P.R.GOVERNMENTCOLLEGE(A), KAKINADA
III B.Sc. – Statistics/ Semester- VI / Paper-VII (Elective-I) Syllabus (2020-21)
Paper Title: SQC & OPTIMIZATION TECHNIQUES

Total Hrs. of Teaching: 45 @ 3 h / Week   **Total Credits: 03**

Objective: The main objective of SQC is to achieve quality in production and service organizations, through the use of adequate statistical techniques.

Operational Research –I: In British usage, is a discipline that deals with the application of advanced analytical methods to help make better decisions. It is often considered to be a sub-field of mathematics. Employing techniques from other mathematical sciences, such as mathematical modeling, statistical analysis, and mathematical optimization, operations research arrives at optimal or near-optimal solutions to complex decision-making problems. Operations research is often concerned with determining the maximum (of profit, performance, or yield) or minimum (of loss, risk, or cost) of some real-world objective. Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries

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Module-1 Statistical Quality Control   **(12h)**
1. Importance of SQC in industry. Process and Product control, Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p, np and c - charts with fixed and varying sample sizes). Interpretation of control charts.
2. Acceptance sampling plans: Producers risk and consumer's risk. Concept of AQL and LTPD. Single and Double sampling plans for attributes and derivation of their OC and ASN functions. Design of single and double sampling plans for attributes using Binomial.

Module – 2 Reliability: **(10h)**

1. Introduction. Hazard function, Exponential distribution as life model, its memory- less property. Reliability function and its estimation. System reliability - series, parallel and k out of N systems and their reliabilities.

Module -3 Introduction of OR and LPP: **(12h)**

1. Linear Programming: Meaning and scope of OR, applications of OR, Convex sets and their properties. Definition of general form of LPP. Formulation of LPP, Fundamental theorem of LPP. Solution of LPP by graphical method.
2. Linear Programming: slack and surplus variable, simplex algorithm.

Module – 4 Artificial variable technique and duality: **(11h)**

1. Concept of artificial variables. Big –M/Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it, Concept of duality, duality as LPP. Dual and Primal relationship. Fundamental theorem of duality.

Additional Input: Specification limits (not included in examination)

List of Text Books:
1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. Kranthi Swaroop, Manmohan and Gupta: Operations Research-Sultan Chand

List of reference books:

1.Parimal Mukhopadhyay : Applied Statistics .   New Central Book agency.
2.B.L.Agarwal: Basic Statistics.New Age publications.
3.   S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
4.   S.D Sharma: Operations Research

List of Practicals: (3 hrs/week   credits:2)

Conduct any SIX (MS-Excel mandatory)

1. Construction of mean, range and standard deviation charts.

2. Construction of p, np and c- charts with fixed and varying sample sizes.

3. Designing of Single sampling plan and Double sampling plan for attributes and

   construction of their OC and ASN curves

4. Computation of reliability for series, parallel and k out of n systems.

5. Formulation and graphical solutions of LPP (using different inequality type constraints)

6. Solution of LPP by simplex method.

7. Solution of an LPP using Big-M and two phase simplex methods

8. Solution of an LPP using principal of duality

9. Practicals 1, 2, 3, 4 using MS-Excel

Paper –VII(E-I): SQC & OPTIMIZATION TECHNIQUES

Model blue print for the Question Paper setter

Max. marks: 60   **Time : 2 1/2 Hrs.**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Statistical Quality Control		2	2	30
Unit – 2				
Reliability		1	2	25
Unit – 3				
Introduction to OR and LPP		2	2	30
Unit – 4				
Artificial variable technique and duality		1	2	25
-				
Total No. of Questions including choice (14)		6	8	-
Total marks allotted to all questions including choice =				110

Statistics paper- VII (E-I): SQC & OPTIMIZATION TECHNIQUES

Question Bank

SHORT QUESTIONS:

1. Explain process control and product control.
2. Explain assignable causes and chance causes.
3. Explain in brief Shewart control charts.
4. Write the difference between attributes and variables.
5. What is meant by Quality and explain 4m's in quality.
6. Explain the terms AQL & LTPD.
7. Explain producer's risk & consumer's risk.
8. Explain Hazard function and estimate it.
9. Explain the concepts of censoring and truncation.
10. Define reliability function.
11. State and prove fundamental theorem of duality.
12. Explain the concept of artificial variables.
13. Explain general LPP.
14. Show that dual of a dual is primal.

ESSAY QUESTIONS:

15. Give the importance of SQC in industry. Explain the construction of X & R charts.
16. Explain the construction of np- charts.
17. Explain construction of C-chart.
18. Explain the role and importance of six sigma.
19. Explain single sampling plan.
20. Explain double sampling plan.
21. Explain exponential distribution as a life model and give memory less property.
22. Explain system reliability with K out of N systems and their reliabilities.
23. Explain about series and parallel system reliability.
24. Explain the procedure for graphical method.
25. Explain scope and models of OR.
26. Explain the concept of degeneracy and how do you solve it.
27. Solve the following LPP by using graphical method.
    Max.$z=3x_1+2x_2$
    Stc
    $x_1-x_2<1$
    $x_1+x_2>3$
    with $x_1,x_2>0$
28. Solve the following LPP by simplex method.
    Max.$z=5x_1+10x_2+8x_3$
    Stc
    $3x_1+5x_2+2x_3<60$
    $4x_1+4x_2+4x_3<72$

$2x_1+4x_2+5x_3<100$

With $x_1,x_2,x_3>0$

29. Use penality method to solve the following LPP

    Min.$z=12x_1+20x_2$

    Stc

    $6x_1+8x_2>100$

    $7x_1+12x_2>120$

    With $x_1,x_2>0$

30. Describe two phase simplex method of solving a LPP.

P.R. Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester
Statistics-VII(E-I): SQC & OPTIMIZATION TECHNIQUES
(Model paper)

Time: 2 1/2 Hrs.   **Max. Marks: 60**

Section – A   4x5 = 20 M
Answer <u>any four</u> of the following questions. Each question <u>carries five</u> marks.
1. Explain the terms of assignable and chance causes.
2. Explain AQL and LTPD.
3. Explain reliability function and it's estimation.
4. Write canonical and standard form of LPP.
5. State and prove fundamental theorem of LPP.
6. Explain Big-M method.

Section – B   2x10 = 20 M
Answer any two questions.
7. What are control charts. How do you construct x and R- charts.
8. Explain the control charts for attributes. How are they useful.
9. What are the uses of statistical quality control. Explain the statistical basis of control chart analysis.
10. Explain importance of exponential distribution as a failure model. State and prove memory less property of exponential distribution.
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Section – C   2x10 = 20 M
Answer any two questions.
11. solve the following LPP by simplex method.

Max.Z=5x1+10x2+8x3

Sub. To constraints

$3x_1+5x_2+2x_3<60$

$4x_1+4x_2+4x_3<72$

$2x_1+4x_2+5x_3<100$

$x_1,x_2,x_3>0$

12. Explain the concept of duality. Show that dual of a dual is primal.
13. Write algorithm for two phase simplex method?
14..Explain the scope and applications of OR.

P.R. Government College (Autonomous), Kakinada
III year B.Sc. Statistics / Semester VI- Paper VII (Elective-II)(2020-21)
Title: Actuarial Statistics

Total Hrs. of Teaching: 45 @ 3 h / Week   **Total Credits: 03**

Module -1   **(12h)**
Utility theory, insurance and utility theory, models for individuals claims and their sums,
survival function, curate future lifetime, force of mortality.
Life table and it's relation with survival function examples, assumptions of fractional ages, some
analytical laws of mortality select and ultimate tables.

Module - 2   **(11h)**
Multiple life functions, joint life and last survivor status, insurance and annuity benefits
through multiple life functions, evaluation for special mortality laws.
Multiple decrement models, deterministic and random survivorship groups, associated single
decrement tables, central rates of multiple decrement, net single premiums and their numerical
evaluations.

Module - 3   **(11h)**
Elements of compound interest (nominal and effective rate of interest)
Life annuities: Single payment, continuous life annuities, discrete life annuities, life   annuities
with monthly payments, communication functions, varying annuities-due recursions and
complete annuities-immediate and apportionable annuities-due.

Module - 4   **(11h)**
Net premiums: Continuous and discrete premiums, true monthly payment premiums,
apportionate premiums, communication functions, and accumulation type benefits.
Net premium reserves: continuous and discrete net premium reserve, reserves on a semi
continuous basis, reserves based on true monthly premiums, reserves on an apportionable or
accounted continuous basis reserves at fractional durations.

Text Books
1.Bowers, N. L., Gerber, H.U., Hickman, J.C., Jones, D.A., Nesbitt, C.L.(1986),
   Actuarial Mathematics, The society of actuaries.

References
1. UK Institute of Actuaries core reading for subject CT5-Contingences.
2. Robin Cunningham, Thomas N. Herzog, Richard L. Models for Quantifying Risk,
   4th Edition, ACTEX Publications, 2011.
3. Dickson, David C. M., Hardy, Mary R. and Waters, Howard R., Actuarial
   Mathematics for life contingent risks, International series on actuarial science,
    Cambridge 2009.
4. Deshmukh S. R., An Introduction to Actuarial Statistics, University Press, 2009

Paper Title-ACTURIAL STATISTICS VII (E-II)

Model blue print for the Question Paper setter

Max. marks : 60   **Time : 2 1/2 Hrs.**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Module-I		2	2	30
Unit – 2				
Module-II		1	2	25
Unit – 3				
Module-III		2	2	30
Unit – 4				
Module-IV		1	2	25
Total No. of Questions including choice (14)		6	8	-
Total marks allotted to all questions including choice =				110

P.R. Government College (Autonomous), Kakinada
Paper Title: Actuarial Statistics
Semester VI paper VII (E-II)
MODEL PAPER

Time : 2 1/2 Hrs.   **Max. Marks: 60M**

SECTION – A

4x5 = 20 M

Answer <u>any four</u> of the following questions. Each question <u>carries five</u> marks.

1. Explain insurance and utility theory.
2. Write force of mortality.
3. Write about central rates of multiple decrement.
4. Write elements of compound interest.
5. Explain life annuities with monthly payments.
6. What is accumulation type benefits.

SECTION – B

2x10 = 20 M

Answer any two questions.
7. Explain models for individual claims and their sums, survival function.
8. Explain life table and it's relation with survival function examples.
9. Describe multiple decrement models, deterministic and random survivorship group
10. Explain distribution of aggregate claims, compound Poisson distribution.

SECTION – C

2x10 = 20 M

Answer any two questions.

11. Describe single payment, continuous life annuities, discrete life annuities.

12. Explain recursions and complete annuities-immediate and apportionable annuities-due.
13. Explain continuous and discrete premiums, true monthly payment premiums.

14. Explain continuous and discrete net premium reserve, reserves on a semi continuous basis.

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2020-21)
Cluster A
Statistics Paper VIII A$_1$: Operations Research

Total Hrs. of Teaching: 45 @ 3 h / Week   **Total Credits: 03**

Objective: The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering systems design, environmental management, financial planning, health care management, inventory control, manpower and resource allocation, manufacturing of goods, military operations, production process control, risk management, sequencing and scheduling of tasks, telecommunications, and traffic control.

Module -1

Transportation Problem   **(12h)**

    Definition of transportation problem,

    TPP as a special case of LPP,

    Feasible solutions by NWCR, MM, VAM

    Optimal solution through MODI

    Unbalanced transportation problem.

    Degeneracy in TP and resolving it.

Module-2   **(11h)**

Assignment Problem

    Formulation and description of Balanced Assignment problem.

    Unbalanced assignment problem,

    Traveling salesman problem.

    Optimal solution using Hungarian method.

Module –3

Sequencing   **(11h)**

    Problem of Sequencing.

    Optimal sequence of N jobs on two and three machines without passing.

Module –4

Game Theory   **(11h)**

    Two Person Zero Sum Game

    Saddle Point

    Dominance property

    Graphical Solution for mx2, 2xn

Additional Input: Sequencing problem with 2 jobs on k machines (not included in examination)

List of Text books:
1. Operations Research by S.D. Sharma.
2. Operations Research by Kranthi Swaroop, Manmohan and Gupta

List of Practicals:
Conduct any SIX: (3 hrs/week   credits:2)

1. Formulation and solution of transportation problem using North-West corner rule, Matrix

   Minima methods and VAM and to test their optimality

2. Optimum solution to balanced and unbalanced transportation problems by MODI method

   (both maximization and minimization cases).

3. Formulation and solution of Assignment problem using Hungarian method (both

   maximization and minimization cases),

4. Solution of unbalanced Assignment problem.

5. Solution of traveling salesman problem.

6. Solution of sequencing problem—processing of n jobs through two machines and

   processing of n jobs through three machines.

7. Solution of graphical method in game theory

8. Solution of dominance rule in game theory.

Paper –VIII Cluster A$_1$: Operations Research

Model blue print for the Question Paper setter

Max. marks:60   **Time : 2 ½ Hrs**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Transportation		2	2	30
Unit – 2				
Assignment		1	2	25
Unit – 3				
Sequencing		1	2	25
Unit – 4				
Game Theory		2	2	30
-				
Total No. of Questions including choice (14)		6	8	
Total marks allotted to all questions including choice =				110

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations-VI Semester
Statistics VIII Cluster A₁: operations research
(Model paper)

Time: 2 1/2Hrs.   **Max. Marks: 60**

Section – A   4x5 = 20 M

Answer any four of the following questions. Each question carries _five_ marks.

1. Explain the procedure of travelling sales man problem.
2. Explain two machines and n jobs for the sequencing problem.
3. Explain the graphical method to solve rectangular game.
4. Give matrix method to solve mxn games.
5. What is unbalanced transportation problem.
6. What is degeneracy in transportation problem.

Section – B   2x10 = 20 M

Answer any two questions.

7. Define a transportation problem and explain the problem of degeneracy. Explain a method of resolving it.

8. Describe the MODI method to solve a transportation problem. Obtain an optimum solution to the following transportation problem.

D	E	F	availability
5	1	7	10
6	4	6	30
3	2	1	15
75	20	50	

1. Explain the procedure of Hungarian Method.

2. .Solve the following assignment problem

Man/ job	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

Section – C   2x10 = 20 M

Answer any two questions.

3. Write the Procedure to determine the sequence for performing the jobs to minimize total elapsed time T.

12. Determine the optimal sequence of jobs that minimizes total based on the following information processing time on machines is given in hours and passing is not allowed.

Job	A	B	C	D	E	F	G
Machine M1:	3	8	7	4	9	8	7
Machine M2:	4	3	2	5	1	4	3
MachineM3:	6	7	5	11	5	6	12

13. .Explain the minimax criterion as applied to the theory of games.

14. Solve the game whose payoff matrix is given by:

Player B

Player A

-1	2	1
1	-2	2
3	4	-3

P.R.GOVERNMENT COLLEGE (A), KAKINADA
III B.Sc. – statistics / Semester- VI (2020-21)
Paper –VIII (A2)

Course: Cluster (A2): Advanced Designs of Experiment
Total Hrs. of Teaching: 45 @ 3 h / Week   **Total Credits: 03**

Objectives: Statistics is an inductive science in which information is extracted from sample data in order to draw inferences. This most often involves planning experiments to ensure that valid answers to questions are obtained from the sample. Statistics is a subject that deals with the collection and analysis of data and affects most aspects of modern life.

Module-1   **(11h)**

Review of Design of Experiment

Review of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Suare Design (L.S.D)

Module-2   **(12h)**

Missing Plot Technique :   Anaysis of Randomized Block Design (R.B.D) with one and two

missing observations and Latin Square Design (L.S.D) with one missing observation.

Module-3   **(10h)**

Analysis of Covariance (ANCOVA): Analysis of covariance for a one-way classification with one

concomitant variable in C.R.D. Layout and for two-way classification with one concomitant variable in

R.B.D

Module-4   **(12h)**

Factorial Design: Estimation of main effects interactions and analysis of $2^2, 2^3, 3^2$ factorial experiments

Additional Input: BIBD (not included in examination)
List of Text Books:
1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand

List of reference books:

1. .Parimal Mukhopadhyay : Applied Statistics .   New Central Book agency.
2. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs. Wiley Eastern.

3. M.R.Saluja : Indian Official Statistics. ISI publications.
4. B.L.Agarwal: Basic Statistics.New Age publications.
5. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
6. PratirupaSidhanthamulu – TeluguAcademy.
7. PrayogaRachana and Visleshana – TeluguAcademy.

List of Practicals: (3 hrs/week   credits:2)

Conduct any SIX (MS-Excel mandatory)
1. Analysis of CRD, RBD and LSD
2. Analysis of RBD with one missing value
3. Analysis of LSD with one missing value
4. Analysis of CRD with one covariant

5. Analysis of RBD with one covariant
6. Analysis of 22and 23 designs
7. Analysis of 32 design
8. Practicals 1, 2, 3, 4, 5 using MS-Excel

Paper –VIII-Cluster (A2): Advanced Designs of Experiment

Model blue print for the Question Paper setter

Max. marks:60   **Time : 2 1/2 Hrs**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Review of CRD, RBD & LSD		2	2	30
Unit – 2				
Missing plot technique		1	2	25
Unit – 3				
Analysis of Covariance (ANCOVA)		2	2	30
Unit – 4				
Factorial Design		1	2	25
-				
Total No. of Questions including choice (14)		6	8	
Total marks allotted to all questions including choice =				110

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester
Statistics Paper-VIII Cluster (A2): Advanced Designs of Experiment
(Model paper)

Time: 2 1/2 Hrs.   **Max. Marks: 60**

Section – A

4x5 = 20 M

Answer any <u>Four</u> of the following questions. Each question carries FIVE marks.

1. Explain principles of experimental design?.
2. Discuss advantages & disadvantages of RBD?.
3. Derive single missing yield in RBD?
4. Explain analysis of covariance (ANCOVA)?
5. Construct lay out of ANCOVA in one way classification?
6. Explain interaction effect in factorial design?

Section – B

Answer any two question   **2x10 = 20 M**

7. Explain the analysis of CRD with ANOVA?
8. Explain concept and lay out of LSD ?
9. Explain in detail the analysis of two missing values in RBD? And also construct ANOVA tables after estimating the two missing values?
10. Derive single missing values in LSD also construct ANOVA tables after estimating the single value?

Section – C

Answer any <u>TWO</u> questions.   **2x10 = 20 M**

11. Derive one way classification in one concomitant variable in ANCOVA?
12.. Explain in brief ANCOVA in RBD with two concomitant variable?.
13. How to estimate main effects in 2^2 factorial designs?
14. How to estimate interaction effects in 3^2 factorial experiments?

P.R. Government College (Autonomous), Kakinada
Paper Title: Econometrics
VI Semester Cluster paper VIII A3 (2020-21)
(Total Hours of Teaching: 45 @ 3 h / Week)

Objective: On successful completion of the course the students should have understood econometric Model, estimation and testing of parameters, forecasting and verification of economic theory and application of models in planning.

Module -1   (11h)
Definition-Scope
 Objectives of Econometrics
 Limitations-Divisions of Econometrics

Module - 2   (12h)
Single equation model two variable case
Reasons for introducing error term in the model
least square method of estimation and testing of parameters of the models
Estimation of error variance
Simple problems.

Module - 3   (11h)
General linear model
Assumptions
Least square method of estimation and testing of the parameters of the models
problems under failure of assumptions.

Module - 4   (11h)
Multicollinearity
 Effects of multicollinearity
 detecting multicollinearity
 Remedies Autocorrelation-sources of autocorrelation

List of reference books:

1.Ecnometrics Basic and applied by Aaron C Johnson Jr,Marvin B Johnson and Rueben C Buse (Maxwell Maxmillan Intl editions)

2. Ecnometric methods by Johnston. J (McGraw Hill Intl students' editions)

3. Theory of Ecnometrics by Koutsoyannis. A (Palgrave publications Ltd)

Paper Title-Econometrics-VIII A3

Model blue print for the Question Paper

Max. marks :60   **Time : 2 ½ Hrs.**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Module-I		1	2	25
Unit – 2				
Module-II		2	2	30
Unit – 3				
Module-III		1	2	25
Unit – 4				
Module-IV		2	2	30
Total No. of Questions including choice (14)		6	8	-
Total marks allotted to all questions including choice =				110

Cluster Paper-VIII A3-Econometrics

QUESTION BANK

SHORT ANSWERS:

1. Define econometrics.
2. Write uses of econometrics.
3. Write about simple linear regression model.
4. Write MLE for linear regression model.
5. Write CI estimation of intercept form.
6. Explain unbaised property.
7. Define general linear model.
8. Write normality of residuals in GLM.
9. Define multicollinearity.
10. Define auto correlation.

ESSAY QUESTIONS:

1. Write nature and scope of econometrics.
2. Write limitations & divisions of econometrics.
3. Write least square estimation of direct regression model.
4. Write properties of direct regression estimators.
5. Derive estimation of variance.
6. Derive estimation of variances of b_0 & b_1 in direct regression model.
7. Write about CI estimation for slope parameter
8. Explain general linear model.
9. Write assumptions of GLM.
10. Write least square estimation of GLM.
11. Explain causes and effects of multicollinearity.
12. Write sources of auto correlation.

P.R. Government College (Autonomous), Kakinada
Paper Title: Econometrics
VI Semester Cluster paper VIII-A3
MODEL PAPER

Time: 2 ½ Hrs.   **Max. Marks: 60 M**

Section – A   4x5 = 20M

Answer <u>any four</u> of the following questions. Each question <u>carries five</u> marks.

1. Write the limitations of econometrics.
2. Define simple linear regression model.
3. Derive estimation of error variance.
4. Define general linear model with example.
5. Explain problem having multi collinearity.
6. Define auto correlation.

Section – B   2x10 = 20 M

Answer any two questions.

7 . Explain scope and objectives of econometrics.
8. Explain limitations and divisions of econometrics.
9. Derive estimates of variances of b_0 & b_1 for single linear regression model.
10. write testing of hypothesis & C.I estimation for slope parameter.

Section –C   2x10 = 20 M

Answer any two questions.

11. Explain assumptions of general linear model.
12. Explain testing of parameters of the models.
13. Explain effects & causes of multi collinearity.
14. Explain sources of autocorrelation.

P.R. Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2020-21)
Statistics Paper VIII Cluster B₁: Operations Research-I

Total Hrs. of Teaching: 45 @ 3 h / Week   **Total Credits: 03**

Objective: The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering systems design, environmental management, financial planning, health care management, inventory control, manpower and resource allocation, manufacturing of goods, military operations, production process control, risk management, sequencing and scheduling of tasks, telecommunications, and traffic control.

Module -1
Linear programming problem –advanced technique   **(12h)**
Introduction to revised simplex method
   Revised simplex method (RSM) algorithm
   Simplex method vs revised simplex method
   Bounded variables
   Bounded variable simplex method

Module-2
Transportation Problem   **(12h)**
   Definition of transportation problem,
   TPP as a special case of LPP,
   Feasible solutions by NWCR, MM, VAM
   Optimal solution through MODI
   Unbalanced transportation problem.
Degeneracy in TP and resolving it.

Module-3   **(11h)**
 Assignment Problem
Formulation and description of Balanced Assignment problem.
 Unbalanced assignment problem,
Traveling salesman problem.
Optimal solution using Hungarian method.

Module –4   **(10h)**

Sequencing Problem

Problem of Sequencing, assumptions
 Optimal solution of N jobs on two and three machines without passing-Johnson's Algorithm

Additional Input: Sequencing problem with 2 jobs on k machines (not included in examination)

List of text books:
1. Operation Research by S.D.Sh Operations Research by S.D. Sharma.
2. Operations Research by Kranthi Swaroop, Manmohan and Gupta

List of Practicals: (3 hrs/week   credits:2)

Conduct any SIX:

1. Solution of LPP by Revised Simplex Method
2. Solution of LPP by the bounded variable simplex method
3. Formulation and solution of transportation problem using North-West corner rule, Matrix

    Minima methods and VAM and to test their optimality

4. Optimum solution to balanced and unbalanced transportation problems by MODI method
    (both maximization and minimization cases).
5. Formulation and solution of Assignment problem using Hungarian method (both

    maximization and minimization cases),

6. Solution of unbalanced Assignment problem.

7. Solution of traveling salesman problem.

8. Solution of sequencing problem—processing of n jobs through two machines and

    processing of n jobs through three machines.

Paper –VIII Cluster B₁:Operations Research-I

Model blue print for the Question Paper setter

Max. marks:60   **Time : 2 1/2 Hrs**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Lpp advanced techni que		1	2	25
Unit – 2				
Transportation		2	2	30
Unit – 3				
Assignment		2	2	30
Unit-4				
Sequencing		1	2	25
-				
Total No. of Questions including choice (14)		6	8	
Total marks allotted to all questions including choice =				**110**

Question Bank

SHORT QUESTIONS:

1. Explain the advantages and disadvantages of revised simplex method.
2. Explain the concept of bounded variables.
3. Explain North-West corner method
4. Write a short note on un balanced transportation problem.
5. Explain travelling sales man problem.
6. Write the procedure for matrix mimima method.
7. Explain unbalanced assignment problem.
8. Explain the assumptions in job sequencing

ESSAY QUESTIONS

9. Explain the Revised simplex algorithm.
10. solve the following LPP
    minimize $Z = 6x_1 - 2x_2 - 3x_3$
    subject to the constraints
    $2x_1 + 4x_2 + 2x_3 \leq 8$
    $x_1 - 2x_2 + 3x_3 \leq 7$
    and $0 \leq x_1 \leq 2$, $0 \leq x_2 \leq 2$, $0 \leq x_3 \leq 1$
11. Obtain IBFS for TP by using north west corner rule

5	1	3	3	34
3	4	5	4	15
6	4	3	9	12
4	1	5	8	19
20	25	15	20	

12. Obtain IBFS for TP by using VAM.

5	1	3	3	34
3	3	5	4	15
6	4	4	3	12
4	1	4	2	19
21	25	17	17	

13. Explain the procedure of MODI method.
14. Describe the TP with its general mathematical formulation.
15. Explain the degeneracy in transportation problem. How can you resolve it.
16. Write the procedure for Hungarian method.
17. Solve the following assignment problem of maximization.

10	5	13	15	16
3	9	18	13	6
10	7	2	2	5
7	11	9	7	12
7	9	10	4	11

18. Explain the sequencing algorithm for n jobs on two machines. And also explain the calculation of minimum total elapsed time.

19. Determine the optimal sequence of jobs that minimizes total based on the following information processing time on machines is given in hours and passing is not allowed.

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

P.R. Government College (Autonomous), Kakinada

III year B.Sc., Degree Examinations-VI Semester
Statistics paper VIII Cluster B₁: operation research-I

Time: 2 1/2 Hrs.   Max. Marks: 60

Section – A   4x5 = 20 M

Answer any four of the following questions. Each question carries <u>five</u> marks.

1. Explain the procedure of travelling sales man problem.
2. Explain the procedure of unbalanced assignment problem.
3. Explain two machines and n jobs for the sequencing problem.
4. Write advantages disadvantages of revised simplex method.
5. What is unbalanced transportation problem.
6. What is degeneracy in transportation problem.

Section – B   2x10 = 20 M

Answer any two questions.

7. solve the following LPP

   minimize $Z = 6x_1 - 2x_2 - 3x_3$

   subject to the constraints

   $2x_1 + 4x_2 + 2x_3 \leq 8$

   $x_1 - 2x_2 + 3x_3 \leq 7$

   and $0 \leq x_1 \leq 2$, $0 \leq x_2 \leq 2$, $0 \leq x_3 \leq 1$

8. write revised simplex method algorithm

9. Define a transportation problem and explain the problem of degeneracy. Explain a method of resolving it.

10. Describe the MODI method to solve a transportation problem. Obtain an optimum solution to the following transportation problem.

D	E	F	availability
5	1	7	10
6	4	6	30
3	2	1	15
75	20	50	

Section-C

Answer any two questions.   **2x10=20**

11. Explain the procedure of Hungarian method

12. Solve the following assignment problem

Man/ job	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

13. Write the Procedure to determine the sequence for performing the jobs to minimize total elapsed time T.

14. Determine the optimal sequence of jobs that minimizes total based on the following information processing time on machines is given in hours and passing is not allowed.

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2020-21)
Statistics Paper VIII Cluster B$_2$: Operations Research-II

Total Hrs. of Teaching: 45 @ 3 h / Week **Total Credits: 03**

Objective: The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering systems design, environmental management, financial planning, health care management, inventory control, manpower and resource allocation, manufacturing of goods, military operations, production process control, risk management, sequencing and scheduling of tasks, telecommunications, and traffic control.

Module -1 **(12h)**

Game and strategies:

Introduction, Two person zero sum game, Saddle point, Dominance property, 2xn,mx2 games-Graphical method.

Module-2 **(12h)**

Inventory control-I

Types of inventories, Cost of inventories, Factors effecting inventory control, Concept of EOQ, Deterministic inventory models.

Module-3 **(10h)**

Inventory control-II

Problems on EOQ with one price &more than one price break, Simple problems, probabilistic inventory model, Instantaneous demand, No setup cost model, News paper boy problem

Module-4 **(11h)**

Net work scheduling.

PERT, CPM , Logical sequencing ,Rules for net work construction, Critical path analysis ,Floats and slack times.

Additional Input: Decision Analysis with Certainty (not included in examination)

List of text books:
1. Operations Research by S.D. Sharma.
2. Operations Research by Kranthi Swaroop, Manmohan and Gupta

List of Practicals:
Conduct any SIX: (3 hrs/week credits:2)

1. Solution of games with saddle points.

2. Solution of games by dominance method

3. Solution of 2Xn and mX2 games by graphical method

4. Determination of EOQ for different inventory models.

5. EOQ problems with one and two price breaks

6. News paper boy problem.

7. Network scheduling by CPM

8. Network scheduling by PERT

.Paper –VIII Cluster B$_2$:Operations Research-II

Model blue print for the Question Paper setter

Max. marks:60   **Time : 2 1/2 Hrs**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Game theorey		1	2	25
Unit – 2				
Inventory models I		2	2	30
Unit – 3				
Inventory models II		1	2	25
Unit-4				
Networking scheduling		2	2	30
-				
Total No. of Questions including choice(14)		6	8	
Total marks allotted to all questions including choice =				110

Question Bank

Short Answer Questions:
1. Define two person zero sum games and pure and mixed strategies.
2. Define payoff and payoff matrix.
3. Explain the maximin and minimax principle. Define saddle point.
4. Explain the different types of inventories.
5. Explain the various costs involved in inventory control.
6. Explain the various factors involved in inventory control.
7. Explain about Economic Order Quantity.
8. Explain the EOQ model with one price break.
9. Explain the rules of constricting a network diagram.
10. Explain CPM and PERT.
11. Explain the components of a network.

Essay Questions:

12. Explain the Dominance principle to solve nxn game.
13. Explain the graphical method to solve 2xn and mx2 games.
14. Find optimal strategies for the games for which for the pay off matrices are given below also find the value of the game

		P_2	
		I	II
P_1	I	1	3
	II	4	2

15. Explain the different methods to determine EOQ.
16. Discuss the EOQ problem with uniform demand and infinite production rate.
17. Discuss the EOQ problem with different demand rates in different cycles and infinite production rate.
18. Find EOQ for the following data

   Annual usage=1,000 pages   Expediting cost=RS.4 per order

   Cost per price =Rs.250   Inventory holing cost=20% of average inventory

   Ordering cost=RS.6per order   material holding cost=Re 1 per price

19. Explain the probabilistic inventory model with instantaneous demand and no setup cost.
20. Explain forward and backward time computations.
21. Explain the critical path method.
22. Explain the PERT algorithm.
23. Find the optimum time of completion of project ,when the time of completion of each task is as follows : A < D ,E ; B,D < F ; C<G ; B ,G< H ; F,G < I.

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

III year B.Sc., Degree Examinations-VI Semester
Statistics VIII Cluster - B₂: operation research-II

Time: 2 1/2 Hrs.   **Max. Marks: 60**

Section – A   4x5 = 20 M

Answer any four of the following questions. Each question carries <u>five</u> marks.

1. Explain pure and mixed strategies.
2. Explain different types of inventories.
3. Explain the determination of EOQ with one price break.
4. Write about economic lot size with finite rate
5. Write basic steps in PERT technique
6. Write rules for drawing net work diagram.

Section-B   2x10=20

Answer any two of the following:

7. Find optimal strategies for the games for which for the pay off matrices are given below also find the value of the game.

P₁	P₂		
		I	II
	I	1	3
	II	4	2

8. Write procedure of graphical method to solve 2Xn games.

9. Find EOQ for the following data

   Annual usage=1,000 pages   *Expediting cost=RS.4 per order*

   Cost per price =Rs.250   *Inventory holing cost=20% of average inventory*

   Ordering cost=RS.6per order   *material holding cost=Re 1 per price*

10. Explain concept of Economic order quantity and explain the different methods to compute EOQ

Section-C   2x10=20

11. Explain the determination of EOQ with one and Two price breaks.
12. Explain the probabilistic inventory modal with instantaneous demand and no setup cost.
13. Explain forward pass time computation&Backward pass time computations
14. Find the optimum time of completion of project ,when the time of completion of each task is as follows : A < D ,E ; B,D < F ; C<G ; B ,G< H ; F,G < I.

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

P.R. Government College (Autonomous), Kakinada
Paper Title: Econometrics
VI Semester Cluster paper VIII B3 (2020-21)
(Total Hours of Teaching: 45 @ 3 h / Week)

Objective: On successful completion of the course the students should have understood econometric Model, estimation and testing of parameters, forecasting and verification of economic theory and application of models in planning.

Module -1 (11h)
Definition-Scope
Objectives of Econometrics
Limitations-Divisions of Econometrics

Module - 2 (12h)
Single equation model two variable case
Reasons for introducing error term in the model
least square method of estimation and testing of parameters of the models
Estimation of error variance
Simple problems.

Module - 3 (11h)
General linear model
Assumptions
Least square method of estimation and testing of the parameters of the models
problems under failure of assumptions.

Module - 4 (11h)
Multicollinearity
Effects of multicollinearity
detecting multicollinearity
Remedies. Autocorrelation-sources of autocorrelation

List of reference books:

1.Ecnometrics Basic and applied by Aaron C Johnson Jr,Marvin B Johnson and Rueben C Buse (Maxwell Maxmillan Intl editions)

2. Ecnometric methods by Johnston. J (McGraw Hill Intl students' editions)

3. Theory of Ecnometrics by Koutsoyannis. A (Palgrave publications Ltd)

Paper Title-Econometrics-VIII B3

Model blue print for the Question Paper

Max. marks :60   **Time : 2 ½ Hrs.**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1				
Module-I		1	2	25
Unit – 2				
Module-II		2	2	30
Unit – 3				
Module-III		1	2	25
Unit – 4				
Module-IV		2	2	30
Total No. of Questions including choice (14)		6	8	-
Total marks allotted to all questions including choice =				110

Cluster Paper-VIII B3-Econometrics

QUESTION BANK

SHORT ANSWERS:

1. Define econometrics.
2. Write uses of econometrics.
3. Write about simple linear regression model.
4. Write MLE for linear regression model.
5. Write CI estimation of intercept form.
6. Explain unbaised property.
7. Define general linear model.
8. Write normality of residuals in GLM.
9. Define multicollinearity.
10. Define auto correlation.

ESSAY QUESTIONS:

11. Write nature and scope of econometrics.
12. Write limitations & divisions of econometrics.
13. Write least square estimation of direct regression model.
14. Write properties of direct regression estimators.
15. Derive estimation of variance.
16. Derive estimation of variances of b_0 & b_1 in direct regression model.
17. Write about CI estimation for slope parameter
18. Explain general linear model.
19. Write assumptions of GLM.
20. Write least square estimation of GLM.
21. Explain causes and effects of multicollinearity.
22. Write sources of auto correlation.

P.R. Government College (Autonomous), Kakinada
Paper Title: Econometrics
VI Semester Cluster paper VIII-B3
MODEL PAPER

Time: 2 ½ Hrs.   **Max. Marks: 60 M**

Section – A   **4x5 = 20M**

Answer <u>any four</u> of the following questions. Each question <u>carries five</u> marks.

1. Write the limitations of econometrics.
2. Define simple linear regression model.
3. Derive estimation of error variance.
4. Define general linear model with example.
5. Explain problem having multi collinearity.
6. Define auto correlation.

Section – B   **2x10 = 20 M**

Answer any two questions.

7 . Explain scope and objectives of econometrics.
8. Explain limitations and divisions of econometrics.
9. Derive estimates of variances of b_0 & b_1 for single linear regression model.
10. write testing of hypothesis & C.I estimation for slope parameter.

Section –C   **2x10 = 20 M**

Answer any two questions.

11. Explain assumptions of general linear model.
12. Explain testing of parameters of the models.
13. Explain effects & causes of multi collinearity.
14. Explain sources of autocorrelation.

P.R. Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2020-21)
Project Work

Total Hrs. of Teaching: 30 @ 2 h / Week   **Total Credits: 02**

Guidelines:

1. A project work shall be supervised by a faculty member assigned by the Head of the Department.

2. The project work shall be done on any one of the following topics
   - Population Statistics
   - Educational Statistics
   - Accidents Statistics
   - Election Statistics
   - Agricultural Statistics
   - Industrial Statistics
   - Election Statistics
   - Medical statistics, etc.,

3. A project work should be chosen such that there is enough scope to apply and demonstrate the statistical techniques learnt in the course

4. A project may be undertaken by a group of students and the maximum number of students in a team shall not exceed five.

5. There shall be an internal examiner for the evaluation of the project work

6. The project shall be submitted as one book for each team before the due date.

7. The project analysis and reports can be created using Excel or R software or SPSS or MATLAB or any other softwares.

8. Exam pattern:(only Internal):

Total : 50 marks

- Seminar 1: 5 marks
- Seminar 2 : 5 marks
- Project report: 25 marks

   It must include:
   - Introduction (topic, Aim & Objectives)
   - Methodology
   - Analysis
   - Conclusion
- Presentation: 10 marks
- Viva voce: 5 marks