**P.R.GOVERNMENTCOLLEGE(A), KAKINADA**

**III B.Sc. – Statistics/ Semester- VI / Paper-VII (Elective-I) Syllabus (2018-19)**

**Paper Title: SQC & OPTIMIZATION TECHNIQUES**

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

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**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](http://en.wikipedia.org/wiki/Mathematical_model), [statistical analysis](http://en.wikipedia.org/wiki/Statistics), and [mathematical optimization](http://en.wikipedia.org/wiki/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](http://en.wikipedia.org/wiki/Maxima_and_minima) (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.

1. Introduction to reliability
2. Hazard function & MLE of Hazard function
3. Memory less property of exponential distribution
4. Reliability function & it’s estimation
5. Concepts of censoring & truncation
6. Types of Systems in reliability
7. Series & Parallel configuration

**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:**

1. Give the importance of SQC in industry. Explain the construction of X & R charts.
2. Explain the construction of np- charts.
3. Explain construction of C-chart.
4. Explain the role and importance of six sigma.
5. Explain single sampling plan.
6. Explain double sampling plan.
7. Explain exponential distribution as a life model and give memory less property.
8. Explain system reliability with K out of N systems and their reliabilities.
9. Explain about series and parallel system reliability.
10. Explain the procedure for graphical method.
11. Explain scope and models of OR.
12. Explain the concept of degeneracy and how do you solve it.
13. Solve the following LPP by using graphical method.

Max.z=3x1+2x2

Stc

x1-x2<1

x1+x2>3

with x1,x2>0

1. Solve the following LPP by simplex method.

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

Stc

3x1+5x2+2x3<60

4x1+4x2+4x3<72

2x1+4x2+5x3<100

With x1,x2,x3>0

1. Use penality method to solve the following LPP

Min.z=12x1+20x2

Stc

6x1+8x2>100

7x1+12x2>120

With x1,x2>0

1. 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 any four of the following questions. Each question carries five 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

 3x1+5x2+2x3<60

 4x1+4x2+4x3<72

 2x1+4x2+5x3<100

 x1,x2,x3>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)**

**Title: Actuarial Statistics**

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

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 **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** **(12h)**

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.

**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**

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 **SECTION – A**

 **4x5 = 20 M**

**Answer any four of the following questions. Each question carries five 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.**

 14. Explain models for individual claims and their sums, survival function.

 15. Explain life table and it’s relation with survival function examples.

 16. Describe multiple decrement models, deterministic and random survivorship group

 17. Explain distribution of aggregate claims, compound Poisson distribution.

 **SECTION – C**

 **2x10 = 20 M**

**Answer any two questions.**

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

 19. Explain recursions and complete annuities-immediate and apportionable annuities-due.

 20. Explain continuous and discrete premiums, true monthly payment premiums.

 21. 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**

**Cluster A**

**Statistics Paper VIII A1: Operations Research**

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

**Objective:** The central objective of operations research is [optimization](http://mathworld.wolfram.com/Optimization.html), 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** **(12h)**

Two Person Zero Sum Game

Saddle Point

Dominance property

Graphical Solution for mx2, 2xn

**List of text books:**

Operation Research by S.D.Sharma.

**Paper –VIII Cluster A1: 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.**

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

15.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 | 103015 |
| 6 | 4 | 6 |
| 3 | 2 | 1 |
|  75 20 50 |

16. Explain the procedure of Hungarian Method.

17.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.**

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

 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

MachineM3: 6 7 5 11 5 6 12

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

21. 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 (W.E.F. 2017-2018)**

**Paper –VIII** (A2)

**Course: Cluster (A2): Advanced Designs of Experiment**

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

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**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.

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 **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)**

**Index Numbers**

**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 classificaction with one concomitant variable in R.B.D

**Module-4** (**12h)**

**Factorial Design:** Estimation of main effects interactions and analysis of 22,23,32 factorial experiments

**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.

1. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs.

Wiley Eastern.

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

**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 Four 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**

1. Explain the analysis of CRD with ANOVA?
2. Explain concept and lay out of LSD ?
3. Explain in detail the analysis of two missing values in RBD? And also construct ANOVA tables after estimating the two missing values?
4. Derive single missing values in LSD also construct ANOVA tables after estimating the single value?

**Section – C**

**Answer any TWO questions. 2x10 = 20 M**

18. Derive one way classification in one concomitant variable in ANCOVA?

 19. Explain in brief ANCOVA in RBD with two concomitant variable?.

 20. How to estimate main effects in 22 factorial designs?

21. How to estimate interaction effects in 32 factorial experiments?

**P.R.Government College (Autonomous), Kakinada**

**Paper Title: Econometrics**

**VI Semester Cluster paper VIII A3**

(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)

**Course Outcomes**:

After completion of this course the student is able to

1. understood econometric Model

2. estimate and test the parameters,

3. Apply the models in the relevant areas for forecasting and verification of economic theory.

**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** |

**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 any four of the following questions. Each question carries five marks.**

1. Write the limitations of econometrics.
2. Define single equation model for two variable case.
3. Explain estimation of error variance.
4. Explain multi colinearity.
5. Explain specification errors.
6. What is 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. Explain reasons for introducing error term in the model.

 10. Explain least square method of estimation.

**Section –C 2x10 = 20 M**

**Answer any two questions.**

 11. Explain general liner model.

 12. Explain testing of parameters of the models.

 13. Explain effects of multi collinearity and detecting multi collinearity.

 14. Explain remedies for autocorrelation and sources of autocorrelation

**P.R.Government College (Autonomous), Kakinada**

**III year B.Sc., Degree Examinations- VI Semester**

**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](http://mathworld.wolfram.com/Optimization.html), 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 of Sequencing.

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

**List of text books:**

Operation Research by S.D.Sharma.

**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** |

**Statistics Paper VIII Cluster B1: Operations Research-I**

**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

1. Explain the Revised simplex algorithm.
2. solve the following LPP

minimize Z=6x1-2x2-3x3

subject to the constraints

2x1+4x2+2x3≤8

x1-2x2+3x3≤7

and 0≤x1≤2 , 0≤x2≤2 , 0≤x3≤1

1. 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

1. 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

1. Explain the procedure of MODI method.
2. Describe the TP with its general mathematical formulation.
3. Explain the degeneracy in transportation problem. How can you resolve it.
4. Write the procedure for Hungarian method.
5. 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

1. Explain the sequencing algorithm for n jobs on two machines. And also explain the calculation of minimum total elapsed time.
2. 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 |

**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 five 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.**

1. solve the following LPP

minimize Z=6x1-2x2-3x3

subject to the constraints

2x1+4x2+2x3≤8

x1-2x2+3x3≤7

and 0≤x1≤2 , 0≤x2≤2 , 0≤x3≤1

1. write revised simplex method algorithm
2. Define a transportation problem and explain the problem of degeneracy. Explain a method of resolving it.
3. 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 | 103015 |
| 6 | 4 | 6 |
| 3 | 2 | 1 |
|  75 20 50 |

**Section-C**

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

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 |

1. Write the Procedure to determine the sequence for performing the jobs to minimize total elapsed time T.
2. 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 |

**P.R.Government College (Autonomous), Kakinada**

**III year B.Sc., Degree Examinations- VI Semester**

**Statistics Paper VIII Cluster B2: Operations Research-II**

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

**Objective:** The central objective of operations research is [optimization](http://mathworld.wolfram.com/Optimization.html), 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.

**List of text books:**

Operation Research by S.D.Sharma.

**Paper –VIII Cluster B2: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** |

**Statistics VIII Cluster - B2**: **operation research-II**

**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:**

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

|  |
| --- |
| P2 |
| P1 |  | I | II |
| I | 1 | 3 |
| II | 4 | 2 |

1. Explain the different methods to determine EOQ.
2. Discuss the EOQ problem with uniform demand and infinite production rate.
3. Discuss the EOQ problem with different demand rates in different cycles and infinite production rate.
4. 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*

1. Explain the probabilistic inventory model with instantaneous demand and no setup cost.
2. Explain forward and backward time computations.
3. Explain the critical path method.
4. Explain the PERT algorithm.
5. 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**

**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 five 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:**

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

|  |
| --- |
| P2 |
| P1 |  | I | II |
| I | 1 | 3 |
| II | 4 | 2 |

1. Write procedure of graphical method to solve 2Xn games.
2. 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*

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

**Section-C 2x10=20**

1. Explain the determination of EOQ with one and Two price breaks.
2. 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**

(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)

**Course Outcomes**:

After completion of this course the student is able to

1. understood econometric Model

2. estimate and test the parameters,

3. Apply the models in the relevant areas for forecasting and verification of economic theory.

**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** |

**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 any four of the following questions. Each question carries five marks.**

1. Write the limitations of econometrics.
2. Define single equation model for two variable case.
3. Explain estimation of error variance.
4. Explain multi colinearity.
5. Explain specification errors.
6. What is 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. Explain reasons for introducing error term in the model.

 10. Explain least square method of estimation.

**Section –C 2x10 = 20 M**

**Answer any two questions.**

 11. Explain general liner model.

 12. Explain testing of parameters of the models.

 13. Explain effects of multi collinearity and detecting multi collinearity.

 14. Explain remedies for autocorrelation and sources of autocorrelation

**Project Work**: ( for VI Semester )

1. 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.,

 2. The project shall be submitted as one book

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

**4. 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

III Year: Statistics Practical Paper-V & VI (SEM V)

**(With Mathematics Combination)**

##  Sampling Techniques

 Estimation of population mean, population total and variance of these estimates by

1. Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison

 between proportional and optimum allocations with SRSWOR.

1. Systematic sampling with N=nk. Comparison of systematic sampling with Stratified and SRSWOR.

 **Design of Experiments:**

1. ANOVA – one – way classification with equal number of observations
2. ANOVA - one–way classification with equal number of observations using MS Excel.
3. ANOVA Two-way classification with equal number of observations.
4. ANOVA Two-way classification with equal number of observations using

 MS Excel

1. Analysis of CRD. Analysis of RBD with and without missing observation
2. Analysis of CRD. Analysis of RBD with and without missing observation using MS Excel
3. Analysis of LSD with and without missing observation
4. Analysis of LSD with and without missing observation using MS Excel.
5. Comparison of relative efficiency of CRD with RBD and comparison of relative efficiencies of LSD with RBD and CRD.

 **Time Series Analysis:**

 13. Measurement of trend by methods of Least squares and moving averages

14. Measurement of trend by method s of Least squares and moving averages using

 MS Excel.

15. Determination of seasonal indices by methods of Ratio to moving averages,

 Ratio to trend and Link relatives.

16. Determination of seasonal indices by methods of Ratio to moving averages, Ratio

to trend and Link relatives using MS Excel.

**Index Numbers:**

 17. Computation of simple and all weighted index numbers.

 18. Computation of reversal tests.

 19. Construction of cost of living index number and wholesale index number.

 20. Construction of fixed base and chain base index numbers.

 21. Base shifting, Splicing and Deflation.

 21 Computation of all weighted indices, cost of living index number, Base

 shifting, splicing and deflation using MS Excel.

 **Vital Statistics:**

 22. Computation of various Mortality rates, Fertility rates and Reproduction rates.

 23. Construction of Life Tables and Abridged life tables.

 24. Construction of various rates, life tables and abridged life tables using MS Excel

**Demand Analysis:**

 25. Construction of Lorenz curve.

 26. Fitting of Pareto law to an income data.

 27. Construction of Lorenz curve using MS Excel.

**Note**: Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MSWord for writing inferences.

**Question paper pattern.** odd sem

**Theory:** Five Questions will be given.

 The Student has to answer three questions**. 3x12=36 M**

 **Record: 10M**

 **Viva: 4M**

**TOTAL: 50M**

Question paper pattern: even sem

**Theory:** Five Questions will be given.

 The Student has to answer three questions**. 3x12=36 M**

 **Record: 10M**

 **Viva: 4M**

**TOTAL: 50M**

B.Sc. III Year: Statistics Syllabus

**Practical Paper –VII & VIII(C1&C2) (SEM VI)**

## Statistical Quality Control

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

2. Construction of mean, range and standard deviation charts using MS Excel

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

4. Construction of p, np and c- charts with fixed and varying sample sizes using MSExcel**.**

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

 construction of their OC and ASN curves

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

construction of their OC and ASN curves using MS Excel**.**

**Reliability**

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

8. Computation of reliability for series, parallel and k out of n systems using MS Excel.

**Operations Research**

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

10. Solution of LPP by simplex method.

11. Solution of LPP by simplex method using.

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

13. Solution of an LPP using Big-M method and two phase simplex method .

14. Solution of an LPP using principal of duality and dual simplex methods.

15. Solution of an LPP using principal of duality and dual simplex methods.

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

 minimum methods and VAM and to test their optimality.

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

 minimum methods and VAM and to test their optimality.

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

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

 maximization and minimization cases),

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

 maximization and minimization cases.

21. Solution of unbalanced Assignment problem.

22. Solution of traveling salesman problem.

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

 processing of n jobs through three machines.

24. Solution of PERT & CPM.

25. Solution of graphical method in game theory

26. Solution of dominance rule in game theory.

27. Determination of EOQ in different inventory models.

28. News paper boy problem.

**Note**: Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MSWord for writing inferences.

**Question paper pattern.** odd sem

**Theory:** Five Questions will be given.

 The Student has to answer three questions**. 3x12=36 M**

 **Record: 10M**

 **Viva: 4M**

**TOTAL: 50M**

Question paper pattern: even sem

**Theory:** Five Questions will be given.

 The Student has to answer three questions**. 3x12=36 M**

 **Record: 10M**

 **Viva: 4M**

**TOTAL: 50M**