Code No: I2201/R16

M. Tech. I Semester Regular Examinations, December-2016

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 Solve the heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions *u(x,0)=0, u(0,t)=0* and *u(1,t)=t* with h= 0.25 and k = 1/16. Compute *u(0.5, 0.125)* using Crank Nicolson method. 12

2. a If $u(r, \theta, \phi)$ depends only on *r* and θ, then find the Laplacian in spherical coordinates. 5

   b Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, 0<x<L, u(0,t)=0, u(L,t) =0 and u(x,0)= f(x) using the method of separation of variables. 7

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

x	1	3	7	9	10	12	15
Y	0	2	6	8	13	14	20

   b Calculate the coefficient of correlation between age of cars and annual maintenance cost. Comment on your result. 6

Age of cars	2	4	6	7	8	10	12
Cost	1600	1500	1700	1900	2200	2300	2000

4. a Find the multiple linear regression equations of X on Y and Z using the data given below: 7

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

   b Following are the ranks obtained by 9 students in History and economics. Find the rank correlation coefficient and comment. 5

History	1	2	3	4	5	6	7	8	9
Economics	3	5	2	1	6	8	9	4	7

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

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6. It is of interest to study th effect of population size in various cities in US on ozone concentratins. 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: 12

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. Solve the $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides x=0=y, x=3=y with u=0 on the boundary. Take h=1. 12

8. Minimize f(x,y) = x-y+2x^2 +2xy +y^2 starting from the point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$. 12

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