MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. Statistics
(Choice Based Credit System)

(with effect from the academic year 2016-2017 onwards)

(44th SCAA meeting held on 30.05.2016)

Part		Title of the Subject	Status	Instructional hours/week	Credits	Exam Hrs	Maximum Marks			Passing Minimum	
							CIA	UE	Total	External	Total
		SEMESTER - III									
I	3.1	Tamil / Other Languages – III	Language	6	3	3	25	75	100	30	40
II	3.2	English – III	Language	6	3	3	25	75	100	30	40
III	3.3	Statistical Distributions	Core	4L + 2T	4	3	25	75	100	30	40
III	3.4	Mathematics – II	Allied	6	4	3	25	75	100	30	40
IV	3.5	Elective – I (Non-Major) Real Analysis	ENM	2	2	3	25	75	100	30	40
IV	3.6	Statistical Analysis using Software-I	SBS	4	4	3	25	75	100	30	40
		Total		30	20						
		SEMESTER - IV									
I	4.1	Tamil / Other Languages IV	Language	6	3	3	25	75	100	30	40
II	4.2	English – IV	Language	6	3	3	25	75	100	30	40
III	4.3	Demographic Methods	Core	4	4	3	25	75	100	30	40
III	4.4	Statistical Practical – II **	Core (Practical)	4	4	3	50	50	100	20	40
III	4.5	Mathematical Computations using R	Allied	4	4	3	25	75	100	30	40
IV	4.6	Elective – II (Non-Major) Matrix Theory	ENM	2	2	3	25	75	100	30	40
IV	4.7	Numerical Methods	SBS	4	4	3	25	75	100	30	40
V	4.8	Extension Activity			1	3				30	40
		Total		30	25						

Note: 1 **EM** **:** **Elective (Major)** **CIA** **:** **Continuous Internal Assessment**

ENM : Elective (Non-Major) UE : University Examination

SBS : Skill Based Subject T : Tutorial

L : Lecture

Note: 2 *Statistical Practical – I is based on the courses: 1.3 Descriptive Statistics

2.3 Sampling Techniques

2.4 Time Series and Official Statistics

** Statistical Practical – II is based on the courses: 3.3 Statistical Distributions
4.3 Demographic Methods
4.7 Numerical Methods

***Statistical Practical – III is based on the courses: 5.1 Statistical Inference - I
5.2 Statistical Quality Control

6.1 Statistical Inference - II

6.2 Design of Experiments

6.3 Operations Research

****Statistical Practical – IV is based on all core subjects from Semester –I to Semester –VI

(Objective: Providing knowledge on collection and analysis of the data applying appropriate statistical tools using Statistical Software)

LIST OF ELECTIVE SUBJECTS

Elective - III

1. Econometrics
2. Stochastic Processes

Elective – IV

1. Actuarial Statistics
2. Java Programming

Elective – V

1. Discrete Mathematics
2. RDBMS with ORACLE

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QUESTION PAPER PATTERN
(For Theory Subjects)

B.Sc., Degree Examinations
STATISTICS (CBCS)

Time: Three Hours   Maximum: 75 marks

PART - A   (10 × 1 =10 marks)
Ten Multiple choice Questions (Two questions shall be asked from each unit with 4 choices each)
Answer ALL questions
Each question carries 1 mark

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

PART - B (5 × 5 = 25 Marks)

Five Questions (One question shall be asked from each Unit) with internal choice
Answer ALL questions
Each question carries 5 marks

11. (a)

                                        (OR)

(b)

12. (a)

                                        (OR)

(b)

13. (a)

                                        (OR)

(b)

14. (a)

                                        (OR)

(b)

15. (a)

                                        (OR)

(b)

Five Questions (One question shall be asked from each Unit) with internal choice.
Answer ALL questions
Each question carries 8 marks)

16. (a)

　　　　　　　　　　　　　　(OR)

　(b)

17. (a)

　　　　　　　　　　　　　　(OR)

　(b)

18. (a)

　　　　　　　　　　　　　　(OR)

　(b)

19. (a)

　　　　　　　　　　　　　　(OR)

　(b)

20. (a)

　　　　　　　　　　　　　　(OR)

　(b)

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QUESTION PAPER PATTERN
(For Practical Subjects)

B.Sc., Degree Examinations
STATISTICS (CBCS)

Time: Three Hours　　　　　　　　　　　　　　　　Maximum: 75 marks

Statistical Practical – I
Answer any 5 Questions without omitting any section
Each question carries 15 marks

　　　　　　　　　　　　　　　　　　(5 × 15 = 75 Marks)

Section A

1. Descriptive Statistics
2. Descriptive Statistics
3. Descriptive Statistics

Section B

4. Sampling Techniques
5. Sampling Techniques
6. Sampling Techniques

Section C

7. Time Series and Official Statistics
8. Time Series and Official Statistics
9. Time Series and Official Statistics
10. Time Series and Official Statistics

Statistical Practical – II
Answer any 5 Questions without omitting any section
Each question carries 15 marks

(5 × 15 = 75 Marks)

Section A

1. Statistical Distributions
2. Statistical Distributions
3. Statistical Distributions
4. Statistical Distributions

Section B

5. Demographic Methods
6. Demographic Methods
7. Demographic Methods

Section C

8. Numerical Methods
9. Numerical Methods
10. Numerical Methods

Statistical Practical – III
Answer any 5 Questions without omitting any section
Each question carries 15 marks

(5 × 15 = 75 Marks)

Section A

1. Statistical Inference – I
2. Statistical Inference - I

Section B

3. Statistical Quality Control
4. Statistical Quality Control

Section C

5. Statistical Inference – II
6. Statistical Inference – II

Section D

7. Design of Experiments
8. Design of Experiments

Section E

9. Operations Research
10. Operations Research

Statistical Practical – IV
Answer any 5 Questions without omitting any section
Each question carries 15 marks

<div align="right">(5 × 15 = 75 Marks)</div>

<div align="center">Section A</div>

1. Descriptive Statistics
2. Sampling Techniques
3. Time Series and Official Statistics

<div align="center">Section B</div>

4. Statistical Distributions
5. Demographic Methods
6. Numerical Methods

<div align="center">Section C</div>

7. Statistical Inference - I
8. Statistical Quality Control
9. Statistical Inference – II
10. Design of Experiments
11. Operations Research

<div align="center">**********</div>

Grading system with Ten point scale approved by standing committee on Academic Affairs of our University is given below:

Percentage of Marks	Grade point	CGPA	Grade	Performance
95-100	9.5 - 10	9.5 and Above	O	Outstanding
85-94	8.5 – 9.4	8.5 and Above	E	Excellent
75-84	7.5 – 8.4	7.5 and Above	D	Distinction
60-74	6.0 – 7.4	6.0 and Above	A	Very Good
50-59	5.0 – 5.9	5.0 and Above	B	Good
40-49	4.0 – 4.9	4.0 and above	C	Average
Up to 39	0	0	RA	Re-Appear

The overall performance level of candidates will be assessed by cumulative weighted Average of marks and Cumulative weighted Average Grade Points. These can be calculated using the following:

$$\text{Weighted Marks} = \text{Marks} \times \text{Credit}$$

$$\text{Cumulative Weighted Average of Marks(CWAM)} = \frac{\text{Sum of Weighted Marks}}{\text{Sum of credits}}$$

$$\text{Weighted Grade Point} = \text{Grade Point} \times \text{Credit}$$

$$\text{Cumulative Weighted Average Grade Point (CGPA)} = \frac{\text{Sum of Weighted Grade Points}}{\text{Sum of credits}}$$

Calculation of these performance measures is illustrated below:

If the marks secured by a students in various subjects as given in the following table

SUB. CODE	SUBJECT TITLE	PART	MARKS SECURED			G.P	Cr.	Weighted Grade point
			INT	EXT	TOT			
		I	19	32	51	5.1	3	15.3
		II	13	30	43	4.3	3	12.9
		III	17	41	58	5.8	4	23.2
1.1 Tamil / Other Languages -I		III	20	30	50	5	4	20
1.2 English – I								
1.3 Subject 2		III	16	35	51	5.1	4	20.4
1.4 Subject 3								
1.5 Subject 4		IV	23	45	68	6.8	2	13.6
1.6 Subject 5								
2.1 Tamil / Other Languages - II		I	17	54	71	7.1	3	21.3
2.2 English – II								
2.3 Subject 6		II	12	52	64	6.4	3	19.2
2.4 Subject 7		III	18	54	72	7.2	4	28.8
2.5 Subject 8								
2.6 Subject 9		III	19	52	71	7.1	4	28.4
2.7 Subject 10								
		III	18	54	72	7.2	4	28.8
		III	19	52	71	7.1	4	28.4
		IV	29	54	83	8.3	2	16.6

The CWAM for each part can be calculated as follows:

$$\text{CWAM for Part I} = \frac{(51 \times 3) + (71 \times 3)}{3+3} = \frac{153+213}{3+3} = \frac{366}{6} = 61$$

$$\text{CWAM for Part II} = \frac{(43 \times 3) + (64 \times 3)}{3+3} = \frac{129+192}{3+3} = \frac{321}{6} = 53.5 = 54$$

$$\text{CWAM for Part III \& IV} = \frac{(58\times4)+(50\times4)+(51\times4)+(68\times2)+(72\times4)+(71\times4)+(72\times4)+(71\times4)+(83\times2)}{4+4+4+2+4+4+4+4+2}$$

$$= \frac{232+200+204+136+282+284+288+284+166}{4+4+4+2+4+4+4+4+2} = \frac{2082}{32} = 65.0625 = 65$$

The CGPA for each part can be calculated as follows:

$$\text{CGPA for Part I} = \frac{(5.1\times3)+(7.1\times3)}{3+3} = \frac{15.3+21.3}{3+3} = \frac{36.6}{6} = 6.1$$

$$\text{CGPA for Part II} = \frac{(4.3\times3)+(6.4\times3)}{3+3} = \frac{12.9+19.2}{3+3} = \frac{32.1}{6} = 5.35 = 5.4$$

$$\text{CGPA for Part III \& IV} = \frac{(5.8\times4)+(5\times4)+(5.1\times4)+(6.8\times2)+(7.2\times4)+(7.1\times4)+(7.2\times4)+(7.1\times4)+(8.3\times2)}{4+4+4+2+4+4+4+4+2}$$

$$= \frac{23.2+20+20.4+13.6+28.2+28.4+28.8+28.4+16.6}{4+4+4+2+4+4+4+4+2} = \frac{208.2}{32} = 6.50625 = 6.5$$

SUBJECTS	CWAM	CGPA
Part – I : Language	61	6.1
Part –II : English	54	5.4
Part III & IV :	65	6.5
Part V :	-	-

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STATISTICAL DISTRIBUTIONS

Unit - I

Distribution functions of one dimensional and two dimensional random variables – applications of Jacobian marginal, conditional distributions - expectation.

Unit - II

Discrete distributions: One-point distribution, Bernoulli, Binomial, Poisson, Recurrence relations for probabilities, Geometric and Negative binomial distributions – Hyper geometric distribution, Multinomial distribution and discrete Uniform distribution- Moments – moment generating function, Characteristic function, Cumulant Generating function. Fitting of Binomial and Poisson distributions.

Unit - III

Continuous distributions: Uniform, Normal, Cauchy and Lognormal distributions- concepts, moments, moment generating and characteristic functions and their properties.

Unit - IV

Exponential, Gamma, Beta (first and second kinds) concepts, moments, moment generating and characteristic functions and their properties.

Unit - V

Sampling distributions: Chi-square, t and F distributions- concepts, moments, moment generating and characteristic functions and their properties.

BOOKS FOR STUDY:
1. Gupta, S. C., and V. K. Kapoor (2000) Fundamentals of Mathematical Statistics, A Modern Approach (Eighth Edition). Sultan Chand & sons. New Delhi.
2. Alexander, M. Mood, Franklin A. Graybill and Duane C. Boes (1974) Introduction to the Theory of Statistics (Third Edition), Mc Graw Hill Comp Ltd. New Delhi.
3. Goon, A. M., M. K. Gupta and B. Dasgupta (2002) Fundamentals of Statistics, Vol. I, World Press Kolkata.
4. Rohatgi, V. K. and A. K. md. Ehsanes Saleh (2009) An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi.
5. Parimal Mukopadhyay (2006) Mathematical Statistics, (Third Edition), Books and Allied Private Limited, Kolkata.
6. Robert, V. Hogg and Allen T. Craig (2012) Introduction to Mathematical Statistics (Fourth Edition), Macmillan Publishing Co., Inc. New York.
7. Harold J. Larson (2004) Introduction to Probability Theory and Statistical Inference (Third Edition), John Wiley & Sons. Inc., New York.
8. Edward J. Dudewicz and Satya N. Mishra (2007). Modern Mathematical Statistics, John Wiley & Sons. Inc., New York.
9. Rice, J.A. (2007) Mathematical Statistics & Data Analysis (Third Edition), Thomas Brooks/Col, Singapore.

MATHEMATICS – II

Unit - I

Theory of Equations: Nature of roots, Formulation of equation whose roots sre given. Relation between coefficients and roots - Transformation of equations - Reciprocal equations - Horner's method of solving equatios.

Unit - II

Successive differentiation – Trignometrical tranformations - Leibnitz's Formulas, nth derivatives of standard functions - simple problems. Partial differentiation – Successive partial differentiation – Implicit functions – homogeneous functions – Euler's theorem.

Unit - III

Maxima and Minima for one variable – Applicationas – Concavity, Convexsity and points of inflexion - Maxima and Minima for two variables – working rule.

Unit – IV

Linear differential equations of second order with constant coefficients - $(aD^2+bD+c)y = X$, various forms of X : $e^{\alpha x}$, cos αx sin αx, x^m. Methods of solving homogenious linear differential equations of second order. Laplace transform and its inverse – solving ordinary differential equation with constant coeficients using Laplce transform.

Unit - V

Integration- Reverse process of differentiation – Methods of integration - Integrals of functions containing linear functions of x - Integrals of functions involving $a^2 \pm x^2$ - Integration of rational algebraic functions - $1/(ax^2+bx+c)$, $(px+q)/(ax^2+bx+c)$. Integration of irrational functions - $1/(ax^2+bx+c)^{1/2}$, $(px+q)/(ax^2+bx+c)^{1/2}$, $(px+q)\sqrt{(ax^2+bx+c)}$ - Integration by parts.

BOOKS FOR STUDY:

1. Narayanan, S. and T.K. Manicavachagom Pillay (2008) Calculus Vol. II and III, S. Viswanathan Pvt. Ltd, Chennai.
2. Narayanan,S., Hanumantha Rao and T.K. Manicavachagom Pillay (2008) Ancillary Mathematics, Volume I, S. Viswanathan Pvt. Ltd, Chennai.

REAL ANALYSIS

Unit - I

Set Theory: Operations on sets, Countability, Real number, Least Upper Bound, Greatest Lower Bound, Set of real numbers, limits, Open and Closed sets.

Unit - II

Sequences: Definition of Sequence, Limit of a sequence, Convergent and Divergent sequences, Bounded and Monotone sequences, Limit Infimum, Limit Supremum, Cauchy sequences, summability of sequences.

Unit - III

Series: Series of real numbers. Convergence and divergence-series with nonnegative terms - comparison test - D'Alembert's ratio test - Cauchy's root test. Alternating series - conditional convergence - absolute convergence - Leibnitz test.

Unit - IV

Differentiation**:** Limit of a function of a single variable, Continuity properties of a continuous function in a closed interval, Derivatives, Rolle's Theorem, Mean value theorem, Taylor's theorem.

Unit - V

Integration: Concept of Riemann Integral, Sufficient condition for Riemann integrability, Darboux theorem, Fundamental theorem, First mean value theorem – Improper Riemann integrals. Beta and Gamma Integrals.

BOOKS FOR STUDY:

1. Arora, S. (1988) Real Analysis. Satya PrakashanMandir, New Delhi.
2. Shanthi Narayan. (2003) Elements of Real Analysis, S. Chand & Co, New Delhi
3. Somasundaram, D. and Choudhary, B. (2002) A First Course in Mathematical Analysis, Narosa, Chennai
4. Rudin,W. (2000) Principles of Mathematical Analysis, McGraw Hill, New York.
5. Malik, S.C. and Arora,S. (2009) Mathematical Analysis, New Age Science, New Delhi.

STATISTICAL ANALYSIS USING SOFTWARE – I

(The following exercise s should be carried out using software)

Unit –I

- Solving a system of equations applying Cramer's rule and Inverse of matrix.
- Fitting of linear and quadratic models.

Unit –II

- Construction of frequency table - univariate, bivariate data.
- Drawing frequency graphs.
- Construction of diagrams: Bar diagrams, Pie diagrams etc.

Unit – III

- Calculation of measures of central tendency - mean, median and mode.
- Calculation of measures of dispersion - quartile deviation, standard deviation, coefficient of variation.

Unit – IV

- Calculation of Karl Pearson's coefficient of correlation.
- Fitting of simple linear regression equation.

Unit - V

- Fitting of binomial distribution.
- Fitting of Poisson distribution.
- Fitting of normal distribution.

DEMOGRAPHIC METHODS

Unit - I

Demography Data: Demography – definition-sources of demographic data - population census - demographic surveys - Registration method: vital registration - population register and other administrative records, registration of population in India.

Unit - II

Fertility: Fertility measurements – crude birth rates - general, specific and total fertility rates - gross and net reproduction rates and their interpretation.

Unit - III

Mortality : Mortality measurements: crude death rate - specific death rate -standardized death rate - infant mortality rate – maternal mortality rate – case fertility rate -comparative mortality index – force of mortality – graduation mortality rates - Makeham's law.

Unit – IV

Life Table and Migration : Description and construction of various columns of a life table and their relationships - construction of an abridged life table – Reid and Pearl method - uses of life table – migration-factors effecting migration - gross and net migration rates.

Unit - V

Population Growth: Population projection – population estimates and projection –arithmetic, geometric and exponential growth rates - logistic curve and its suitability for graduating population data - Basic ideas of stationary and stable population.

BOOKS FOR STUDY:

1. Agarwala, S.N. (1991) Indian Population Problems, Tata Mc Graw Hill Publishing House, New Delhi.
2. Goon, A. M., Gupta. M. K and B. Das Gupta (1993) Fundamentals of Statistics- Vol.II. World press Ltd, Kolkata.
3. Gupta, S.C, and V. K. Kapoor (2007) Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
4. Mishra, D.E. (1982) An introduction to the Study of Population, South India Publishers, Madras.
5. Hansraj, D.R. (1981) Fundamentals of Demography, Surjeet publications, New Delhi
6. Asha A. Bhende and Tara Karitkar (1994) Principles of Population Studies, Himalaya Publishing House Pvt Ltd., Mumbai.

STATISTICAL PRACTICAL - II

(The following exercises should be carried out using non-programmable scientific calculator)

Statistical Distributions

1. Determination of the distribution function of a random variable X.
2. Find the marginal distributions of two random variables X, Y and obtain the conditional probability distribution of $X \mid Y$.
3. Determination of mean and variance using expectation.
4. Fitting of Binomial distribution.
5. Fitting of Poisson distribution.
6. Fitting of Normal distribution.
7. Random number generation (using Remainder, Quotient approach).

Demographic Methods
8. Calculation of crude birth, general, specific and total fertility rates; Gross and net reproduction rates.

9. Calculation of crude death, specific, standardized death rates; infant mortality rates.
10. Construction of life table.

Numerical Methods

11. Solving system of linear equations using Cramer's rule.
12. Solving linear equations using inverse of matrix.
13. Evaluation of degree of polynomials using Newton's forward and backward interpolation method.
14. Determination of roots using Newton Raphson method.
15. Evaluation of partial derivatives applying Euler's method.
16. Evaluation of degree of polynomials using Lagrange's method.
17. Solving a system of linear equations using Gaussian Elimination method.
18. Evaluation of integral applying trapezoidal rule.
19. Evaluation of integral using Simpson's one - third rule.
20. Evaluation of integral using Simpson's three - eighth rule.

MATHEMATICAL COMPUTATIONS USING R

UNIT–I

Introduction - History of R programming - R commands – Random numbers generation – Data Types – Objects – Basic data and Computations – Data input – Data frames – Graphics – Tables.

UNIT–II

Descriptive Statistics - Diagrammatic representation of data - measures of central Tendency - measures of dispersion - measures of skewness and kurtosis.

UNIT–III

Probability and probability distributions - problems on finding basic probabilities - some special discrete distributions – Bernoulli distribution - Binomial distribution – Poisson Distribution – Geometric Distribution.

UNIT–IV

Continuous distributions – Normal distribution – Uniform distribution – Gamma distribution – Exponential distribution - sketching graphs for various distributions.

UNIT–V

Correlation - inference procedure for correlation coefficient - bivariate correlation - multiple correlations - Linear regression and its inference procedure.

BOOKS FOR STUDY:

1. Normal Maltoff (2009) The art of R programming, William Pollock Publishers, San Fransisco
2. Purohit S. G., Gore S. D. and Deshmukh S. K. (2010) Statistics using R, Narosa Narosa

   Publishing House Pvt. Ltd., New Delhi.

3. John Braun, W. and Duncan James Murdoch (2007) First Course in Statistical Programming with R, Cambridge University Press, Uk.
4. Ugarte, M. D., A. F. Militino, A. T. Arnholt (2008) Probability and Statistics with R, CRC Press, Taylo & Francis Group, London.
5. Peter Dalgaard (2008) Introductory Statistics with R, Springer India Private Limited, New

   Delhi.

6. Michael J. Crawley (2007) The R Book, John Wiley and Sons, New York.

MATRIX THEORY

Unit - I

Matrices and System of Linear Equations: Transpose-Conjugate transpose. Adjoint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices. Orthogonal and Unitary matrices. Use of inverse of a matrix to find the solution of a system of linear equations - conditions for consistency of equations.

Unit - II

Rank of a matrix: Elementary transformations, Elementary matrices, Row and Column ranks – rank of a matrix. Invariance of rank through elementary transformations, Reduction to Normal form, Rank of sum and product of matrices, Equivalent matrices.

Unit - III

Characteristic Roots and Vectors: Matrix polynomials, Characteristic roots and vectors, Cayley-Hamilton theorem, Minimal equation of a matrix.

Unit – IV

Matrix Algebra: Introduction – Operations on Matrices – Symmetric and Skew-symmetric Matrices – Conjugate of a Matrix – Determinant of a Matrix – Adjoint and Inverse of a Matrix – Singular and Non-singular Matrices - Inverse of Matrices.

Unit - V

Quadratic Forms: Quadratic Form – Matrix of a quadratic form – rank, signature and classification of quadratic forms – Sylvester's of Inertia.

BOOKS FOR STUDY:

1. Vasishtha,A.R.(2014) Matrices, Krishna Prakashan, Meerut.
2. Shanthi Narayan. and Mittal,P.K. (2000) A Text Book of Matrices, S.Chand& Co, New Delhi

3. Gentle,J.E. (2007) Matrix Algebra Theory, Computations, and Applications in Statistics, Springer, New York.

4. Richard Bronson. (2011) Matrix Operations, Schaum'sOuline Series, McGraw Hill, New York.

5. Searle, S. R. (2006) Matrix Algebra useful for Statistics, Wiley Interscience, New York.

NUMERICAL METHODS

Unit - I

Elimination method, Gauss -Jocobian and Gauss- Seidel methods. Solving system of linear equations using Cramer's rule and inverse of matrix.

Unit - II

Solving algebraic equations: Bisection method, False position method, Newton - Raphson method.

Unit - III

operators and differences: Operators – E, Δ, δ and ∇ , and their relationship and their role in difference tables.

Interpolation: Solving problems for equidistant cases using Newton's Forward and Backward difference formula - Lagrange's formula for unequal intervals.

Unit - IV

Numerical differentiation – Newton's forward and backward formula – maxima and minima using numerical methods.

Unit - V

Numerical Integration: Trapezoidal rule - Simpson's one - third rules and three-eighth rule – Gragry Formula, Newton – Cole's formula.

BOOKS FOR STUDY:

1. Sastry, S. S. (2005) Introductory Methods of Numerical Analysis, Prentice Hall of India.
2. Atkinson, K. (2004) Elementary Numerical Analysis (2nd Edition), John Wiley & sons, New York.
3. Gerald, C. F. and P. O. Wheatley (2003) Applied Numerical Analysis (4th Edition), Addison-Wesley.
4. James B. ScarBorough, (2010) Numerical Mathematical Analysis (6th Edition) Oxford & IBH publishing Co.,
5. Jain, M. K., S. R. K. Iyengar, R.K. Jain (2010) Numerical Methods for Scientific and Engineering Computation (Second Edition), Wiley Eastern Limited, New Delhi.