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B.Tech. Fourth Semester (Food, Pulp & Paper, Oil & Paint & Petrochem.) (CBCS)

11010 : Engineering Mathematics - II

4 CT 01

P. Pages : 3
Time : Three Hours

AW - 3075
Max. Marks : 80

Notes :
1. All question carry marks as indicated.
2. Answer **three** question from Section A and **three** question from Section B.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answer necessary with the help of neat sketches.
6. Use of slide rule logarithmic tables, Steam tables, Mollier's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.
7. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) A tightly stretched string of length ℓ with fixed ends is initially in equilibrium position. It is set vibrating by giving each point a velocity $v_0 \sin^3\left(\frac{\pi x}{\ell}\right)$. Find the displacement y(x, t). **7**

b) Using the method of separation of variables, solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x, 0) = 6e^{-3x}$ **7**

OR

2. a) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(x, 0) = 3\sin n\pi x$ $u(0, t) = 0$ and $u(1, t) = 0$ where $0 < x < 1$, & $t > 0$. **7**

b) Find the deflection of a vibrating string of unit length having fixed ends with initial velocity zero and initial deflection $f(x) = k(\sin x - \sin 2x)$. **7**

3. a) If f(z) is an analytic function with constant modulus, show that f(z) is constant. **5**

b) If $(a+ib)^b = m^{x+iy}$, prove that one of the values of y/x is $2\tan^{-1}(b/a)/\log(a^2+b^2)$ **4**

c) Find the analytic function, whose real part is $\sin 2x/(\cosh 2y - \cos 2x)$. **4**

OR

4. a) Find the conjugate harmonic of $v(r,\theta) = r^2\cos 2\theta - r\cos\theta + 2$ and show that v is harmonic. **5**

b) Prove that $\tanh^{-1} x = \sinh^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)$ **4**

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c) Find the orthogonal trajectories of the family of the curves. 4

$x^4 + y^4 - 6x^2y^2 = \text{constant}$

5. a) Find the positive root of $x^4 - x = 10$ correct to three decimal places, using Newton-Raphson method. 6

b) From the following table the number of students who obtained marks between 40-45. 7

Marks	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of students	31	42	51	35	31

OR

6. a) Solve the system of non-linear equations $x^2 + y = 11$, $y^2 + x = 7$ by Newton's - Raphson method. 6

b) Use Simpson's $1/3^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. 7

7. a) Using simplex method, solve the LPP. 7

Minimize : $Z = x_1 - 3x_2 + 3x_3$

subject to : $3x_1 - x_2 + 2x_3 \le 7$

$2x_1 + 4x_2 \ge -12$

$-4x_1 + 3x_2 + 8x_3 \le 10$

$x_1, x_2, x_3 \ge 0$

b) Solve graphically the following LPP 7

Maximize : $Z = 4x_1 + 3x_2$

subject to : $x_1 - x_2 \le -1$

$-x_1 + x_2 \le 0$

$x_1, x_2 \ge 0$

OR

8. a) Using simplex method, solve following LPP 7

Minimize : $Z = 3x_1 + 5x_2 + 4x_3$

subject to : $2x_1 + 3x_2 \le 8$

$2x_2 + 5x_3 \le 10$

$3x_1 + 2x_2 + 4x_3 \le 15$

$x_1, x_2, x_3 \ge 0$

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b) Solve graphically the following LPP 7

Maximize : $Z = 2x_1 + 3x_2$

Subject to : $x_1 - x_2 \leq 2$

$x_1 + x_2 \geq 4$

$x_1, x_2 \geq 0$

9. a) Two cards are drawn in succession from a pack of 52 cards find the chance that the first is a king and the second is a queen, if the first card is 6

i) replaced ii) not replaced

b) A skilled typist on routine work kept a record of mistakes made per day during 300 working days. 7

Mistake/day	0	1	2	3	4	5	6
No. of days	143	90	42	12	9	3	1

OR

10. a) A certain screw making machine produces on average of 2 defective screws out of 100 and packs them in boxes of 500 find the probability that a box contains 15 defective screws. 6

b) If the variance of Poisson's distribution is 2. Find the probabilities for r = 1, 2, 3, 4, from the recurrence relation of the Poisson's distribution. Also find $\rho(r \geq 4)$. 7

11. a) Fit a straight line to the data. 6

x	1	2	3	4	5
y	5	7	9	10	11

b) The regression equation of two variables x & y are 7

$x = 0.7y + 5.2$

$y = 0.3x + 2.8$

find the mean of x & y

OR

12. a) The regression equation calculated from a given set of observation two random variables are 6

$x = -0.4y + 6.4$ $y = -0.6x + 4.6$ calculate $\bar{x}$, $\bar{y}$ & r.

b) Fit a straight line to the data. 7

x	0	5	10	15	20	25
y	12	15	17	22	24	30

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