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Code No: 152AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year II Semester (Special) Examinations, January - 2021

MATHEMATICS-II

(Common to CE, EEE, ECE, CSE, IT)

Time: 2 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

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1.a) Solve $(3xy^2 - y^3)\,dx - (2x^2y - xy^2)\,dy = 0$.

b) Radium decomposes at a rate proportional to the quantity present at time t. Suppose that it is found that in 25 years approximately 1.1% of certain quantity of radium has decomposed. Determine approximately how long it will take for one-half of the original amount of radium to decompose. [7+8]

2.a) Solve $y - 2px = \tan^{-1}(xp^2)$; where $p = \frac{dy}{dx}$.

b) A body of temperature $80\,^0$F is placed in a room of constant temperature $50\,^0$F at time $t = 0$. At the end of 5 minutes the body has cooled to a temperature of $700\,^0$F. After how many minutes will the temperature of the body be within $1\,^0$F of the constant $50\,^0$F temperature of the room? [7+8]

3.a) Using the method of variation of parameters solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$.

b) Solve $(D^2 - 4D + 4)y = x^2\sin x + e^{2x} + 3$. [8+7]

4.a) Evaluate $\iint_R (x + y)^2\,dxdy$; where R is the parallelogram in the xy-plane with vertices (1, 0), (3, 1), (2, 2), (0, 1) using the transformation $u = x + y$, $v = x - 2y$.

b) Evaluate $\int_0^a \int_y^a \frac{x}{x^2+y^2}\,dxdy$ by changing the order of integration. [8+7]

5.a) A vector field is given by $A = (x^2 + xy^2)\,i + (y^2 + x^2y)\,j$, show that the field is irrotational and find the scalar potential.

b) Find the maximum value of the directional derivative of $\emptyset = x^2yz$ at (1, 4, 1). [8+7]

6.a) Evaluate $\iint_S A.n\,ds$ where $A = (x + y^2)\,i - 2xj + 2yzk$ and S is a surface in the plane $2x + y + 2z = 6$ in the first octant.

b) If $\overline{F} = x^3i + x^2yj + xyz^2k$, find Curl $\overline{F}$. [8+7]

7. State and verify Stokes theorem for the function $f = x^2i + xyj$ integrated round the square in the plane $z = 0$ whose sides are along the lines $x = 0 = y, x = a = y$. [15]

8. State and verify Gauss divergence theorem for $f = (x^3 - yz)\,i - 2x^2yj + zk$ taken over the surface of the cube bounded by the planes $x = y = z = a$ and coordinate planes. [15]

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