



Department of Mathematics
Indian Institute of Technology Guwahati
End–Semester Examination November 24, 2021
MA 473 Computational Finance (Part – II)

Time: **10:30 – 12:00 Hrs.**

Marks: **13**

There are **THREE** questions in this paper. Answer all questions.

4. The PDE modelling the *Asian option* with arithmetic average (for $S > 0$, $A > 0$, $0 \leq t \leq T$) is given by

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} + S \frac{\partial V}{\partial A} - rV = 0.$$

By using the transformation $V(S, A, t) = \tilde{V}(S, R, t) = SH(R, t)$, with $R = A/S$, show that the above PDE becomes

$$\frac{\partial H}{\partial t} + \frac{1}{2}\sigma^2 R^2 \frac{\partial^2 H}{\partial R^2} + (1 - rR) \frac{\partial H}{\partial R} = 0.$$

Also obtain the boundary and terminal conditions for the transformed PDE. (6 marks)

5. Define the **strong** and **weak-order of convergence** of a numerical scheme for a SDE. (2 marks)
6. Derive the second-order scheme for the following scalar SDE:

$$\begin{cases} dX(t) = a(X(t))dt + b(X(t))dW(t), \\ X(0) = X_0. \end{cases}$$

The scheme has to be derived completely without omitting any intermediate steps. Just by writing the final answers will not be considered. (5 marks)
