Code No: 152AA **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year II Semester Examinations, June - 2022
MATHEMATICS - II
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, ECM, AE, MIE, PTM, CSBS, CSIT, ITE, CE(SE), CSE(CS), CSE(AIML), CSE(DS), CSE(IOT), CSE(Networks))

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Suppose that the temperature of a cup of coffee obeys Newton's law of cooling. If the coffee has a temperature of 200 ^{0}F when freshly poured, and 1 min later has cooled to 190 ^{0}F in a room at 70 ^{0}F, determine when the coffee reaches a temperature of 150 ^{0}F.

b) Find an integrating factor and solve the given equation $(3x^2y + 2xy + y^3) + (x^2 + y^2)y' = 0$. [8+7]

2. Solve the following differential equations, where $p = \frac{dy}{dx}$

a) $y^2p^2 - 3xp + y = 0$
b) $x^2(y - px) = yp^2$ [8+7]

3.a) Solve $\frac{d^2y}{dx^2} + 2y = x^2e^{3x} + e^x \cos 2x$.

b) Use the method of variation of parameters to solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ [8+7]

4.a) Solve $(5 + 2x)^2y'' - 6(5 + 2x)y' + 8y = 2(2x + 5)^2$.

b) Solve $x^2y'' - xy' + y = \log x$. [8+7]

5.a) Find the volume of the region bounded above by the paraboloid $z = x^2 + y^2$ and below by the square $R: -1 \le x \le 1, -1 \le y \le 1$.

b) Find the volume using Triple Integral for the region between the cylinder $z = y^2$ and the xy-plane that is bounded by the planes $x = 0, x = 1, y = -1, y = 1$. [8+7]

6.a) Prove that $\bar{A} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find the scalar potential f such that $\bar{A} = \nabla f$.

b) Evaluate $\nabla^2 \bar{F}$ if $\bar{F} = r^a \bar{r}$. [8+7]

7.a) What is the directional derivative of $f = xy^2 + yz^3$ at the point (2,-1,1) in the direction of the normal to the surface $x \ln z - y^2 - 4$ at (-1,2,4).

b) Prove that $\nabla(\bar{A}\bar{B}) = (\bar{B}.\nabla)\bar{A} + (\bar{A}\nabla)\bar{B} + \bar{B} \times (\nabla \times \bar{A}) + \bar{A} \times (\nabla \times \bar{B})$. [8+7]

8.a) Prove that i) $\bar{F} = (4xy - 3x^2z^2)\bar{i} + 2x^2\bar{j} - 2x^3z\,\bar{k}$ is a conservative field and find its scalar potential ii) Find the work done in moving an object in this field from (1,1,1) to (0,0,0).

b) Use Green's theorem to evaluate $\oint(3x^2 - 8y^2)dx + (4y - 6xy)dy$ along the curve C: the boundary of the region defined by $x = 0, y = 0, x + y = 1$. [6+9]

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