M.Phil / Ph.D., WRITTEN EXAMINATIONS

PAPER – I : RESEARCH METHODOLGY
SYLLABUS

SECTION – I : **NUMERICAL METHODS**

System of Linear algebraic equations and eigen value problems – Introducti

SECTION – IV : **RELIABILITY**

Introduction – definition of Reliability – reliability function – Mean failure Rate – Mean time for failure (MTTF) – Reliability in terms Hazard rate and failure density constant Hazard and linearly increasing Hazard – Weibull Model – Reliability structures – Series systems – parallel systems – MTTF in failure law follows Exponential distributions (2 questions)

Ref : Srinath, L.S., "Reliability Engineering", Affiliated East-West Press Pvt. Ltd. Delhi
Balagurusamy,E, "Reliability Engineering", Tata McGraw Hill, Delhi

SECTION – V : **SIMULATION**

Introduction – Elements of a simulation models – Event type simulation – Steps in simulation – advantages and disadvantages – Generation of Random numbers – The inverse transformation method – The rejection method – Simulation technique applied to inventory and queuing problems. (1 question)

Ref: Kanthi Swaroop, Manmohan and Guptha, "Operations Research", S.Chand & Co.,

Chapter – 20, 20.1 to 20.7.

(Note: A short notes question covering all the above five topics)

MODEL PAPER

M.Phil./Ph.D. EXAMINAITONS 2008

Paper – I : Research Methodology

Time : 3 hours] [Max. Marks: 100

Answer any FIVE questions.
All questions carry equal marks.

1. a) Define characteristic equation, Eigen values and Eigen vectors. Solve the following system of equations using Gauss Elimination Method.

$$10\,x_1 - x_2 + 2\,x_3 = 4$$
$$x_1 + 10\,x_2 - x_3 = 3$$
$$2\,x_1 + 3\,x_2 + 20\,x_3 = 7.$$

b) Show that no eigen value of a matrix exceed the Norm of the Matrix. Find all Eigen values of the matrix

$$A = \begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}.$$

2. a) Explain Lagrange and Newton Interpolation methods of a polynomial.

b) Discuss the method of determining optimum choice of Step-length in numerical differentiation methods.

3. a) Define Laplace and Inverse Laplace transforms of a function. Obtain the Laplace transform of the function

$$f(t) = \frac{e^{at} - 1}{a}.$$

b) Discuss the properties of Laplace Transforms and prove any two of them.

4. a) Explain the application of Residues in finding out the Inverse Laplace Transforms. Find the Inverse Laplace Transform of

$$f(s) = \frac{3s + 1}{(s-1)(s^2+1)}.$$

b) State and prove the Convolution Theorem and discuss its application in obtaining Laplace Transforms. Find the Inverse Laplace Transform of the function.

$$f(s) = \frac{1}{(s+a)(s+b)}$$

5. a) Distinguish between multistage and multiphase sampling with suitable examples with usual notations if simple random sample of size 'n' units with 'm' subunits from each is drawn, then show hat the sample mean per sub unit $\bar{\bar{y}}$ is an unbiased estimate of the Population mean $\bar{\bar{Y}}$. Also obtain the variance of the same.

b) Explain the need of sub-sampling with units of un-equal sizes with two suitable examples.

(P.T.O)

6. a) Explain the double sampling method for stratification. With usual notations if the first sample is a random sample of size n_1 and the second sample is a random sample of the first, of size $n_h = v_h n_{1h}$, where $0 < v_h \leq 1$, and v_h are fixed,

$$V(\bar{y}_{st}) = S^2\left(\frac{1}{n_1} - \frac{1}{N}\right) + \sum_h^L \frac{W_h S_h^2}{n_1}\left(\frac{1}{v_h} - 1\right)$$

where S^2 is the population variance.

b) Explain the double sampling for regression estimators with suitable examples.

7. a) Define (i) Reliability function (ii) MTTF (iii) MTBF and (iv) Hazard function.
b) Obtain the Reliability of an exponential failure model.

8. a) Explain Weibull failure model along with its applications.
b) Obtain the reliability function of a Weibull failure model.

9. a) Give two situations to explain when to use simulation. Also discuss advantages and limitations of simulation.
b) A bakery keeps stock of a popular brand of cake. Daily demand for 100 days is given as follows

Daily Demand	:	0	15	25	35	45	50
No. of Days	:	1	15	20	50	12	2

Simulate the demand for the cake for the next 10 days.

10. Write short notes on any THREE of the following
a) Error Analysis
b) Properties of Inverse Laplace Transforms
c) Two Stage Sampling
d) Series and parallel systems
e) Generation of Random numbers.