Code No: I2201/R16

M. Tech. I Semester Supplementary Examinations, February-2020

ADVANCED MATHEMATICS

Common to Transportation Engineering (22), Structural Design (85), Structural Engineering (87), Soil Mechanics & Foundation Engineering (19), Geotechnical Engineering (20) and Computer Aided Structural Engineering (35)

Time: 3 Hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a Derive two dimensional Laplace equation in spherical coordinates. 6

   b Find the solution of $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, 0< x< L, t > 0, with the boundary conditions 6

   $u(0,t) = 0$, and $u(L,t)=0$ for all t>0, $u(x,0)=f(x)$ and $\frac{\partial u(x,0)}{\partial t} = g(x)$ for 0<x<L.

2. Solve the Poisson equation $\nabla^2 u = x^2 + y^2$ with $u(x,y)=0$ on the boundary of the square defined by $x=0$, $x=1$, $y=0$ and $y=1$ with mesh length 0.25. 12

3. a Fit a regression curve of the form $y = a + bx + cx^2$ to the following data and estimate y when $x = 1.5$ 6

x	1	2	3	4
y	1.7	1.8	2.3	3.2

   b Fit a curve of the form $y = ax^b$ to the following data 6

x	20	16	10	11	14
y	22	41	120	89	56

4. From the data relating to the variables X_1, X_2 and X_3 of 18 samples the following correlation coefficients were obtained 12

   $r_{12}=0.52$, $r_{13}=0.77$ and $r_{23}=0.72$

   Find the multiple correlation coefficients $R_{1.23}$

5. a Solve LPP Minimize $z = 1.5x_1 + 2.5x_2$ subject to $x_1 + 3x_2 \geq 3, x_1 + x_2 \geq 2$ and $x_1, x_2 \geq 0$ using Graphical method 6

   b Solve LPP Maximize $z = x_1 - 3x_2 + 2x_3$ subject to $3x_1 - x_2 + 3x_3 \leq 7$, $-2x_1 + 4x_2 \leq 12$, $-4x_1 + 3x_2 + 8x_3 \leq 10$ and $x_1,\ x_2,\ x_3 \geq 0$ 6

6. Determine the coefficient of correlation to the following bivariate frequency distribution 12

x / y	15-25	25-35	35-45	45-55	55-65	65-75
15-25	1	1				
25-35	2	12	1			
35-45		4	10	1		
45-55			3	6	1	
55-65				2	4	2
65-75					1	2

7. Solve the following problem by Big-M method Max.$z = x_1 + 2x_2 + 3x_3 - x_4$ subject to $x_1 + 2x_2 + 3x_3 = 15$, $2x_1 + x_2 + 5x_3 = 20$, $x_1 + 2x_2 + x_3 + x_4 = 10$ and $x_1,\ x_2,\ x_3,\ x_4 \geq 0$ 12

8. Estimate the equation of regression plane connecting x_1, x_2 and y for the following data 12

x_1	3	5	6	8	12	14
x_2	16	10	7	4	3	2
Y	90	72	54	42	30	12

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