CBCS Scheme

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

16/17MDE23

Second Semester M.Tech. Degree Examination, June/July 2018
Dynamics and Mechanism Design

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State and explain Grashof's law. **(04 Marks)**

b. Define kinematic inversion. Sketch and explain any two inversions of four bar chain. **(04 Marks)**

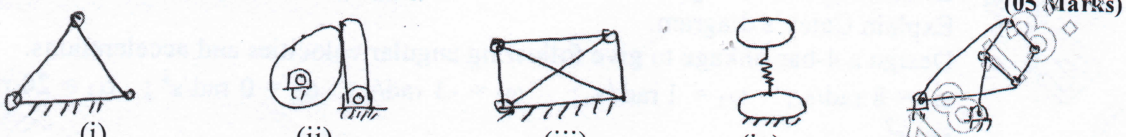
c. Draw the equivalent linkage for the following and find their degree of freedom. Solve any four. **(08 Marks)**

(i) (ii) (iii) (iv) (v)

OR

2 a. Write down the main differences between
i) Plane, spherical and spatial mechanisms.
ii) Analysis and synthesis. **(06 Marks)**

b. Find degree of freedom of following mechanisms and identify which is a mechanism, structure and redundant constraint. **(05 Marks)**



(i) (ii) (iii) (iv) (v)

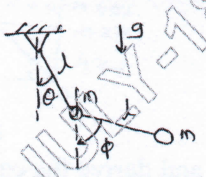
c. Sketch and explain Oldham's coupling. **(05 Marks)**

Module-2

3 a. Explain Holonomic and non-holonomic constraints. **(04 Marks)**

b. Explain principle of virtual work. **(04 Marks)**

c. A double pendulum consists of two particles suspended by massless rods. Assuming that all motions takes place in a vertical plane, find the differential equations of motions. **(08 Marks)**



Linearize these equations, assuming small motion.

OR

4 a. A particle of mass "M" can slide without friction on the inside of a small tube which is bent in the form of a circle of radius 'r'. The tube rotates about a vertical diameter with a constant angular velocity "W" as shown in Fig.Q.4(a). Write the differential equations of motion.

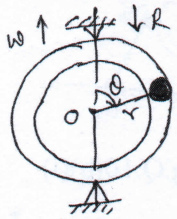
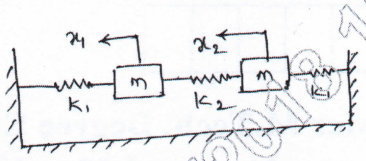


Fig.Q.4(a)

(08 Marks)

b. Using Hamilton equation, find the equations of motion for the system shown in Fig.Q.4(b) below. **(08 Marks)**

Fig.Q.4(b)



Module-3

5 a. Explain any four : i) Type synthesis; ii) Number synthesis; iii) Dimensional synthesis; iv) Path generation; v) Function generation. **(08 Marks)**

b. The rocker of a crank rocker mechanism is to have a length of 50mm and swings through a total angle of 45° with a time ratio of 1.25. Determine the suitable set of dimensions. **(08 Marks)**

OR

6 a. What are the important tasks of kinematic synthesis? Discuss in brief. **(06 Marks)**

b. Define poles and relative poles. **(02 Marks)**

c. Define the transmission and deviation angle of a four bar mechanism. What are their optimum values and what is mechanical advantage? **(08 Marks)**

Module-4

7 a. Explain synthesis of function generation using overlay method of synthesis. **(04 Marks)**

b. Synthesize a function $y = 1/x$ in the range of $1 \leq x \leq 2$ for a function generator using three precession points by Freudenstein's equation. Range of input 30° to 120° and output 240° to 330°. **(12 Marks)**

OR

8 a. Define cognate linkage. **(03 Marks)**

b. Explain Caley's diagram. **(03 Marks)**

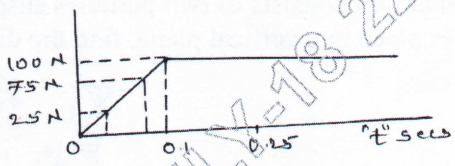
c. Design a 4-bar linkage to give following angular velocities and accelerations.
$\omega_2 = 8$ rad/s ; $\omega_3 = 1$ rad/s ; $\omega_4 = -3$ rad/s ; $\alpha_2 = 0$ rad/s^2 ; $\alpha_3 = 20$ rad/s^2 ; $\alpha_4 = 0$ rad/s^2. **(10 Marks)**

Module-5

9 a. Deduce the condition for free precession of gyroscope with steady precession. **(06 Marks)**

b. Obtain phase plane response of a single degree freedom of a spring mass system with K = 100,000 N/m (100N/mm) mass M = 50kg subjected to excitation as shown below in Fig.Q.9(b). **(10 Marks)**

Fig.Q.9(b)



OR

10 a. Define Eulerian angles and derive the equation for angular velocities. **(10 Marks)**

b. Find the degree of freedom of the following mechanisms. (Refer Fig.Q.10(b)(i) and (ii)). **(06 Marks)**

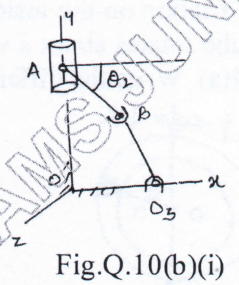


Fig.Q.10(b)(i)

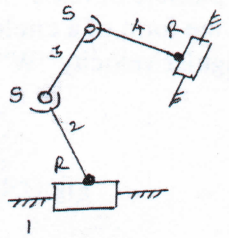


Fig.Q.10(b)(ii)

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