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**VEER NARMAD SOUTH GUJARAT UNIVERSITY**

University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.

**વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી**

યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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## **-: પરિપત્ર :-**

વિજ્ઞાન વિદ્યાશાખા હેઠળની આંકડાશાસ્ત્ર વિષય ચલાવતી સંલગ્ન સ્નાતક કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૧૯-૨૦ થી અમલમાં આવનાર T.Y.B.Sc.(Statistics) Sem-VI નાં અભ્યાસક્રમ અંગે આંકડાશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા.૦૪/૦૫/૨૦૧૯ ની સભાનાં ઠરાવ ક્રમાંક: ૪ અન્વયે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ મંજૂરીની અપેક્ષાએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલએ તેની તા.૦૭/૬/૨૦૧૯ ની સભાના ઠરાવ ક્રમાંક:૩૨ અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

### **આંકડાશાસ્ત્ર વિષયની અભ્યાસસમિતિની તા.૦૪/૦૫/૨૦૧૯ની સભાનાં ઠરાવ ક્રમાંક: ૪**

:: આથી ઠરાવવામાં આવે છે કે, T.Y.B.Sc.(Statistics) Sem-VI નો અભ્યાસક્રમ શૈક્ષણિક વર્ષ ૨૦૧૯-૨૦ થી અમલ આવે તે રીતે સ્વીકારી મંજૂર કરવામાં આવે છે અને તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

### **એકેડેમિક કાઉન્સિલની તા.૦૭/૦૬/૨૦૧૯ ની સભાનાં ઠરાવ ક્રમાંક: ૩૨**

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૧૯-૨૦ થી અમલમાં આવનાર T.Y.B.Sc.(Statistics) Sem-VI નો અભ્યાસક્રમ સ્વીકારી મંજૂર કરવામાં આવે છે.

બિડાણ: ઉપર મુજબ

ક્રમાંક : એકે./પરિપત્ર/૧૦૩૬૦/૧૯

તા.૨૦-૦૬-૨૦૧૯

ઈ.ચા. કુલસચિવ

પ્રતિ,

- ૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની આંકડાશાસ્ત્ર વિષય ચલાવતી સંલગ્ન સ્નાતક કોલેજોના આચાર્યશ્રીઓ.
- ૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા
- ૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

**Proposed Syllabus of T.Y.B.Sc. (Statistics)**  
(IN FORCE FROM JUNE 2019-2020)

VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURAT  
T.Y.B.Sc.- SEM-VI  
STATISTICS PAPER-601  
MATHEMATICAL STATISTICS-III

- Unit-I
- Concept of sampling distributions.
  - $\chi^2$  distribution, moment generating function, mean, variance measures of skewness and kurtosis of it.
  - t distribution, various measures of it.
  - F distribution, various measures of it.
  - Relation between  $\chi^2$ , t and F distributions.
- Unit-II
- Sampling distribution of sample correlation coefficient from bivariate normal population when population correlation coefficient is zero.
- Unit-III
- Z transformation and its uses.
- Unit-IV
- Correlation and regression
  - Linear and multiple regressions.
  - Partial and multiple correlation for three variables only.

**Books Recommended**

- (1) Anderson T. W.: "An Introduction to Multivariate Statistical Analysis." John Wiley.
- (2) Johnson and Wichern : "Applied multivariate Statistical Analysis".
- (3) Khirsagar A.M. : "Multivariate Analysis"; Marcel Dekker.
- (4) Srivastava and Khatri C.G. : "An introduction to the Multivariate Statistics."; North Holland.
- (5) Gupta S.C. : "Fundamental of Statistics"; 6<sup>th</sup> edition Himalaya Publishing House.
- (6) Mood A.m., Graybill F.A. and Boes D.C. : "An introduction to theory of Statistics." Tata McGraw Hill.
- (7) Goon A.M., Gupta M.K. and Dasgupta B. : "An outline of Statistical theory" vol. 1,2; The world press Private Limited.

વિસ્તૃતરિતિ ૫૨૧૭  
સુરત યુનિવર્સિટી  
૬૦૨૦૧ મહાવિદ્યાલય  
સુરત-૧

Dated

VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURAT  
T.Y.B.Sc-SEM-VI  
STATISTICS PAPER-602  
STATISTICAL INFERENCE-III

- Unit-I ➤ Testing of hypothesis.
- Introduction.
  - Optimum test under different situations.
  - Neyman Pearson lemma.
  - The most powerful test of simple hypothesis against simple alternative.
  - Likelihood ratio test procedure
- Unit-II ➤ Nonparametric tests - I.
- Comparison of parametric test procedure with non parametric test procedure.
  - Advantages and disadvantages of nonparametric methods.
  - One sample nonparametric tests.
    - Kolmogorov – Smirnov test
    - Ordinary sign test
    - Wilcoxon signed – rank test
    - Runs test
- Unit-III ➤ Nonparametric tests – II.
- Two and more samples nonparametric tests.
    - Kolmogorov – Smirnov two-sample test
    - Sign test for paired samples
    - Wilcoxon paired sample signed – rank test
    - Median test.
    - Wald- Wolfowitz runs test
    - Mann-Whitney U- test
    - Kruskal- Wallis one way analysis.
    - Friedman’s method of two way analysis.
    - Mood’s test.

**Books recommended**

- (1) Mood A.M. , Graybill F.A. & Boes D.C. (2001) : “An introduction to theory of Statistics”, McGraw Hill & Tata McGraw Hill, ISBN-13:9780070445208, 9780070445208.

VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURAT  
T.Y.B.Sc. - SEM-VI  
STATISTICS PAPER-603  
OPERATIONS RESEARCH-II

- Unit-I
- Two-Phase Simplex method.
    - Solution of LPP using Two-Phase Simplex method.
    - Examples.
  - Duality in LPP.
    - The non symmetric & symmetric dual problems.
    - Relation between primal & dual problems.
    - Examples.
- Unit-II
- Transportation problems (TP).
    - Introduction.
    - Mathematical formulation of the problem.
    - Methods of finding initial basic feasible solution.
      - The North-West Corner Rule.
      - The Raw Minima Method.
      - The Column Minima Method.
      - The Matrix Minima Method.
      - Vogel's Approximation Method (VAM).
    - Optimum solution of TP.
    - Unbalanced TP.
    - Examples.
- Unit-III
- Assignment problems.
    - Introduction.
    - Mathematical formulation of the problem.
    - The Hungarian methods.
    - Unbalanced assignment problems.
    - Examples.
- Unit-IV
- Inventory models.
    - Basic definition of inventory problems.
    - Various costs associated with inventory problems.
    - Inventory models with finite rate of replenishment with & without shortages.

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- (2) Goon A.M., Gupta M.K. & Dasgupta B. (2000): "An outline of Statistical theory".Vol.1,2. The World press private Ltd, ISBN:8187567260, ISBN:13 9788187567264,9788187567264
- (3) Lehman, E.L.(1986): "Testing statistical hypothesis", John wiley & sons, New York.
- (4) Lehman, E.L. & Joseph P. Romano(2005) :“Testing statistical hypothesis” 3<sup>rd</sup> edition, Springer , ISBN 0-387-98864-5
- (5) Gibbons J.D. & Pratt J. W. (1981): “ Concepts of non parametric theory” Springer- Verlag ISBN:0387905820,ISBN-13: 9780387905822, 978-0387905822
- (6) Mukhopadhyay,P.(1996): “Mathematical Statistics” ; New central Book Agency, Calcutta.
- (7) Rao. C. R. (2001): “Linear Statistical inference & its application”; 2<sup>nd</sup> edition,Wiley inter science, ISBN-10:0471218758, ISBN-13:978-0471218753.
- (8) Daniel W.W. (1990): “Applied non parametric statistics”, PWS-KENT publishing Co, Boston.
- (9) Daniel W.W. (1989): “ Applied non parametric statistics”; 2<sup>nd</sup> edition; Wadsworth publishing company, Belmont, California, U.S.A., ISBN-10;0534919766,ISBN-13;978-0534919764
- (10) Gibbons J.D.,Subhabrata Chakraborti (2003): “ Nonparametric Statistical Inference”;4<sup>th</sup> Revised Edition, CRC Press (Taylor & Francis Ltd), ISBN: 9780824740528,ISBN -10 0824740521.

*J. D. Gibbons*

VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURAT  
T.Y.B.Sc.- SEM-VI  
STATISTICS PAPER-604  
OPERATIONS RESEARCH-III

- Unit-I      ➤ Game theory.
- Introduction.
  - Competitive games.
  - Two person zero sum games.
  - The Minimax & Maximin principle.
  - Fundamental theorem of game theory.
  - Saddle points.
  - Value of game with/ without saddle point.
  - Dominance Property.
  - Solution of  $m \times 2$  and  $2 \times n$  games using graphical method.
  - Algebraic methods of solving games.
  - Examples.
- Unit-II      ➤ Queueing theory.
- Introduction.
  - Classification of queues.
  - Poisson process & exponential distribution.
  - Transient & steady states.
  - Poisson queues with single service channel.
  - Finite & infinite capacity & its characteristics.
- Unit-III    ➤ Network Scheduling by PERT and CPM.
- Network diagram.
    - Network diagram representation.
    - Rules of Construction of Network diagram.
    - Time estimates & critical path in Network analysis.
    - Disadvantages of Network techniques.
  - Critical Path Method (CPM)
    - Procedure.
    - Examples.
  - Programme Evaluation & Review Technique (PERT).
    - Procedure.
    - Examples.

**Books recommended**

- (1) K.swarup, Gupta P.K. & Man Mohan (2008): "Operation Research",  
S.Chand & Co. New Delhi, ISBN: 8180545350, ISBN-13:  
9788180545351

### Books recommended

- (1) K.swarup,GuptaP.K.& Man Mohan(2008): "Operation Research", S.Chand & Co. New Delhi, ISBN: 8180545350, ISBN-13; 9788180545351
- (2) G. Hadley (2002): "Linear programming" ; Narosa Book distributors pvt Ltd., ISBN; 8185015910,ISBN-13; 9788185015910
- (3) Kasana H. S. & Kumar K.D. (2005) : "Introductory operation research Theory & Application", Springer Verlag, ISBN;8181282827,9798181282827.
- (4) Kapoor V.K. (2006) : "Operation research", 7<sup>th</sup> edition , jain book depot , ISBN:8170148286
- (5) Sharma S. D. (2005) : "Operation research";15<sup>th</sup> edition , Kedarnath Ramnath & Co. Publisher, Meerut
- (6) Hira D.S, Gupta,P.K.(2007) : " Operation research"; S.Chand & Co. New Delhi, ISBN: 81-219-0281-9

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VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURAT  
T.Y.B.Sc. - SEM-VI  
STATISTICS PAPER - 605  
DESIGN OF EXPERIMENTS

- Unit-I
- Properties of randomization.
  - Replication & local control.
  - Analysis of variance with fixed effect model & random effect model.
- Unit-II
- Completely randomized design.
  - Randomized block design.
  - Latin square design.
- Unit-III
- Analysis of covariance up to two way classification.
  - Factorial experiments involving three factors at two levels only.

**Books recommended**

- (1) Cochran & Cox (1957): "Experimental design" 2<sup>nd</sup> edition , John Wiley & Sons Inc, New York,ISBN:0471162035.
- (2) S.M.Shah: "Sampling technique & Experimental Designs" (Gujarati)
- (3) Das, M.N. & Giri N.C. (1999) : "Design and Analysis of Experiments" 2<sup>nd</sup> Edition, New Age International Publishers Ltd,ISBN;0852269145, ISBN-13:9780852269145.
- (4) Cochran & Cox (2003): "Experimental design" 2<sup>nd</sup> edition, John Wiley & Sons Inc, New York, ISBN: 9971513110. ISBN: 9789971513110ISBN-13:9789971513115.
- (5) Montgomery, D.C. (2006) : "Design and analysis of experiments"; 5<sup>th</sup> edition Wiley (India) ISBN-13: 9788126510481.

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- (2) G. Hadley (2002): "Linear programming" ; Narosa Book distributors pvt Ltd., ISBN; 8185015910,ISBN-13; 9788185015910
- (3) Kasana H. S.& Kumar K.D. (2005) : "Introductory operation research Theory & Application" Springer Verlag, ISBN;8181282827,9798181282827.
- (4) Kapoor V.K. (2006) : "Operation research", 7<sup>th</sup> edition , jain book depot , ISBN:8170148286
- (5) Sharma S. D. (2005) : "Operation research";15<sup>th</sup> edition , Kedarnath Ramnath & Co. Publisher, Meerut
- (6) Hira D.S, Gupta,P.K.(2007) : " Operation research"; S.Chand & Co. New Delhi, ISBN: 81-219-0281-9

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VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURA  
T.Y.B.Sc.- SEM-VI  
STATISTICS PAPER-606  
STATISTICAL QUALITY CONTROL

Unit-I **Statistical Techniques in quality control-I:**

- Introduction of Statistical Quality Control (SQC), Importance of Statistical methods in industrial research, Objectives and Advantages of SQC, Causes of variations, Types of Quality control, Control charts, Advantages of the use of a control chart,  $3\sigma$  limits, Theory of runs,
- Control chart for variables: (i) RChart (ii)  $\sigma$  Chart and (iii)  $\bar{X}$  Chart,
- Behavior of  $\bar{X}$  chart in relation to R chart, R chart versus  $\sigma$  chart,

Unit-II **Statistical Techniques in quality control-II:**

- Control chart for attributes: (i) pChart (ii) np Chart and (iii) c Chart and its uses, (iv) u chart
- Difference between variable charts and attribute charts.

Unit-III **Acceptance sampling plan for attributes:**

- Introduction,
- Principle of accepting sampling,
- Sampling risks and indices,
- Role of Acceptance sampling,
- Producer's risk and Consumer's risk,
- Acceptable Quality Level (AQL) and AOQL
- Lot Tolerance Proportion Defective (LTPD),
- Construction of Operating Characteristic Curve, Ideal Operating Characteristics Curve,
- Effect of lot size, sample size on Operating Characteristic Curve
- Single Sampling Plan:
  - Explain
  - Operating Characteristics Curve (OC Curve)
  - Average Sample Number (ASN)
  - Rectifying inspection procedure
  - Average Outgoing Quality (AOQ)
  - Average Total Inspection (ATI)
  - Numerical examples

- Double Sampling Plan:
  - Explain
  - Operating Characteristics Curve (OC Curve)
  - Average Sample Number (ASN)
  - Rectifying inspection procedure
  - Average Outgoing Quality (AOQ)
  - Average Total Inspection (ATI)
  - Numerical examples
- Comparison between single Sampling Plan and Double Sampling Plan

**REFERENCES:**

- Montgomery, D.C. (2001): Introduction to Statistical Quality Control, Wiley.
- Grant, E.L. (2000) : Statistical Quality Control, 7th Ed., Tata Mcgraw Hill.
- Ott, E.R. (1975) : Process Quality Control, McGraw Hill.
- Wetherill, G.B. (1977) : Sampling Inspection and Quality Control, Halsted Press.
- Wetherill, G.B. and Brown, D.W. : Statistical Process Control, Theory and Practice, - Chapman and Hall,

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**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

[Effective from June – 2019-20]

**T.Y. B.Sc. Semester – VI**

**STATISTICS PRACTICAL PAPER – 601 : Based on Theory paper 601**  
**STATISTICS PRACTICAL PAPER – 602 : Based on Theory paper 602**  
**STATISTICS PRACTICAL PAPER – 603 : Based on Theory paper 603**  
**STATISTICS PRACTICAL PAPER – 604 : Based on Theory paper 604**  
**STATISTICS PRACTICAL PAPER – 605 : Based on Theory paper 605**  
**STATISTICS PRACTICAL PAPER – 606 : Based on Theory paper 606**

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## Proposed Syllabus of T.Y.B.Sc. (Statistics)

(IN FORCE FROM JUNE 2019-2020)

VEER NARMAD SOUTH GUJRAT UNIVERSITY, SURAT

T.Y.B.Sc. - SEM-VI- STATISTICS

(GENERIC ELECTIVE) – ECONOMIC STATISTICS & DEMOGRAPHY

### Unit-1 Demand Analysis:

- Demand & Supply function, market equilibrium, elasticity of demand and supply.
- Methods for determining demand and supply curves for cross section data and time series data.
- Leontief's Method, Pigu's method, Engel's curve, Pareto's law of income distribution.
- Effect of taxation and subsidy on market equilibrium.

### Unit-2: **Utility function & Demography:**

- Constrained Utility Maximization
- Indifference curves
- Derivation of demand curves using indifference curves.
- Meaning and scope of demography.
- Measures of population growth, mortality rates, National and parinatal mortality rates, standardized age specific death rates with numerical examples.

### Unit-3: **Life tables:**

- Different methods of construction of life tables.
- Abridged life tables.
- Population projection methods of projection.
- Study of simple models for population projection.
- Producer's risk and Consumer's risk,
- Fertility and reproduction rates.

### Unit-4

- Matrices:
- Definition of  $m \times n$  matrix.
- Transpose, symmetric, skew symmetric, null matrix, identity , orthogonal matrix
- Addition, subtraction, scalar multiplication & multiplication of matrices.
- Singular and non singular matrix.
- Inverse of matrix (for 3 variables)
- Solution of non-homogenous linear equations using inverse of matrix.

### Books Recommended

- (1) Croxton E.F., Cowden D.J. and Klein S. (1967): "Applied General Statistics"; III-Ed Prentice-Hall (Englewood Cliffs, N.J).
- (2) Karmel P.H. (1963): "Applied Statistics for Economics"; 2nd ed., Pitman (Melbourne)
- (3) Gupta S.C. and Kapoor V.K.(2006) : " Fundamentals of Applied Statistics"; Sultan Chand & Sons, **ISBN: 8170141516, ISBN-13: 9788170141518**
- (4) M.C.Jayswal (1974):Arth Vishayaka Ankdashastra, Univ. Granth Nirman Board, Ahmedabad.
- (5) Thomas S. shores(2007) : "Applied Linear Algebra And Matrix Analysis", Springer Verlag  
Publication,ISBN:10:0387331956,ISBN-13:9780387331959
- (6) Shantinarayan: "Text book of matrices"
- (7) Pathak K.B. & F.Ram (1998): " Technique of Demographic Analysis";2<sup>nd</sup> Edition, Himalaya Publishing House ISBN: 81-7493-472-3

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