

**S. P. Mandali's**  
**Ramnarain Ruia Autonomous College**  
*(Affiliated to University of Mumbai)*



**Program: T.Y.B.Sc.**

**Program Code: Elements of Operations Research  
(RUSACOR)**

(Credit Based Semester and Grading  
System for academic year 2020–2021)

## PROGRAM OUTCOMES

| PO          | PO Description  |
|-------------|---|
|             | <b>A student completing Bachelor's/Master's Degree in science program will be able to:</b>  |
| <b>PO 1</b> | Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science. |
| <b>PO 2</b> | Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.  |
| <b>PO 3</b> | Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.   |
| <b>PO 4</b> | Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.  |
| <b>PO 5</b> | Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.                                    |
| <b>PO 6</b> | Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.   |
| <b>PO 7</b> | Follow ethical practices at work place and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.   |
| <b>PO 8</b> | Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.                                      |

## PROGRAM SPECIFIC OUTCOMES

| PSO          | Description  |
|--------------|--|
|              | <b>A student completing Bachelor's Degree in science program in the subject of Elements of Operations Research (AC) will be able to:</b>   |
| <b>PSO 1</b> | Understand, condense, visualize, analyze and interpret the data collected in daily walk of life.   |
| <b>PSO 2</b> | Understand the data generated in various scenarios of scientific, industrial, or social problems.  |
| <b>PSO 3</b> | Pursue their higher education programs leading to post-graduate or doctoral degrees.   |
| <b>PSO 4</b> | Enhance knowledge of Statistical tools.  |
| <b>PSO 5</b> | Enhance the theoretical rigor with technical skills which prepare them to become globally competitive to enter into a promising professional life after graduation.  |
| <b>PSO 6</b> | Make a pathway to a range of traditional avenues in Academia and Industry , Govt. Service, IAS, Indian Statistical/ Economic Services, Industries, Commerce, Investment Banking, Banks and Insurance Sectors, CSO and NSSO, Research Personnel/Investigator in Govt. organizations such as NCAER, IAMR, ICMR, Statistical and Economic Bureau & various PSUs., Market Research, Actuarial Sciences, Biostatistics, Demography etc. |
| <b>PSO 7</b> | Seek employment in different sectors like Stock trading, Sports, Politics, Business, Financial services and Media Industry.  |

## PROGRAM OUTLINE

| YEAR  | SEM | COURSE CODE | COURSE TITLE                        | CREDITS |
|-------|-----|-------------|-------------------------------------|---------|
| TYBSc | V   | RUSACOR501  | ELEMENTS OF OPERATIONS RESEARCH- I  | 2       |
| TYBSc | V   | RUSACORP501 | PRACTICAL BASED ON RUACOR501        | 2       |
| TYBSc | VI  | RUSACOR601  | ELEMENTS OF OPERATIONS RESEARCH –II | 2       |
| TYBSc | VI  | RUSACORP601 | PRACTICAL BASED ON RUSACOR601       | 2       |

**Course Code: RUSACOR501**

**Course Title: ELEMENTS OF OPERATIONS RESEARCH- I**

**Academic year 2020-21**

**COURSE OUTCOMES:**

| <b>COURSE OUTCOME</b> | <b>DESCRIPTION</b>  |
|-----------------------|---|
|                       | <b>A student completing this course will be able to:</b>  |
| <b>CO 1</b>           | Formulate and Solve LPP using Graphical method and mathematical methods. Perform Graphical Sensitivity        |
| <b>CO 2</b>           | Understand the concept of Duality. Perform Sensitivity Analysis.  |
| <b>CO 3</b>           | Apply network models  |
| <b>CO 4</b>           | Solve a transportation and its variants using various methods and optimise it. Solve a transshipment problem. |

**DETAILED SYLLABUS**

| <b>Course Code/ Unit</b> | <b>Unit</b>     | <b>Course/ Unit Title</b>   | <b>Credits/ Lectures</b> |
|--------------------------|-----------------|---|--------------------------|
| <b>RUSACOR501</b>        | <b>Unit I</b>   | <b>Linear programming problem (LPP) and Graphical Sensitivity:</b> <ul style="list-style-type: none"> <li>• Introduction, formation of LPP, solution of LPP using</li> <li>• Graphical method and Sensitivity</li> <li>• Simplex Method (with and without artificial variable)</li> <li>• Solution of LPP for unrestricted variables</li> <li>Two Phase Method</li> </ul>   | 15 Lectures              |
| <b>RUSACOR501</b>        | <b>Unit II</b>  | <b>Duality and Sensitivity analysis:</b> <ul style="list-style-type: none"> <li>• Concept of Duality.</li> <li>• Its use in solving L.P.P. Relationship between optimum solutions to Primal and Dual.</li> <li>• Dual Simplex Algorithm.</li> <li>• Sensitivity analysis:-[With Proof] <ul style="list-style-type: none"> <li>➤ Variation in the price vector "c".</li> <li>➤ Variation in requirement vector "b".</li> <li>➤ Addition and deletion of a new variable to the LPP.</li> <li>➤ Addition and deletion of a new constraint to the LPP.</li> </ul> </li> </ul> | 15 Lectures              |
| <b>RUSACOR501</b>        | <b>Unit III</b> | <b>Network Models:-</b> <ul style="list-style-type: none"> <li>• Objective and outline of CPM/PERT techniques.</li> </ul>   | 15 Lectures              |



|                   |                |   |             |
|-------------------|----------------|---|-------------|
|                   |                | <ul style="list-style-type: none"> <li>• Critical path computation. Slack and Three float times.</li> <li>• Probability consideration in project scheduling. Project cost analysis.</li> <li>• Minimal Spanning and Shortest Route method</li> </ul>  |             |
| <b>RUSACOR501</b> | <b>Unit IV</b> | <b>Transportation Problem:</b> <ul style="list-style-type: none"> <li>• Concept, Mathematical Formulation. Initial Basic Feasible Solution by North-West Corner Rule, Matrix Minima Method, Vogel's Approximation Method. Optimal Solution by MODI Method. Optimality test, Improvement procedure. Variants in Transportation Problem: Unbalanced, Maximization type, Restricted allocations.</li> <li>• Transshipment Problem</li> </ul> | 15 Lectures |

### DISTRIBUTION OF TOPICS FOR PRACTICALS

| <b>Course Code RUSACORP501</b> |   |
|--------------------------------|---|
| <b>Sr. No</b>                  | <b>Practicals based on course</b>                   |
| 1                              | Formulation and Graphical solution with sensitivity |
| 2                              | Two Phase Method                                    |
| 3                              | Duality And Dual Simplex                            |
| 4                              | Sensitivity Analysis                                |
| 5                              | PERT CPM 1  |
| 6                              | PERT CPM 2  |
| 7                              | Transportation Problems                             |
| 8                              | Transshipment Problem                               |

### REFERENCES

1. Kantiswaroop and Manmohan Gupta.: Operations Research 4<sup>th</sup> Edition; S Chand & Sons.
2. Sharma J K, (1989).: Mathematical Models in Operations Research ,Tata McGraw Hill Publishing Company Ltd.
3. Sharma S D.: Operations Research 11<sup>th</sup> edition, KedarNath Ram Nath& Company.
4. Taha H A.: Operations Research 6<sup>th</sup> edition, Prentice Hall of India.
5. Sharma J K,: Quantitative Techniques For Managerial Decisions: , (2001), MacMillan India Ltd.
6. Kapoor V K. :Operation research technique for management 7<sup>th</sup> edition



7. Gupta R K. :Linear Programming , 2<sup>nd</sup> Edition
8. Gupta M P and Sharma J K.: Linear programming for management : 1<sup>st</sup> edition national publishing house
9. Shrinath L S: Principles and application: Pert and CPM. :Affiliated East West press pvt ltd
10. Ingels Franklin M: Information and coding Theory : Intext Educational publishers

### Modality of Assessment

#### Theory Examination Pattern:

##### A) Internal Assessment- 40%- 40 Marks

| Sr No | Evaluation type                                 | Marks     |
|-------|---|-----------|
| 1     | Class Test/ Project / Assignment / Presentation | 20        |
| 2     | Class Test/ Project / Assignment / Presentation | 20        |
|       | <b>TOTAL</b>                                    | <b>40</b> |

##### B) External Examination- 60%- 60 Marks

###### Semester End Theory Examination:

1. Duration - These examinations shall be of **two hours** duration.
2. Theory question paper pattern:

###### Paper Pattern:

| Question | Options      | Marks     | Questions Based on |
|----------|--------------|-----------|--------------------|
| 1        | A            | 15        | Unit I             |
|          | B or C       |           |                    |
| 2        | A            | 15        | Unit II            |
|          | B or C       |           |                    |
| 3        | A            | 15        | Unit III           |
|          | B or C       |           |                    |
| 4        | A            | 15        | Unit IV            |
|          | B or C       |           |                    |
|          | <b>TOTAL</b> | <b>60</b> |                    |

**Practical Examination Pattern:****A) Internal Examination: 20%- 20 Marks**

| Particulars                            | Marks     |
|--|-----------|
| Journal                                | 5         |
| Experimental tasks/Project/Assignments | 15        |
| <b>Total</b>                           | <b>20</b> |

**B) External Examination: 80%- 80 Marks****Semester End Practical Examination:**

Duration - These examinations shall be of **THREE HOURS** duration.

| Particulars  | Paper       |
|--------------|-------------|
| EXAM         | RUSACORP501 |
| <b>Total</b> | <b>80</b>   |

**Overall Examination & Marks Distribution Pattern****Semester V**

| Course     | RUSACOR501 |          | Total |
|------------|------------|----------|-------|
|            | Internal   | External |       |
| Theory     | 40         | 60       | 100   |
| Practicals | 20         | 80       | 100   |

**Course Code: RUSACOR601**

**Course Title: ELEMENTS OF OPERATIONS RESEARCH- II**

**Academic year 2020-21**

**COURSE OUTCOMES:**

| COURSE OUTCOME | DESCRIPTION  |
|----------------|--|
|                | <b>A student completing this course will be able to:</b>             |
| CO 1           | Solve a two-sum zero-sum game.                                       |
| CO 2           | Apply decision making under various criteria.                        |
| CO 3           | Understand the various terminologies of information theory.          |
| CO 4           | Apply various methods in investment decisions                        |
| CO 5           | Understand the concept of Mutual Funds and Investment Plans          |
| CO 6           | Distinguish between security markets and futures, forwards & options |

**DETAILED SYLLABUS**

| Course Code/<br>Unit | Unit   | Course/ Unit Title   | Credits/<br>Lectures |
|----------------------|--------|--|----------------------|
| RUSACOR601           | Unit I | <p><b><u>GAME THEORY</u></b></p> <ul style="list-style-type: none"> <li>• Definitions of Two-person Zero Sum Game, Saddle Point, Value of the Game, Pure and Mixed strategy. Optimal solution of two-person zero sum games.</li> <li>• Dominance property, Derivation of formulae for (2x2) game. Graphical solution of (2xn) and (mx2) games. Solution to Game using Linear Programming Approach.</li> </ul> <p><b><u>DECISION THEORY</u></b></p> <ul style="list-style-type: none"> <li>• Decision making under uncertainty: Laplace criterion, Maximax (Minimin) criterion, Maximin (Minimax) criterion, Hurwicz <math>\alpha</math> criterion, Minimax Regret criterion.</li> <li>• Decision making under risk: Expected Monetary Value criterion, Expected Opportunity Loss criterion, EPPI, EVPI. Bayesian Decision rule for Posterior analysis.</li> <li>• Decision tree analysis.</li> </ul> | 15<br>Lectures       |



|            |          |   |             |
|------------|----------|---|-------------|
| RUSACOR601 | Unit II  | <b>Information theory</b> <ul style="list-style-type: none"> <li>• Introduction. Fundamental Theorem of Information Theory.</li> <li>• Measures of Information. Properties of Entropy Function.</li> <li>• Communication System. Memory less channel, Binary Symmetric channel, channel matrix, joint, marginal and conditional Entropies.</li> <li>• <math>H(X, Y) = H(X/Y) + H(Y) = H(Y/X) + H(X)</math> <math>H(X) \geq H(X/Y)</math></li> <li>• Channel capacity, Efficiency and Redundancy, Encoding, Shannon–Fano Encoding Procedure.</li> </ul>  | 15 Lectures |
| RUSACOR601 | Unit III | <b>Mathematics of Finance, Mutual Funds</b> <ul style="list-style-type: none"> <li>• Accumulated Value and Present Value of Single Payment and Series of Payments.</li> <li>• Application to investment decisions <ul style="list-style-type: none"> <li>➤ Payback Method</li> <li>➤ Net present value Method (NPV),</li> <li>➤ Internal Rate of Return Method</li> </ul> </li> </ul> <b>Mutual Funds (M.F)</b> <ul style="list-style-type: none"> <li>• Introduction, Types of M.F, Net Asset Value (NAV), entry, exit loads.</li> <li>• Classification of M.Fs. option plans given by M.Fs. Evaluation of M.Fs</li> <li>• Advantages and Disadvantages of M.Fs</li> <li>• Simple problems on calculation of Net income after considering entry load, dividend, change in NAV and exit load.</li> <li>• Introduction to:-Investment Plans</li> <li>• Averaging of price under the <ul style="list-style-type: none"> <li>➤ Systematic Investment Plan (SIP)</li> <li>➤ Systematic Withdrawal Plan (SWP)</li> <li>➤ Systematic Transfer Plan (STP)</li> </ul> </li> </ul> | 15 Lectures |
| RUSACOR601 | Unit IV  | <b>Securities Market, Futures &amp; Options</b> <ul style="list-style-type: none"> <li>• Concept of Index, Nifty-Fifty, Sensex, Dow Jones Index, Hang Seng Index</li> <li>• Concept of stock market, share, face value, market value, dividend, equity share, preferential share, bonus and right shares.</li> <li>• Initial Public Offer (IPO), Earning Per Share (EPS), Price Earnings Ratio (PE ratio), Price to Book Ratio (P/B Ratio), Beta value, Volatility index. Simple problems.</li> </ul> <b>Options terminology:-</b> <ul style="list-style-type: none"> <li>• Index option, Stock option, American option, European option.</li> <li>• Strike price, Expiry date, Call option, Put option, Buyer of an option, Writer of an option.</li> </ul> <b>Futures &amp; Options:-</b>   | 15 Lectures |



|  |  |  |
|--|--|--|
|  | <ul style="list-style-type: none"> <li>• Introduction to F &amp; O market.</li> <li>• Difference between Forward and Futures contracts.</li> <li>• Factors influencing the market.</li> <li>• Hedging, Arbitrage, Open interest</li> </ul> |  |
|--|--|--|

### **DISTRIBUTION OF TOPICS FOR PRACTICALS**

| <b>Course Code RUSACORP501</b> |                                   |
|--------------------------------|-----------------------------------|
| <b>Sr. No</b>                  | <b>Practicals based on course</b> |
| 1                              | Game Theory                       |
| 2                              | Decision Theory 1                 |
| 3                              | Decision Theory 2                 |
| 4                              | Information Theory                |
| 5                              | Investment Analysis               |
| 6                              | Mutual Funds                      |
| 7                              | Market Analysis,                  |
| 8                              | Futures And Options               |

### **REFERENCES**

1. Kantiswarup and Manmohan Gupta.: Operations Research 4<sup>th</sup> Edition; S Chand & Sons.
2. Richard Bronson.: Schaum Series book in O.R 2<sup>nd</sup> edition Tata Mcgraw Hill Publishing Company Ltd.
3. Sasieni Maurice Arthur Yaspan and Lawrence Friedman: Operations Research: Methods and Problems John Wiley & Sons.
4. Sharma J K: Mathematical Models in Operations Research ,Tata McGraw Hill Publishing Company Ltd. (1989)
5. Harvey M. Wagner: Principles of Operations Research with Applications to Management Decisions 2<sup>nd</sup> Edition, Prentice Hall of India Ltd.
6. Sharma S D.: Operations Research 11<sup>th</sup> edition, Kedar Nath Ram Nath & Company.
7. Taha H A.: Operations Research 6<sup>th</sup> edition, Prentice Hall of India.

8. Sharma J K, : Quantitative Techniques For Managerial Decisions, MacMillan India Ltd. (2001)
9. Kapoor V K. : Operation research technique for management 7<sup>th</sup> edition
10. Shankaran Sunder : Indian mutual funds handbook - A guide for industry professionals and intelligent investors
11. Hull John C: Options futures and other derivatives: –7<sup>th</sup> edition. Prentice hall
12. Hull John C : Fundamentals of futures of Options and Market : 6<sup>th</sup> edition
13. Ingles Franklin M: Information and coding Theory : Intext Educational Publishers

### Modality of Assessment

#### Theory Examination Pattern:

##### A) Internal Assessment- 40%- 40 Marks

| Sr No | Evaluation type                                 | Marks     |
|-------|---|-----------|
| 1     | Class Test/ Project / Assignment / Presentation | 20        |
| 2     | Class Test/ Project / Assignment / Presentation | 20        |
|       | <b>TOTAL</b>                                    | <b>40</b> |

##### B) External Examination- 60%- 60 Marks

#### Semester End Theory Examination:

1. Duration - These examinations shall be of **two hours** duration.
2. Theory question paper pattern:

#### Paper Pattern:

| Question | Options | Marks | Questions Based on |
|----------|---------|-------|--------------------|
| 1        | A       | 15    | Unit I             |
|          | B or C  |       |                    |
| 2        | A       | 15    | Unit II            |
|          | B or C  |       |                    |
| 3        | A       | 15    | Unit III           |
|          | B or C  |       |                    |
| 4        | A       | 15    | Unit IV            |



|  |              |           |  |
|--|--------------|-----------|--|
|  | B or C       |           |  |
|  | <b>TOTAL</b> | <b>60</b> |  |

**Practical Examination Pattern:**

**A) Examination: 20%- 20 Marks**

| Particulars                            | Marks     |
|--|-----------|
| Journal                                | 5         |
| Experimental tasks/Project/Assignments | 15        |
| <b>Total</b>                           | <b>20</b> |

**B) External Examination: 80%- 80 Marks**

**Semester End Practical Examination:**

Duration - These examinations shall be of **THREE HOURS** duration.

| Particulars  | Paper              |
|--------------|--------------------|
| <b>EXAM</b>  | <b>RUSACORP601</b> |
| <b>Total</b> | <b>80</b>          |

**Overall Examination & Marks Distribution Pattern**

**Semester VI**

| Course     | RUSACOR601 |          | Total |
|------------|------------|----------|-------|
|            | Internal   | External |       |
| Theory     | 40         | 60       | 100   |
| Practicals | 20         | 80       | 100   |

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