ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION
REVISED UG SYLLABUS UNDER CBCS
(Implemented from Academic Year 2020-21)
PROGRAMME: THREE YEAR B.Sc.,

Domain Subject**: STATISTICS**

Skill Enhancement Courses (SECs) for Semester V, from 2022-23
(Syllabus-Curriculum)

Structure of SECs for Semester – V

(To choose One pair from the Four alternate pairs of SECs)

Univ. Code	Courses 6 & 7	Name of Course	Th. Hrs. / Week	IE Mar-ks	EE Mar-ks	Credits	Prac. Hrs./ Wk	Mar-ks	Credits
	6A	OPERATIONS RESEARCH - I	**3**	**25**	**75**	**3**	**3**	**50**	**2**
	7A	OPERATIONS RESEARCH - II	**3**	**25**	**75**	**3**	**3**	**50**	**2**
OR									
	6B	Statistical Process and Quality Control	**3**	**25**	**75**	**3**	**3**	**50**	**2**
	7B	Computational Techniques and R Programming	**3**	**25**	**75**	**3**	**3**	**50**	**2**
OR									
	6C	Econometrics	**3**	**25**	**75**	**3**	**3**	**50**	**2**
	7C	Regression Analysis	**3**	**25**	**75**	**3**	**3**	**50**	**2**

Note-1: For Semester–V, for the domain subject Botany, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C . The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note-2: *One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.*

A.P. State Council of Higher Education
Semester – wise Revised Syllabus under CBCS, 2020-21

Course Code:

Three-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 6A: **OPERATIONS RESEARCH - I**
(Skill Enhancement Course(Elective), 05 Credits
Max. Marks: Theory :100 + Practicals: 50

Objective: The Objective of the paper is to introduce the basic concepts of Operational Research and linear programming to the students.

I Learning Outcomes:

After learning this course, the student will be able

1. To know the scope of Operations Research
2. To link the OR techniques with business environment and life sciences
3. To convert real life problems into mathematical models
4. To find a solution to the problem in different cases
5. To inculcate logical thinking to find a solution to the problem

II SYLLABUS

UNIT-I

Introduction of OR – Origin and development of OR – Nature and features of OR –Scientific Method in OR – Modeling in OR – Advantages and limitations of Models-General Solution methods of OR models – Applications of Operation Research. Linear programming problem (LPP) - Mathematical formulation of the problem - illustrations on Mathematical formulation of Linear programming of problem. Graphical solution of linear programming problems. Some exceptional cases - Alternative solutions, Unbounded solutions, non-existing feasible solutions by Graphical method.

UNIT-II

General linear programming Problem (GLP) – Definition and Matrix form of GLP problem, Slack variable, Surplus variable, unrestricted Variable, Standard form of LPP and Canonical form of LPP. Definitions of Solution, Basic Solution, Degenerate Solution, Basic feasible Solution and Optimum Basic Feasible Solution. Introduction to Simplex method and Computational procedure of simplex algorithm. Solving LPP by Simplex method (Maximization case and Minimization case)

UNIT-III

Artificial variable technique - Big-M method and Two-phase simplex method, Degeneracy in LPP and method to resolve degeneracy. Alternative solution, Unbounded solution, Non existing feasible solution and Solution of simultaneous equations by Simplex method.

UNIT-IV

Duality in Linear Programming –Concept of duality - Definition of Primal and Dual Problems, General rules for converting any primal into its Dual, Economic interpretation of duality, Relation between the solution of Primal and Dual problem (statements only). Using duality to solve primal problem. Dual Simplex Method.

UNIT-V

Post Optimal Analysis - Changes in cost Vector **C** , Changes in the Requirement Vector **b** and changes in the Coefficient Matrix **A**. Structural Changes in a LPP.

III Practical/Lab to be performed on a computer using OR/Statistical packages

1. To solve Linear Programming Problem using Graphical Method with
   (i) Unbounded solution
   (ii) Infeasible solution
   (iii) Alternative or multiple solutions.
2. Solution of LPP with simplex method.
3. Problem solving using Charnes-M method.
4. Problem solving using Two Phase method.
5. Illustration of following special cases in LPP using Simplex method
   (i) Unrestricted variables
   (ii) Unbounded solution
   (iii) Infeasible solution
   (iv) Alternative or multiple solutions.
6. Problems based on Principle of Duality.
7. Problems based on Dual simplex method.
8. Problems based on Post Optimal Analysis.

1V Practicals Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Solve LPP using Graphical method
2. Solve the LPP using Simplex method, Big M method and Two Phase method
3. Solve the problems using principle of duality
4. Solve the Problems using Dual Simplex method
5. Solve the problems for Post Optimal Analysis

V Reference Books:

1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co, Meerut.
2. Kanti Swarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi.

3. J.K. Sharma, Operations Research and Application, Mc.Millan and Company, New Delhi.
4. Gass S.I : Linear Programming. Mc Graw Hill.
5. Hadly G : Linear programming. Addison-Wesley.
6. Taha H.M: Operations Research: An Introduction : Mac Millan.

VI : Co-Curricular Activities:

a) Mandatory:

1.For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevantoutside data (Field/Web).

1.To Solve the LPP using Graphical method

2.To Solve the LPP using Simplex method, Big M method and Two Phase Methods

3. To solve the LPP using Dual Simplex method

2.For Student: Fieldwork; Each student individually shall undertake field work and submit a reportnot exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

5.Collecting the data and to perform OR techniques-Simplex method

(or)

6.Collecting the data and and to conduct post optimal analysis

3.Max. marks for Field Work Report: 05.

4.Suggested Format for Field work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5.Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to any specified areas for doing survey and data collection
3. Invited lectures and presentations on related topics by experts in the specified area.

VII Suggested Question Paper Pattern:

Max. Marks: 75 **Time: 3 hrs**

SECTION A (Total: 10 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION B (Total: 5 X 5=25 Marks)

(Answer any **five questions**. Each answer carries **5 Marks)(At least 1 question should be given from each Unit)**

1.	
2.	
3.	
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8.	

SECTION C (Total: 5 X 8 = 40 Marks)

(Answer ALL the questions. Each question carries 8 Marks)

1.	(a) or (b)
2.	(a) or (b)
3.	(a) or (b)
4.	(a) or (b)
5.	(a) or (b)

A.P. State Council of Higher Education
Semester – wise Revised Syllabus under CBCS, 2020-21

Course Code:

Three-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 7A: **OPERATIONS RESEARCH - II**
(Skill Enhancement Course (Elective), 05 Credits
Max.Marks: Theory :100 + Practicals: 50

Objective: To enrich the knowledge of students with advanced techniques of linear programming problem along with real life applications.

I Learning Outcomes:

After learning this course, the student will be able

1. To solve the problems in logistics
2. To find a solution for the problems having space constraints
3. To minimize the total elapsed time in an industry by efficient allocation of jobs to the suitable persons.
4. To find a solution for an adequate usage of human resources
5. To find the most plausible solutions in industries and agriculture when a random environment exists.

II SYLLABUS

UNIT -I

Transportation Problem - Introduction, Mathematical formulation of Transportation problem. Initial Basic feasible solution of Transportation problem - North-West corner rule, Lowest cost entry method, Vogel's approximation method. Method of finding optimal solution-MODI method(U-V method). Degeneracy in transportation problem, Resolution of degeneracy, Unbalanced transportation problem. Maximization TP. Transhipment Problem.

UNIT-II

Assignment Problem - Introduction, Mathematical formulation of Assignment problem, Reduction theorem (statement only), Hungarian Method for solving Assignment problem, Unbalanced Assignment problem. The Traveling salesman problem, Formulation of Traveling salesman problem as an Assignment problem and Solution procedure.

UNIT-III

Sequencing problem: Introduction and assumptions of sequencing problem, Sequencing of n jobs and one machine problem. Johnson's algorithm for n jobs and two machines problem- problems with n-jobs on two machines, algorithm for n jobs on three machines problem- problems with n-jobs on three machines, algorithm for n jobs on m machines problem, problems with n-jobs on m-machines.

UNIT-IV

Network Scheduling: Basic Components of a network, nodes and arcs, events and activities– Rules of Network construction – Time calculations in networks - Critical Path Method (CPM) and PERT.

UNIT –V

Game Theory: Two- person zero-sum games. Pure and Mixed strategies. Maxmin and Minimax Principles - Saddle point and its existence. Games without Saddle point-Mixed strategies. Solution of 2 x 2 rectangular games. Graphical method of solving 2 x n and m x 2 games. Dominance Property.

III Practical/Lab to be performed on a computer using OR/Statistical packages

1. IBFS of transportation problem by using North- West corner rule, Matrix minimum method and VAM
2. Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases)
3. Solution of Assignment problem using Hungarian method (both maximization and minimization cases),
4. Solution of sequencing problem—processing of n jobs through two machines
5. Solution of sequencing problem - processing of n jobs through three machines
6. To perform Project scheduling of a given project (Deterministic case-CPM).
7. To perform Project scheduling of a given project (Probabilistic case-PERT).
8. Graphical method of solving for m x 2 and 2 x n games.
9. Solution of m x n games by dominance rule.
10. Linear programming method for solving m x n games.

1V Practicals Skills Outcomes:

On successful completion of this practical course, student shall be able to:

6. Find IBFS by using North- West corner rule, Matrix minimum method and VAM
7. Find Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases)

8. Find Solution of Assignment problem using Hungarian method (both maximization and minimization cases),
9. Find Solution of sequencing problem—processing of n jobs through two machines and three machines
10. perform Project scheduling of a given project (Deterministic case-CPM) and (Probabilistic case-PERT).
11. Solve for m x 2 and 2 x n games using Graphical method
12. Find Solution of m x n games by dominance rule.
13. Solve m x n games by Linear programming method

V Reference Books:

1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co, Meerut.
2. Kanti Swarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi.
3. J.K. Sharma, Operations Research and Application, Mc.Millan and Company, New Delhi.
4. Gass: Linear Programming. Mc Graw Hill.
5. Hadly : Linrar programming. Addison-Wesley.
6. Taha : Operations Research: An Introduction : Mac Millan.
7. Dr.NVS Raju; Operations Research, SMS education,

VI : Co-Curricular Activities:

c) Mandatory:

1.For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevantoutside data (Field/Web).

1.To find IBFS by using North- West corner rule, Matrix minimum method and VAM for the given Transportation Problem

2.To Find Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases)

3. To find the Assignment of n jobs to n persons using Hungarian method

4.To find processing of n jobs through two machines and three machines using Sequencing Problem

5.To solve network problems using PERT and CPM techniques

6.To Solve for m x 2 and 2 x n games using Graphical method

7.To Find Solution of m x n games by dominance rule.

8.Solve m x n games by Linear programming method

2.For Student: Fieldwork; Each student individually shall undertake field work and submit a reportnot exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

5.Collecting the data and to perform OR techniques

(or)

6.Visiting Transportation places and Companies

3.Max. marks for Field Work Report: 05.

4.Suggested Format for Field work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5.Unit tests (IE).

d) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to any specified areas for doing survey and data collection
3. Invited lectures and presentations on related topics by experts in the specified area.

VII Suggested Question Paper Pattern:

Max. Marks: 75 **Time: 3 hrs**

SECTION A (Total: 10 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION B (Total: 5 X 5=25 Marks)

(Answer any **five questions**. Each answer carries **5 Marks)**

(At least 1 question should be given from each Unit)

1.	
2.	
3.	
4.	
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6.	
7.	
8.	

SECTION C (Total: 5 X 8 = 40 Marks)

(Answer ALL the questions. Each question carries 8 Marks)

1.	(a) or (b)
2.	(a) or (b)
3.	(a) or (b)
4.	(a) or (b)
5.	(a) or (b)

A.P. State Council of Higher Education
Semester – wise Revised Syllabus under CBCS, 2020-21

Course Code:

Three-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 6B: **Statistical Process and Quality Control**
(Skill Enhancement Course(Elective), 05 Credits
Max.Marks: Theory :100 + Practicals: 50

Course Objectives: To understand the concept of quality, process control and product control using control chart techniques and sampling inspection plan. To have an idea about quality management, quality circles, quality movement and standardizations for quality.

I Learning Outcomes:
After learning this course, the student will be able

1. To define 'quality' in a scientific way
2. To differentiate between process control and product control
3. To speak about quality awareness in industry
4. To pave a path to an industry to meet the standards
5. To effectively implement various plans to control the quality standards at various stages of an industry.

II SYLLABUS

Unit I

Meaning of quality, concept of total quality management (TQM) and six-sigma, ISO, comparison between TQM and Six Sigma, Meaning and purpose of Statistical Quality Control (SQC), Seven Process Control Tools of Statistical Quality Control (SQC) (i) Histogram (ii) Check Sheet, (iii) Pareto Diagram (iv) Cause and effect diagram(CED), (v) Defect concentration diagram (vi) Scatter Diagram (vii) Control chart. (Only introduction of 7 tools is expected).

Unit II

Statistical basis of Shewhart control charts, use of control charts. Interpretation of control charts, Control limits, Natural tolerance limits and specification limits. Chance causes and assignable causes of variation, justification for the use of 3-sigma limits for normal distribution, Criteria for detecting lack of control situations:

(i) At least one point outside the control limits

(ii) A run of seven or more points above or below central line.

Unit III

Control charts for Variables: Introduction and Construction of $\underline{X}$ and R chart and Standard Deviation Chart when standards are specified and unspecified, corrective action if the process is out of statistical control.

Control charts for Attributes: Introduction and Construction of p chart, np chart, C Chart and U charts when standards are specified and unspecified, corrective action if the process is out of statistical control.

Unit IV

Acceptance Sampling for Attributes: Introduction, Concept of sampling inspection plan, Comparison between 100% inspection and sampling inspection. Procedures of acceptance sampling with rectification, Single sampling plan and double sampling plan.

Producer's risk and Consumer's risk, Operating characteristic (OC) curve, Acceptable Quality Level (AQL), Lot Tolerance Fraction Defective (LTFD) and Lot Tolerance Percent Defective (LTPD), Average Outgoing Quality (AOQ) and Average Outgoing Quality Limit (AOQL), AOQ curve, Average Sample Number (ASN), Average Total Inspection (ATI).

Unit V

Single Sampling Plan: Computation of probability of acceptance using Binomial and Poisson approximation, of AOQ and ATI. Graphical determination of AOQL, Determination of a single sampling plan by: a) lot quality approach b) average quality approach.

Double Sampling Plan: Evaluation of probability of acceptance using Poisson distribution, Structure of OC Curve, Derivation of AOQ, ASN and ATI (with complete inspection of second sample), Graphical determination of AOQL, Comparison of single sampling plan and double sample plan.

III Practical/Lab to be performed on a computer using Statistical packages

1. Construction of $\underline{X}$ and R Charts.
2. Construction of $\underline{X}$ and σ Charts.
3. Construction of p Charts for fixed sample size.

4. Construction of p Charts for variable sample size.
5. Construction of np Charts.
6. Construction of C charts.
7. Construction of U charts.
8. Single sampling plan for attributes (OC Curve, Producer's and Consumer's risks, AOQ, AOQL, ATI).
9. Determination of single sampling plan by: a) lot quality approach b) average quality approach.
10. Double sampling plan for attributes (OC curve, AOQ, AOQL, ATI, ASN using Poisson distribution).

1V Practicals Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Construct Control Charts for Variables (X bar , R and σ) charts using R.
2. Construct Control Charts for Attibutes (p, np,c and u charts with fixed and varying sample sizes)
3. Draw (OC Curve, Producer's and Consumer's risks, AOQ, AOQL, ATI).for Single sampling plan for attributes
4. Determination of single sampling plan by: a) lot quality approach b) average quality approach.
5. Draw (OC curve, AOQ, AOQL, ATI, ASN using Poisson distribution). For Double Sampling Plan for attributes
6. Determine single sampling plan by: a) lot quality approach b) average quality approach.

V Text Books:

1. **Montgomery, D. C. (2008)**: Statistical Quality Control, 6thEdn., John Wiley, New York.
2. **Parimal Mukhopadhyay:** Applied Statistics, New Central Book Agency.
3. **Goon A.M., Gupta M.K. and Das Gupta B. (1986):** Fundamentals of Statistics, Vol. II, World Press, Calcutta.
4. **S.C. Gupta and V.K. Kapoor:** Fundamentals of Applied Statistics – Chand publications.

References:

1. **R.C. Gupta:** Statistical Quality Control.
2. **Duncan A.J. (1974):** Quality Control and Industrial Statistics, fourth edition D.B. Taraporewala Sons and Co. Pvt. Ltd., Mumbai.
3. **Grant, E. L. and Leavenworth (1980):** Statistical Quality Control, fifth edition, Mc-Graw Hill, New Delhi.

VI : Co-Curricular Activities:

a) Mandatory:

1.For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevantoutside data (Field/Web).

1. Construct Control Charts for Variables (X bar , R and σ) charts for the data

2. Construct Control Charts for Attibutes (p, np,c and u charts with fixed and varying sample sizes) for the data
3. Draw (OC Curve, Producer's and Consumer's risks, AOQ, AOQL, ATI).for Single sampling plan for attributes
4. Determination of Single sampling Plan and Double Sampling plan for the data

2.For Student: Fieldwork; Each student individually shall undertake field work and submit a reportnot exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

6. Collecting the data and construct Control charts for Variables and Control charts for Attributes

(or)

7.Collecting the data and construct OC curve, producers risk, consumers risk, AOQ, AOQL and ATI for single and Double sampling Plans

3.Max. marks for Field Work Report: 05.

4.Suggested Format for Field work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5.Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to any specified areas for doing survey and data collection
3. Invited lectures and presentations on related topics by experts in the specified area.

VII Suggested Question Paper Pattern:

Max. Marks: 75 **Time: 3 hrs**

SECTION A (Total: 10 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION B (Total: 5 X 5=25 Marks)

(Answer any **five questions**. Each answer carries **5 Marks)**

(At least 1 question should be given from each Unit)

1.	
2.	
3.	
4.	
5.	
6.	
7.	

SECTION C (Total: 5 X 8 = 40 Marks)

(Answer ALL the questions. Each question carries 8 Marks)

1.	(a) or (b)
2.	(a) or (b)
3.	(a) or (b)
4.	(a) or (b)
5.	(a) or (b)

A.P. State Council of Higher Education
Semester – wise Revised Syllabus under CBCS, 2020-21

Course Code:

Three-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 7B: **Computational Techniques and R Programming**
(Skill Enhancement Course(Elective), 05 Credits
Max.Marks: Theory :100 + Practicals: 50

Course Objectives: To learn the statistical analysis with the help of the statistical software R

I Learning Outcomes:

After learning this course the student will be able

1. Know about basics of computer
2. Know about Organization of digital computers
3. Know about Computer Programming and flow charts
4. Know and study about R Programming
5. Know about the usage of R in Descriptive Statistics

II SYLLABUS

Unit I

Computer basics: Introduction and brief history of evolution of computers, Classification of computers: special purpose and general purpose; analog, digital and hybrid; Super, main-frame etc.

Unit II

Organization of general purpose digital computers: CPU, main memory and peripherals. Mass storage devices and other I/O devices. Computer languages: Machine code language (machine language), assembly language and high level languages. Software: Operating systems, linker, loader, compiler, interpreter and assembler.

Unit III

Computer programming: Algorithm and flow-chart. Storage of information: concepts of records and files. File organization: sequential, relative and indexed.

Unit IV

Programming with R: Introduction to R, Data types in R (numeric, logical, character, complex etc.), R objects: vector, matrix, array, list, data frame, factor, and time series. Arithmetic, logical and relational operators, explicit and implicit looping, functions and functional programming in R, Lexical scoping rules in R, benefits of Lexical scoping, other scoping rules, debugging facility in R. Few important mathematical, statistical and graphical functions in R.

Unit V

Descriptive Statistics with R software: : Calculations with R software such as descriptive statistics, frequency distribution, Graphics and plots, statistical functions of central tendency, variation, skewness and kurtosis and illustration with examples.

III Practical/Lab to be performed on a computer using R Software

1. Data visualization using R - frequency polygon, Ogives, Histogram.
2. Data visualization using R - simple and multiple bar diagram, pie chart.
3. Computation of Descriptive Statistics using R - Central Tendencies, Dispersions, Moments, Skewness and Kurtosis.
4. Computation of Karl Pearson's Coefficient of Correlation and Rank Correlation using R.
5. Construction of Control Charts for variables (X bar , R and σ) charts using R.
6. Construction of Control Charts for attributes (p, np charts with fixed and varying sample sizes) using R.
7. Construction of Control Charts using R - C and U charts.

1V Practicals Skills Outcomes:

On successful completion of this practical course, student shall be able to:

5. Draw frequency polygon, ogives, Histogram, Simple and multiple bar diagrams and Pie chart using R
6. Compute Descriptive statistics using R
7. Compute Coefficient of Correlation and Rank Correlation usimg R
8. Construct Control Charts for Variables (X bar , R and σ) charts using R.
9. Construct Control Charts for Attibutes (p, np charts with fixed and varying sample sizes) using R.
10. Construction of Control Charts using R - C and U charts.

V Reference Books

1. Chambers, J. (2008). Software for Data Analysis: Programming with R, Springer.
2. Crawley, M.J. (2017). The R Book, John Wiley & Sons.
3. Eckhouse, R.H. and Morris, L.R. (1975). Minicomputer Systems Organization, Programming and Applications, Prentice-Hall.
4. Matloff, N. (2011). The Art of R Programming, No Starch Press, Inc.
5. Peter N. (1986). Inside the IBM PC, Prentice-Hall Press.
6. Dr. Mark Gardener(2012): Beginning R The statistical Programming Languages, John Wiley & Sons.
7. Sudha G. Purohit, SharadD.Gore, and ShailajaR.Deshmukh (2008), Statistics Using R, Narosa Publishing House, India.
8. Crawley, M.J. (2006). Statistics – An introduction using R. John Wiley London.
9. Purohit, S.G., Deshmukh, S.R. and Gore, S.D., (2015): Statistics using R, Alpha Science International.
10. Verzani, J., (2018): Using R for introductory statistics. CRC press.
11. Schumacker, R.E., (2014): Learning statistics using R. Sage Publications.
12. Michale J. Crawley (2009), THE R BOOK, John Wiley & Sons.

VI : Co-Curricular Activities:

c) Mandatory:

1.For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevantoutside data (Field/Web).

1.To draw Frequency Polygon, Histogram, Ogives, bar diagrams and pie charts using R for the collected data

2.To calculate Descriptive Statistics using R for the data

3. To calculate Correlation coefficient and rank correlation coefficient using R for the collected data

4. To Construct Control charts for Variables and Attributes using R for the data

2.For Student: Fieldwork; Each student individually shall undertake field work and submit a reportnot exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

6.Collecting the data and construct charts-Histogram, bar diagrams and pie chart, and to calculate Descriptive statistics, Correlation, Rank correlation for the collected data usng R

(or)

7.Collecting the data and construct Control charts for Variables and Control charts for Attributes using R

3.Max. marks for Field Work Report: 05.

4.Suggested Format for Field work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5.Unit tests (IE).

d) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to any specified areas for doing survey and data collection
3. Invited lectures and presentations on related topics by experts in the specified area.

VII Suggested Question Paper Pattern:

Max. Marks: 75 **Time: 3 hrs**

SECTION A (Total: 10 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION B (Total: 5 X 5=25 Marks)

(Answer any **five questions**. Each answer carries **5 Marks)**

(At least 1 question should be given from each Unit)

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

~~**SECTION C** (Total: 5 X 8 = 40 Marks)~~

~~(Answer ALL the questions. Each question carries 8 Marks)~~

1.	(a) or (b)
2.	(a) or (b)
3.	(a) or (b)
4.	(a) or (b)
5.	(a) or (b)

A.P. State Council of Higher Education
Semester – wise Revised Syllabus under CBCS, 2020-21

Course Code:

Three-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 6C: **ECONOMETRICS**
(Skill Enhancement Course(Elective), 05 Credits
Max. Marks: Theory :100 + Practicals: 50

I Learning Outcomes:

The course on econometrics will primarily focus on the use of statistical modelling and the relevant analyses to economic data problems. After learning this course the student will be able

1. various important econometric models and relevant model building concepts in econometrics
2. general linear models and estimation of inherent model parameters
3. multicollinearity, its detection and consequences and related inferential aspects
4. some advanced concepts of generalised least squares estimation, autocorrelation, its consequences, detection and strategy for reducing autocorrelation,
5. heteroscedasticity and its inherent concepts including its consequences,
6. some inferential aspects on heteroscedasticity,
7. practical aspects and real data illustration of the related problems.

II Syllabus:

UNIT-I

Basic Econometrics: Nature of econometrics and economic data, concept of econometrics, steps in empirical economic analysis, econometric model, importance of measurement in economics, the structure of econometric data, cross section, pooled cross section, time series and paired data, simple regression models, two variable linear regression model, assumptions estimations of parameters.

UNIT-II

Models and Estimations: Gauss marcoff theorem, OLS estimations, partial and multiple correlations coefficients. The general linear model assumptions, estimation and properties of estimators, BLUEs, and tests of significance of estimators, R square and ANOVA.

UNIT-III

Problems in OLS Estimators: Multicollinearity: Introduction and concepts, detection of multicollinearity, consequences, tests and solutions of multicollinearity.

Unit IV

Autocorrelation: concept, consequences of autocorrelated disturbances, detection and solution of autocorrelation.

Unit V

Heteroscedastic disturbances: Concepts, Consequences of heteroscedasticity. Tests and solutions of heteroscedasticity. specification error, Errors of measurement.

III Practical/Lab to be performed on a computer using Statistical packages

1. Problems based on estimation of General linear model.
2. Testing of parameters of General linear model.
3. Forecasting of General linear model.
4. Problems concerning specification errors.
5. Problems related to consequences of Multicollinearity.
6. Diagnostics of Multicollinearity.
7. Problems related to consequences of Autocorrelation (AR(I)).
8. Diagnostics of Autocorrelation.
9. Estimation of problems of General linear model under Autocorrelation.
10. Problems related to consequences Heteroscedasticity.
11. Diagnostics of Heteroscedasticity.
12. Estimation of problems of General linear model under Heteroscedastic distance terms.

1V Practicals Skills Outcomes:

On successful completion of this practical course, student shall be able to:

11. Solve the General Linear Model Problems, Testing of Parameters of General linear Model and forecasting of General linear model
12. Solve the problems concerning Specification errors
13. Solve the problems related to multicollinearity and its Diagnostics
14. Solve the problems related to Autocorrelation and its Diagnostics and to estimate problems of General linear model under Autocorrelation
15. Solve the problems related to Heteroscadisticity and its Diagnostics and to estimate problems of General linear model under Heteroscadisticity

V References:

1. Gujarati, D. and Sangeetha, S. (2007). Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972). Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004). Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited.
4. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

VI : Co-Curricular Activities:

e) Mandatory:

1.For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevantoutside data (Field/Web).

1.Solving the problems related to General Linear Problems

2.Solving the problems related to Specification errors

3. Solving the problems related to Multicollinearity

4. S olving the problems related to Autocorrelation

5. Solving the problems related to heteroscadisticity

2.For Student: Fieldwork; Each student individually shall undertake field work and submit a reportnot exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

6.Collecting the data and frame General linear model and draw the conclusions by solving it

(or)

7.Collecting the data and finding the relationship between the variables using Multicollinearity and to draw conclusions from it.

3.Max. marks for Field Work Report: 05.

4.Suggested Format for Field work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5.Unit tests (IE).

f) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to any specified areas for doing survey and data collection
3. Invited lectures and presentations on related topics by experts in the specified area.

VII Suggested Question Paper Pattern:

Max. Marks: 75 **Time: 3 hrs**

SECTION A (Total: 10 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION B (Total: 5 X 5=25 Marks)

(Answer any **five questions**. Each answer carries **5 Marks)**

(At least 1 question should be given from each Unit)

1.	
2.	
3.	
4.	
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6.	
7.	
8.	

~~**SECTION C** (Total: 5 X 8 = 40 Marks)~~

~~(Answer ALL the questions. Each question carries 8 Marks)~~

1.	(a) or (b)

2.	(a) or (b)
3.	(a) or (b)
4.	(a) or (b)
5.	(a) or (b)

A.P. State Council of Higher Education
Semester – wise Revised Syllabus under CBCS, 2020-21

Course Code:

Three-year B.A./B.Sc.
Domain Subject: **Statistics**
Course 7C: **REGRESSION ANALYSIS**
(Skill Enhancement Course(Elective), 05 Credits
Max. Marks: Theory :100 + Practicals: 50

I Learning Outcomes:

After learning this course the student will be able

1. To know about correlation and regression techniques, the two very powerful tools in statistics,
2. To get an idea of Linear and Multiple Linear regression,
3. To learn about regression diagnostics, multicollinearity, residual plots and estimation and tests for regression coefficients.
4. To study concept of coefficient of determination and inference on partial and multiple correlation coefficients.
5. To learn the regression with qualitative independent and dependent variables by dummy variable technique.
6. To learn the selection of the best regression model.
7.

II SYLLABUS

Unit I

Correlation: Bivariate data, Scatter diagram and interpretation. Karl Pearson's correlation coefficient, Properties. Spearman's rank correlation coefficient, with ties and without ties, limits. Regression, difference between correlation and regression.

Unit II

Steps in Regression Analysis: Assumptions of regression models. Simple linear regression model, Estimation of regression parameters by least squares method (fitting of regression model), Interpretation of parameters. Concept of residual, Residual plots. Multiple linear regression: Estimation of regression parameters by least square method, Interpretation of parameters. Concept of coefficient of determination.

Unit III

Regressions with Qualitative Independent Variables: Dummy variable technique — Testing structural stability of regression models comparing two regressions, interaction effects, seasonal analysis.

Unit-IV

Regressions with Qualitative Dependent Variables: Piecewise linear regression, use of dummy variables, regression with dummy dependent variables; The LPM, Logit, Probit and Tobit models — Applications.

Unit – V

Best Model: Selecting 'Best' regression model. All possible regressions – R^2, Adjusted R^2, MS_{Res}, Mallow's statistic. Sequential selection – forward selection, backward elimination.

III Practical/Lab to be performed on a computer using Statistical packages

1. Correlation coefficient
2. Rank correlation Coefficient
3. Regression Lines
4. Linear Models
5. Structural stability
6. Selecting best regression model by R^2
7. Selecting best regression model by Adjusted R^2
8. Selecting best regression model by MS_{Res}
9. Selecting best regression model by Mallow's statistic
10. Selecting best regression model by forward selection
11. Selecting best regression model by backward elimination.

1V Practicals Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Calculate Correlation Coefficient, RankCorrelation Coefficient, Regression lines and Linear models for the data
2. Select best regression model by R^2, Adjusted R^2, MS_{Reg}, Mallow's Statistic
3. Select best regression model by forward selection and backward elimination

V References:

1. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis. 3rd Edition. John Wiley.
2. Hosmer, D. W., Lemeshow, S. and Sturdivant R.X. (2013). Applied Logistic Regression, Wiley Blackwell.
3. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2013). Introduction to Linear Regression Analysis. 5th Edition. Wiley.
4. Neter, J., Kutner, M. H., Nachtsheim, C.J. and Wasserman, W. (1996). Applied Linear Statistical Models, 4th Edition, Irwin USA.
5. Gujarati, D. and Sangeetha, S. (2007). Basic Econometrics, 4th Edition

VI : Co-Curricular Activities:

a) Mandatory:

1.For Teacher: Teacher shall train students in the following skills for 15 hours, by taking relevantoutside data (Field/Web).

1.Collection of data and to calculate correlation coefficient, rank correlation Coefficient, Regression lines and linear models and to draw conclusions from it.

2.Selecting the best regression model by R^2, Adjusted R^2, MS_{Reg}, Mallow's Statistic for the data and to draw conclusions from it

3.Selecting the best regression model by forward selection and backward elimination

2.For Student: Fieldwork; Each student individually shall undertake field work and submit a reportnot exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

6.Collecting the data and calculate correlation coefficient , rank correlation, regression lines and linear models and draw the conclusions by solving it

(or)

7.Collecting the data and select the best regression model by forward selection and backward elimination and to draw conclusions from it.

3.Max. marks for Field Work Report: 05.

4.Suggested Format for Field work Report: Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5.Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to any specified areas for doing survey and data collection
3. Invited lectures and presentations on related topics by experts in the specified area.

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~~(Answer ALL the questions. Each question carries 8 Marks)~~

1.	(a) or (b)
2.	(a) or (b)
3.	(a) or (b)
4.	(a) or (b)
5.	(a) or (b)