NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION : BACHELOR OF SCIENCE	
QUALIFICATION CODE: 07BOSC	**LEVEL:** 7
COURSE CODE: MMP701S	**COURSE NAME:** MATHEMATICAL METHODS IN PHYSICS
SESSION: JULY 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Prof Dipti R Sahu
MODERATOR:	Dr Habatwa V Mweene

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

Non-programmable Calculators

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

Question 1 ***[25]***

1.1 Find the solution of the exponential decay equation $N' = -kN$ with initial condition $N(0) = N_0$ (5)

1.2 Show that in a radioactive material, the decay constant k and the half-life τ are related by the equation (5)

$$k\tau = \ln 2$$

1.3 Find the differential equation which satisfy $y' = f(y)$ whose solution is $y(t) = 4e^{2t} + 3$ (5)

1.4 Solve $\frac{dy}{dx} + 5y = -2$ (10)

Question 2 ***[25]***

2.1 Assume an object weighing 2 lb stretches a spring 6 in. Find the equation of motion if the spring is released from the equilibrium position with an upward velocity of 16 ft/sec. What is the period of the motion? Given acceleration due to gravity is $32 ft/sec^2$. (15)

2.2 Solve $Y'' + 4Y = e^{3x}$ (10)

Question 3 ***[25]***

3.1 Find K if (5)

$$A = \begin{bmatrix} k-2 & 1 \\ 5 & k+2 \end{bmatrix} \text{ is singular}$$

3.2 Solve the following system of equations using Gauss-Jordan elimination: (10)

$$-3x - 2y + 4z = 9$$

$$3y - 2z = 5$$

$$4x - 3y + 2z = 7$$

3.3 Using the Laplace transform method find the solution for the following equation (10)

$$\frac{\partial}{\partial t} y(t) = e^{(-3t)}$$

with initial conditions y (0) = 4 and Dy (0) = 0

Question 4 ***[25]***

4.1 Given the unit vector basis as (5)

$$V_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}; \quad V_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}; \quad V_3 = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

express the vector $V_4 = \begin{pmatrix} 5 \\ -3 \\ 7 \end{pmatrix}$ as a linear combination of the above basis

4.2 Convert the set V = $\{1, t, t^2\}$ into the orthonormal set E= $\{e_1, e_2, e_3\}$ where $t \in (-1,1)$. (10)

4.3 Express first three Legendre polynomials $P_0(x)$, $P_1(x)$ and $P_2(x)$ using the given function (10)

$$P_n(x) = \frac{(2n)!}{2^n (n!)^2} \left[x^n - \frac{n(n-1)}{2(2n-1)} x^{n-2} + \frac{n(n-1)(n-2)(n-3)}{2 \times 4(2n-1)(2n-3)} x^{n-4} - \ldots \right]$$

....**END**..