**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS**

**SCHOOL OF SCIENCE AND TECHNOLOGY**

**JUNE/JULY EXAMINATION**

**COURSE CODE: MTH315**

**COURSE TITLE: ANALYTICAL DYNAMICS(3 units)**

**TIME ALLOWED:3 HOURS**

**INSTRUCTION: ANSWER ANY 4 QUESTIONS**

1.(a)) Define degrees of freedom and give two examples **-7½ 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 and 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 ,where and are the angles of the incline.

**-17½ 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. 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  and  the velocity is and  respectively, prove that the work done is the change in kinetic energy,ie

 **-8½ 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  find (i) the speed (ii) the distance travelled after time t.

**-8½ marks**

6. (a) Exaplain 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**