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MMT-007(P)

**M. Sc. (Mathematics with
Applications in Computer
Science) M. Sc. (MACS)
Term-End Examination
December, 2018**

**DIFFERENTIAL EQUATIONS AND
NUMERICAL SOLUTIONS**

Time : $1\frac{1}{2}$ Hours

Maximum Marks : 40

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- Note :** (i) There are *two* questions in this paper, totalling 30 marks.
(ii) Answer both of them.
(iii) Remaining 10 marks are for viva-voce.
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1. Write a program in 'C' language to solve the boundary value problem :

$$y'' = xy' + 2y, \quad 0 \leq x \leq 1$$

$$y'(0) = 1, y'(1) = (e^2 + e^{-1}) / 2$$

using the shooting method. Use third order Taylor series method with $h = 0.25$ to solve the resulting initial value problem. 15

2. Write a program in 'C' language to solve the equation :

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, \quad 0 \leq x \leq 1, t \geq 0$$

with $u(0, t) = 0, u(1, t) = 0, \frac{\partial u}{\partial t}(x, 0) = 0$ and $u(x, 0) = \sin \pi x$ using the

scheme :

$$u_i^{n+1} = 2u_i^n - u_i^{n-1} + r^2 [u_{i+1}^n - 2u_i^n + u_{i-1}^n]$$

Use the central difference approximation to the derivatives to obtain initial condition. Assume $h = \frac{1}{4}, r = 1$ and integrate for two time steps. 15