

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



**Syllabus for**

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

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

(Credit Based Semester and Grading  
System for academic year 2021–2022)

## 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 2021-22****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 2021-22**

**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/ Unit	Unit	Course/ Unit Title	Credits/ 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 Lectures
RUSACOR601	Unit	Information theory	15



	II	<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>	Lectures
RUSACOR601	Unit III	<p><b>Mathematics of Finance, Mutual Funds</b></p> <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> <p><b>Mutual Funds (M.F)</b></p> <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	<p><b>Securities Market, Futures &amp; Options</b></p> <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> <p><b>Options terminology:-</b></p> <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> <p><b>Futures &amp; Options:-</b></p> <ul style="list-style-type: none"> <li>• Introduction to F &amp; O market.</li> </ul>	15 Lectures

	<ul style="list-style-type: none"> <li>• Difference between Forward and Futures contracts.</li> <li>• Factors influencing the market.</li> <li>• Hedging, Arbitrage, Open interest</li> </ul>	
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### DISTRIBUTION OF TOPICS FOR PRACTICALS

Course Code RUSACORP501	
Sr. No	Practicals based on course
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:

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##### 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:

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	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
EXAM	RUSACORP601
<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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