Printed pages: 01 **Sub Code: MTCM 041**

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M. TECH.
(SEM - II) THEORY EXAMINATION 2018-19
DYNAMICS OF MECHANICAL SYSTEMS

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

(a) What is meant by fundamental laws of motion?
(b) Why co-ordinate systems are important in dynamics?
(c) Discuss the term 'angular velocity'.
(d) What are the joint reaction forces?
(e) Discuss briefly about Euler angles.
(f) When a system a said to be autonomous?
(g) What is meant by work-energy principle?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

(a) The parallelogram linkage, which is situated in the vertical plane, is steadied by identical springs that are fastened across the diagonals. The stiffness of the springs is k and the springs are unstretched when the angle of elevation $\beta = 90°$. The mass per unit length of each bar is a. Determine the potential energy of this system as a function of β.
(b) What is Hamilton's principle? Explain with the help of a suitable figure.
(c) Explain the principles of angular momentum.
(d) What are the simple applications of planer systems?
(e) What is Routh's criteria for stability?

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write the equations of motion of multi-body system.
(b) Two bars, pinned at joint B, move in the horizontal plane subject only to the restriction that the velocity of end C must be directed toward end A. Determine the corresponding velocity constraint. Is this constraint holonomic?

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) Disk B rotates at 900 rev/min relative to the turntable, which is rotating about a fixed axis at a constant rate of 300 rev/min. Determine the acceleration of point C on the perimeter of the disk at the instant shown using:
i) a moving coordinate system that is attached to the turntable; and
ii) a moving coordinate system that is attached to the disk.
(b) What are the time derivatives of transformation matrices?

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Use the Gibbs-Appell equations to derive Euler's equations of motion for a rigid body
(b) What are the body-fixed rotations in relative motion?

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) How Liapunov's function is used to determine stability of the system?
(b) What are the joint reaction forces in multi-body dynamics? Explain.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) What is the mechanics of system of particles? Explain with example.
(b) How the direction cosines are used in rotation about an arbitrary axis?

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