AQ – 2831

First Semester M. E. (Mechanical Engg.) (Thermal Engg.) Examination
(New–CGS)

ADVANCED MATHEMATICS

Paper – 1 MTE 1

P. Pages : 3

Time : Three Hours]   [Max. Marks : 80

Note : (1) Separate answer book must be used for each section in the subject Geology, Engineering material of civil branch and Separate answer-book must be used for Section A and B in Pharmacy and Cosmetic Tech.
(2) All question carry equal marks.
(3) Answer **Two** questions from Section A and **Two** questions from Section B.
(4) Assume suitable data wherever necessary.
(5) Retain the construction lines.
(6) Use of calculator is permitted.
(7) Use pen of Blue/Black ink/refill only for writing the answer

SECTION A

1. (a) Solve :—

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6 \frac{\partial^2 z}{\partial y^2} = y \cos x$$

10

(b) Solve :—

$$(D^2 - D'^2 + D + 3D' - 2y)z = x^2 y.$$

10

2. (a) Solve :—

$$(D^2 + 2DD' + D'^2 - 2D - 2D')z = \sin(x + 2y).$$

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(b) Solve the equation $\dfrac{\partial u}{\partial x} = 2 \dfrac{\partial u}{\partial t} + u.$ subject to the

condition that $u(x, o) = 6.e^{-3x}$ by method of separation of variables.

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3. (a) A rod of length l with insulated sides is initially at uniform temperature, u_o. It's ends are suddenly cooled to 0^0C and are kept at that temperature. Find the temperature function u(x, t) satisfying equation

$$\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$$

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(b) A tightly stretched string with the fixed end points x = 0 and x = l is initially at rest in it's equilibrium position. If it is set vibrating by giving to each of it's points a velocity $\lambda x(l - x)$, find the displacement of the string at any distance x from one end at any time t. The wave equation is

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$$

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SECTION B

4. (a) If P is the pull required to lift a load W by means of pulley block, find the Linear Law of the form

P = mW + C using following data

P	12	15	21	25
W	50	70	100	120

where P and W are tken in kg-wt.
Compute P when W = 150 kg-wt. 7

(b) The probability that bad reaction from certain injection is 0.001, Determine the chance that out of 2000 individuals more than two will get a bad reaction. 7

(c) Find the coefficient of correlation between x and y. Also find Regression line of y on x, for the given data

x	1	2	3	4	5
y	2	5	3	8	7

6

5. (a) Given that :—

x	5	7	11	13	17
y	150	392	1452	2366	5202

using Lagrange's Interpolation formula estimate the value of y at x = 9.

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(b) From the following data, find θ at $x = 43$ and at $x = 84$

x	40	50	60	70	80	90
θ	184	204	226	250	276	304

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6. (a) Evaluate the integral $I = \int\limits_{4}^{5.2} \log_e x \, dx$ by using

    (i) Trapezoidal Rule.

    (ii) Simpson's 3/8 Rule.   6

(b) Using Euler's method find the approximate value of y when

$$\frac{dy}{dx} = x^2 + y^2 \text{ and } y(0) = 1 \text{ in}$$

five steps taking $h = 0.2$.   7

(c) Using Runge–Kutta method of fourth order find $y(0.8)$ correct up to four decimal places if

$$\frac{dy}{dx} = y - x^2, \quad y(0.6) = 1.7379.$$

7

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