Code No: I2201/R16

M. Tech. I Semester Regular/Supple Examinations, Jan/Feb-2018

ADVANCED MATHEMATICS

(Common to Transportation Engineering (22), Structural Engineering (87),Structural Design(85), 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. Solve the heat equation $u_t = u_{xx}$ subject to the conditions u(x,0)= sin πx *for* $0 \le x \le 1$, u(0,t) = 0 and u(1,t) = 0 with h= 0.25 and k = 1/16. Compute u(0.5, 0.125) using Crank Nicolson method. 12M

2. Solve the boundary value problem $\nabla^2 u = 0, 0 \le r \le 10, 0 \le \theta \le 10$ subject to the conditions u(10,θ)= $\frac{400}{\pi}(\pi\theta - \theta^2)$, u(r,0) = 0 and u(0,θ) is finite. 12M

3. a Fit a curve of the form $y = ax^b$ for the following data 6M

X	1	2	3	4	5
y	0.5	2	4.5	8	12.5

b Calculate the coefficient of correlation for the following data. 6M

X	1	2	3	4	5
y	5	4	3	2	1

4. a Find the multiple linear regression equations of X on Y and Z using the data given below: 6M

X	2	3	7	8	9
Y	6	9	12	13	15
z	7	12	15	16	17

b Find the rank correlation coefficient for the following data. 6M

X	30	48	54	62	48	60	50	55
y	40	35	48	54	36	50	30	54

5. Use M method to maximize Z = 6x + 4y subject to 2x + 3y ≤ 30, 3x + 2y ≤ 24, x + y ≥ 3, x, y ≥ 0. 12M

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6. It is of interest to study the effect of population size in various cities in US on ozone concentrations. The data consists of 1999 population in millions and the amount of ozone present per hour in parts per billion. The data are as follows: 12M

Ozone present	126	135	124	128	130	128	126	128	128
X- population	0.6	4.9	0.2	0.5	1.1	0.1	1.1	2.3	0.6

Fit a linear regression model relating ozone concentration to population.
Test H_0 : $\beta=0$ using ANOVA approach

7. A bar of 10cm long with insulated sides has its ends A and B maintained at temperatures 0^0C and 100^0C respectively, until steady-state conditions prevail. The temperature at A is suddenly raised to 20^0C and at the same time that at B is lowered to 80^0C. Find the temperature distribution in the bar at time t using the method of separation of variables. 12M

8. Minimize $f(x,y) = 2x^2 + y^2$ by using the steepest descent method with the starting point $X_1 = \begin{Bmatrix} 1 \\ 2 \end{Bmatrix}$ (3 iterations only) 12M

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