



NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
MARCH/APRIL 2014 EXAMINATION

COURSE CODE: MTH315

COURSE TITLE: ANALYTICAL DYNAMICS

TIME ALLOWED: 3HOURS

INSTRUCTION: ANSWER ANY 4 QUESTIONS

1.(a)) Define degrees of freedom and give two examples -**7 ½ marks**

(b) A system of particles consists of a 3 gram mass located at (1,0,-1), a 5 gram mass at (-2,1,3) and 2 gram mass at (3,-1,1). Find the coordinates of the center of mass -**10 marks**

2. Two particles having masses m_1 and m_2 are located on a frictionless double inclined curves and connected by an inextensible mass less string passing over a smooth pulley. Use the principle of virtual work to show that for

equilibrium we must have $\frac{\sin \alpha_1}{\sin \alpha_2} = \frac{m_2}{m_1}$, where α_1 and α_2 are the angles of the incline. -**17 ½ marks**

3. (a) State the laws of motion given by **Sir Isaac Newton** which are considered the axioms of mechanics -**8 marks**

(b) Due to a force field, a particle of mass 5 units moves along a space curve whose position vector is given as a function of time t by

$r = (2t^3 + t)i + (3t^4 - t^2 + 8)j - 12t^2k$. Find (i) the velocity, (ii) the acceleration -**9 ½ marks**

4.(a) Explain the following terms (i) Work (ii) Power (iii) Energy -**9 marks**

(b) (i) A particle of constant mass m moves in space under the influence of a force field F . Assuming that at times t_1 and t_2 the velocity is v_1 and v_2 respectively, prove that the work done is the change in kinetic energy, ie

$$\int_{t_1}^{t_2} F \cdot dr = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

-**8 ½ marks**

5.(a) Explain the following terms (i) uniform force field (ii) uniformly accelerated motion -**9 marks**

(b) A particle of mass m moves along a straight line under the influence of a constant force of magnitude F . If its initial speed is v_0 find (i) the speed (ii) the distance travelled after time t . -**8 ½ marks**

6. (a) Explain the following terms (i) moment of a force (ii) Equilibrium of a Particle -**9 marks**

(b) (i) A uniform beam is 24m long and has a mass 100kg and masses of 60kg and 80 kg are suspended from its ends; at what point must the beam be supported so that it may rest horizontally? -**8½ marks**