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S.E. (Mining) (Sem-IV) (Revised Course 2016-2017)  
 EXAMINATION Nov/Dec 2019  
 Numerical Techniques & Statistics

[Duration : Three Hours]

[Total Marks : 100]

Instructions:

- 1) Attempt **five** questions, **any two** questions each from **PART-A** and **PART-B** and **one** from **PART-C**.
- 2) Assume suitable data, if necessary.
- 3) Figures to the **right** indicate full **marks**.

PART-A

Answer any **TWO** questions from the following:

2×20=40

Marks

- 1) a) Find an approximate root of the equation  $x^4 - x - 10 = 0$  by Newton Raphson method (6)  
 taking initial approximation  $x_0 = 2$  correct up to 3 decimal places.
- b) From the table given below, find  $f(18)$  and  $f(37)$  using appropriate formula. (8)

x	15	20	25	30	35	40
y=f(x)	12.849	16.357	19.524	22.396	24.999	27.356

- c) Solve the equation  $e^{2x} - 3x^2 - 8 = 0$  in the interval (1,2) using Bisection method correct up to 3 decimal places. (6)
- 2) a) Using Taylor's series method, find the value of  $y(1.1)$  given that (6)  
 $\frac{dy}{dx} = 3e^x + 4y, y(1) = 1.$
- b) Given  $\frac{dy}{dx} = \frac{y-x}{y+x}$  with initial conditions  $y=1$  at  $x=0$ , find  $y$  for  $x=0.2$  by using Modified Euler's method taking step size  $h=0.1$ . (8)
- c) Using Lagrange's Interpolation formula, find  $y$  when  $x=3$  from the following table. (6)

x	2	5	8	14
y=f(x)	94.8	87.9	81.3	68.7

- 3) a) Solve the hyperbolic partial differential equation (10)  
 $\frac{\partial^2 y}{\partial t^2} = 4 \frac{\partial^2 y}{\partial x^2}$   
 with the boundary conditions  
 $y(0, t) = 0 = y(4, t), y(x, 0) = x(4 - x)$  and  $\frac{\partial y}{\partial t}(x, 0) = 0$

- using explicit finite different method.
- b) Prove that  $\delta^2 = \nabla\Delta = \Delta - \nabla$  (4)
- c) Draw a flowchart for implementing Runge-Kutta fourth order method. (6)

**PART-B**

Answer any **TWO** question from the following:

**2×20=40Marks**

- 4) a) Two dice are rolled once. Find the probability that (4)
- (i) the numbers appearing on the two dice are different.
- (ii) the numbers appearing on the two dice are same.
- b) Using Trapezoidal rule, evaluate  $\int_0^1 e^{-x^2} dx$  taking by  $h=0.1$  and  $h=0.2$ . Use Romberg's (10)
- method to improve the result.
- c) The number of accidents in a year to auto-drivers in a city is a Poisson variable with mean (6)
- equal to 3. Out of 1000 drivers, find approximately the number of drivers with
- (i) No accident in a year
- (ii) More than 3 accidents in a year
- 5) a) Solve the following system of equations using Gauss Jordan method. (10)

$$\begin{aligned} 2x + 8y + z &= 7 \\ x + 2y + 6z &= 8 \\ 4x + 2y + z &= 6 \end{aligned}$$

- b) A company has two plants to manufacture motorcycles. 70% motor cycles are manufactured (6)
- at the first plant, while 30% are manufactured at the second plant. At the first plant, 80%
- motorcycles are rated of the standard quality while at the second plant, 90% are rated of
- standard quality. A motorcycle, randomly picked up, is found to be of standard quality. Find
- the probability that it has come out from the second plant.
- c) A discrete random variable X has the following probability distribution. (4)

X	0	1	2	3
P(X)	k	4k	3k	2k

- Find (i) k
- (ii) Expected value E(x).

- 6) a) Solve the following system of linear equations by Jacobi's iterative method correct upto (10)
- three decimal places.

$$\begin{aligned} 28x + 4y - z &= 32 \\ x + 3y + 10z &= 24 \\ 2x + 17y + 4z &= 35 \end{aligned}$$

- b) Write a program in C to evaluate an integral by Simpson's  $1/3^{\text{rd}}$  rule. (6)
- c) A problem in statistics is given to 2 students A and B whose chances of solving it are  $\frac{1}{2}$  and  $\frac{3}{4}$  (4)  
 respectively. What is the probability that the problem will be solved?

**PART-C**

Answer any **ONE** question from the following:

**1×20=20Marks**

- 7) a) Given the following data. (8)

x	0	1	2	4
f(x)	1	14	15	5

Find the interpolating polynomial using Newton's divided difference formula.

- b) Use Stirling's formula to find  $f(3.75)$  from the following table. (6)

x	2.5	3.0	3.5	4.0	4.5	5.0
f(x)	24.145	22.043	20.225	18.644	17.262	16.047

- c) Use Runge-Kutta second method to find the value of  $y(0.2)$ , (6)  
 given that  $\frac{dy}{dx} = 1 + xy$ ,  $y(0) = 1$ . Take  $h=0.1$ .

- 8) a) Solve the equation  $e^x - x - 2 = 0$  in the interval (1,2) by using Secant method correct upto (7)  
 3 decimal places.

- b) The length of life of an instrument produced by a machine has a normal distribution with a (7)  
 mean of 12 months and standard deviation of 2 months. Find the probability that an  
 instrument produced by this machine will last.

a) less than 14 months.

b) between 10 and 16 months.

(The area of standard normal variable  $z$  between  $z=0$  and  $z=1$  is 0.3413 and that from  $z=0$   
 and  $z=2$  is 0.4772)

- c) A binomial random variable  $X$  has mean 4 and variance  $4/3$ . Find  $P(X>1)$  (6)