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## NATIONAL OPEN UNIVERSITY OF NIGERIA Plot 91, Cadastral Zone, Nnamdi Azikiwe Express Way, Jabi-Abuja FACULTY OF SCIENCES January\February Examination 2018

Course Code: MTH315 Course Title: Analytics Dynamics I Credit Unit: 3 Time Allowed: 3Hours Total Marks: 70%

## **INSTRUCTION:** ANSWER QUESTION ONE(1) AND ANY FOUR (4) QUESTIONS (TOTAL = 5 QUESTIONS IN ALL)

| 1(a) St   | tate Conservation theorem for Total Angular Momentum  | (4marks)                              |
|---|---|---------------------------------------|
| 1(b) P  | rove the theorem in a) above (  | 12marks)                              |
| (1c) What are the scalar and vector representation of a conservative force?<br>(3marks each =6maks) |   |                                       |
| 2(a)  | Write out the Lagrange's equation   | (4marks)                              |
| 2(b)  | A particle is moving with simple harmonic motion of period $4\pi$ about a c passes through a point distance $4m$ from 0 with the velocity $4m$ /sec awa Find the time which elapses before it next passes through this point. | centre O, it<br>y from O.<br>(8marks) |
| 3   | A particle moves along a curve whose parameter equation is given as $x = e^t$ , $y = 2\cos 3t$ , $z = 2\sin 3t$ ; where <i>t</i> is the time.   | (oniarits)                            |
|   | (a) Determine its velocity and acceleration at any time t   | (6marks)                              |
|   | (b) Find the magnitude of its velocity and acceleration at $t = 0$  | (6marks)                              |
|   |   |                                       |

4 A train moving with constant acceleration passes through three post A, B, C on a straight road. The distance from A to B is 15m and from B to b to C is 20m. The train takes 6seconds to go from A to B and 5seconds to go from B to C. Find the acceleration of the train and its distance from A to when its speed is 5.5m/seconds (12marks)

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- 5(a) A particle moves along the x-axis in a force field having potential  $V = \frac{1}{2}kx^2$ ,  $k \succ 0$ . Determine the point of equilibrium (4marks)
- 5 (b) A string is tied to two points at the same level, and a smooth ring of weight W which can slide freely along the string is pulled by a horizontal force P. If in the position of equilibrium, the portions of the string are inclined at angle 60° and 30° to the vertical, find the value of P and the tension in the string. (8marks)
- 6 A particle moves along a curve whose parameter equation is given as  $x = e^t$ ,  $y = 2\cos 3t$ ,  $z = 2\sin 3t$ ; where *t* is the time.

| (a) Determine its velocity and acceleration at any time t          | (6marks) |
|--|----------|
| (b) Find the magnitude of its velocity and acceleration at $t = 0$ | (6marks) |