ELIZADE UNIVERSITY,

ILARA-MOKIN,

ONDO STATE

FACULTY: BASIC AND APPLIED SCIENCES

DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE

1st **SEMESTER EXAMINATIONS**

2016 / 2017 **ACADEMIC SESSION**

COURSE CODE: MTH 325

COURSE TITLE: Mathematical Methods II

DURATION: 2 Hours

HOD's SIGNATURE

INSTRUCTION:

1. YOU ARE TO ANSWER **FOUR** QUESTIONS FROM THE **FIVE** QUESTIONS ON THE EXAMINATION PAPER.

Question One

1a) Explain the following terms

(i) Geodesic problem **1 Mark**
(ii) Transversality conditions **1 Mark**
(iii) Variation problem **1 Mark**
(iv) Variation principle **1 Mark**

1b) State fermat principle of optics **2 Marks**

1c) Find the curve which minimize $\int_a^b (y^2 + y^{1^2})dx$ **9 Marks**

Question Two

2a) Find the curve which gives the shortest distance between the two points on a plane
$I = \int_a^b \sqrt{(1 + (y^1)^2)}\, dx$ **7 Marks**

2b) State the necessary and sufficient condition for Euler-Lagrange equation. Hence find the $I[y(x)] = \int_a^b x(1 + y^{1^2})^{\frac{1}{2}}\, dx$ integral curve of the Euler-Lagrange equation. **8 Marks**

Question Three

3a) Determine the extrema of the functional $I[y(x)] = \int_a^b f(x, y, y^1)dx$ subjected to the condition that the point $A(x_0, y_0)$ moves on $x^2 + y^2 = 1$ and the other end $B(x_1, y_1)$ lies on a straight line $x + y = 4$ **10 Marks**

3b) Find the Laplace transform of $\sin 2t \sin 3t \sin 4t$ **5 Marks**

Question Four

4a) State the Hamilton principle and write the Lagrange equation **2 Marks**

b) A particle of mass 3kg moves on x y plane. The potential energy of the particle as a function is given by $V = 36xy - 48x^2$. The particle starts at time t=0 at the point with the position vector (10, 10).

(i) Write the differential equations describing the motion **3 Marks**

(ii) Solve the equation to determine position of the particle as a function of time **3 Marks**

(iii) Find the velocity and acceleration as a function of time **3 Marks**

4c) State and prove the convolution theorem. Using the convolution theorem evaluate

$$H(s) = \frac{1}{(s+2)^2 + (s^2+1)}$$ **4 Marks**

Question Five

5a)i Find the $L^{-1}\left(\frac{5s+8}{s^2+4}\right)$ **3 Marks**

(ii) Find the Laplace transform $f(t) = \sin at$ Using Euler method **3 Marks**

(iii) Find the $L^{-1}\left(\frac{3}{s-5}\right)$ **2 Marks**

5b) Solve the differential equation $y''+5y'+6y=0 \quad y(0)=2, \quad y'(0)=3$ Using Laplace transform. **7 Marks**