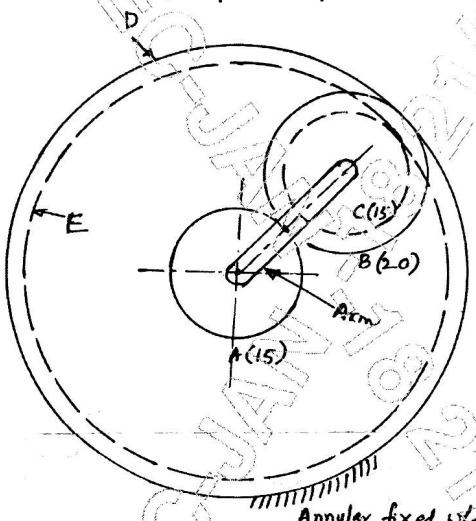

Fig.Q8(b) **(12 Marks)**

Module-5

9 A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5 cm diameter. The follower motion is defined as below:

i) Outward during 150° with UARM.
ii) Dwell for next 30°.
iii) Return during next 120° with SHM.
iv) Dwell for the remaining period.

Stroke of the follower is 3 cm. Minimum radius of the cam is 3 cm. Draw the cam profile, when the follower axis passes through the cam axis. Find the maximum velocity and acceleration during outstroke. **(16 Marks)**

OR

10 a. Define the terms:
i) Cam profile
ii) Base circle
iii) Prime circle
iv) Pitch curve **(04 Marks)**

b. Derive expressions for displacement, velocity and acceleration of the follower when the flat faced follower is in contact with any point on the circular flank. **(12 Marks)**

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