MATH-3.4

Sl.No. :

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III Semester M.Sc. Degree Examination, May - 2025
(Non CBCS, SLM Scheme)
MATHEMATICS
Mathematical Modeling

Time : 3 Hours **Max. Marks : 80**

Instructions : 1) ***Answer any five full questions.***
2) ***All questions carry equal marks.***

Q1) a) Explain any four characteristics of Mathematical modeling.

b) What are the limitation of Mathematical modeling? Explain.

c) A particle of mass m is stationary at time $t = 0$ and subject to a force $F(t)$, where $F(t) = F_0 \sin^2 wt$. Set up a differential equation to describe the motion.

[8+4+4]

Q2) a) Using qualitative technique explain the general properties of the solution of differential equation $\frac{dx}{dt} = bx - x^3$, where $b > 0$. Also draw its trajectories.

b) Explain linear population growth model. Find the expression for doubling half-life period.

[8+8]

Q3) a) Explain the construction of spring and dashpot systems. Find the expression for the displacement at any time t.

b) Set up a differential equation model to describe age structured population.

[10+6]

Q4) a) Describe conventional combat models in detail.

b) Find the expressions for velocity and acceleration vectors along radial and transverse direction.

[8+8]

Q5) a) Show that velocity profile for irrotational flow of a fluid is a harmonic function.

b) Derive Euler - Lagrange equation for the variational problem involving two independent variables.

[8+8]

Q6) a) Describe a partial differential equation model for birth-death-immigration process.

b) Derive Burger's equation for the convection diffusion process.

[8+8]

Q7) a) What are the composition of nitrogen, oxygen, carbon-dioxide and organ-inter gas in air pollution?

b) What is meant by 'Smog'? Discuss its cause and effects.

c) Distinguish between primary and secondary air pollutants.

[5+5+6]

Q8) a) Write a short note on Suspended Particulate Matter (SPM) and atmospheric fluid.

b) Give mathematical formulation of SPM in Taylor dispersion model.

[6+10]

