

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



Syllabus for
Program: T.Y.B.Sc.
Program Code For Semester 5:
Elements of Operations Research (RUSACOR)
Program Code For Semester 6:
Data Analysis Using Python(RUSACDA)

(Credit Based Semester and Grading
System for academic year 2022–2023)

PROGRAM OUTCOMES

PO	PO Description
	A student completing Bachelor's/Master's Degree in science program will be able to:
PO 1	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.
PO 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
PO 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
PO 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
PO 5	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.
PO 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
PO 7	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.
PO 8	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
	A student completing Bachelor's Degree in science program in the subject of Elements of Operations Research (AC) (Semester 5) / Data Analysis using Python(AC)(Semester 6) will be able to:
PSO 1	Understand the data generated in various scenarios of scientific, industrial or social problems.
PSO 2	Apply Statistical tools for data analysis.
PSO 3	Pursue their higher education programs leading to post-graduate and/or doctoral degrees in Statistics, Data Science, Business Analytics, Biostatistics, Econometrics, Management Studies.
PSO 4	Compete globally to enter into promising careers.
PSO 5	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.
PSO 6	Seek employment or self-employment in different sectors like Stock trading, Pharmaceutical sector, Sports, Politics, Business, Financial services and Media Industry.

PROGRAM OUTLINE

YEAR	SEMESTER	COURSE CODE	COURSE TITLE	CREDITS
TYBSc	V	RUSACOR501	ELEMENTS OF OPERATIONS RESEARCH- I	2
TYBSc	V	RUSACORP501	PRACTICAL BASED ON RUACOR501	2
TYBSc	VI	RUSACDA601	DATA ANALYSIS WITH PYTHON	2
TYBSc	VI	RUSACDAP601	PRACTICAL BASED ON RUSACDA601	2

Course Code: RUSACOR501**Course Title: ELEMENTS OF OPERATIONS RESEARCH****Academic year 2022-23****COURSE OUTCOMES:**

COURSE OUTCOME	DESCRIPTION
	A student completing this course will be able to:
CO 1	Use two-phase method and dual simplex method and perform Sensitivity Analysis.
CO 2	Measure entropy, efficiency and redundancy of the communication system
CO 3	Understand and evaluate various methods in investment decisions in security and derivative markets

DETAILED SYLLABUS

Course Code/ Unit	Unit	Course/ Unit Title	Credits/ Lectures
RUSACOR501	Unit I	Overview of Linear Programming Problem, Sensitivity Analysis and Duality: <ul style="list-style-type: none"> • Overview of LPP: Formulation, Solution by graphical and Simplex Method • Introduction and Graphical method of Sensitivity • Sensitivity analysis using Simplex Method [With Proof] <ul style="list-style-type: none"> ➤ Variation in the price vector “c”. ➤ Variation in requirement vector “b”. ➤ Addition and deletion of a new variable to the LPP. ➤ Addition and deletion of a new constraint to the LPP • Solution of LPP for unrestricted variables using Two Phase Method • Concept of Duality. • Its use in solving L.P.P. Relationship between optimum solutions to Primal and Dual. • Dual Simplex Algorithm 	15 Lectures
RUSACOR501	Unit II	Information theory <ul style="list-style-type: none"> • Introduction. Fundamental Theorem of Information Theory. • Measures of Information. Properties of Entropy Function. 	15 Lectures

		<ul style="list-style-type: none"> • Communication System. Memory less channel, Binary Symmetric channel, channel matrix, joint, marginal and conditional Entropies. • $H(X, Y) = H(X/Y) + H(Y) = H(Y/X) + H(X)$ $H(X) \geq H(X/Y)$ <p>Channel capacity, Efficiency and Redundancy, Encoding, Shannon–Fano Encoding Procedure.</p>	
RUSACOR501	Unit III	<p>Securities Market and Derivatives</p> <ul style="list-style-type: none"> • Concept of Index, Nifty-Fifty, Sensex, Dow Jones Index, Hang Seng Index • Concept of stock market, share, face value, market value, dividend, equity share, preferential share, bonus and right shares. • 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. <p>Options terminology:</p> <ul style="list-style-type: none"> • Index option, Stock option, American option, European option. • Strike price, Expiry date, Call option, Put option, Buyer of an option, Writer of an option. <p>Futures & Options:</p> <ul style="list-style-type: none"> • Introduction to F & O market. • Difference between Forward and Futures contracts. • Factors influencing the market. Hedging, Arbitrage, Open interest 	15 Lectures
RUSACOR501	Unit IV	<p>Mathematics of Finance, Mutual Funds</p> <ul style="list-style-type: none"> • Accumulated Value and Present Value of Single Payment and Series of Payments. • Application to investment decisions <ul style="list-style-type: none"> ➤ Payback Method ➤ Net present value Method (NPV), ➤ Internal Rate of Return Method <p>Mutual Funds (M.F)</p> <ul style="list-style-type: none"> • Introduction, Types of M.F, Net Asset Value (NAV), entry, exit loads. • Classification of M.Fs. option plans given by M.Fs. Evaluation of M.Fs • Advantages and Disadvantages of M.Fs • Simple problems on calculation of Net income after considering entry load, dividend, change in NAV and exit load. • Introduction to:-Investment Plans • Averaging of price under the <ul style="list-style-type: none"> ➤ Systematic Investment Plan (SIP) ➤ Systematic Withdrawal Plan (SWP) ➤ Systematic Transfer Plan (STP) 	15 Lectures

DISTRIBUTION OF TOPICS FOR PRACTICAL

Course Code RUSACORP501	
Sr. No	Practical based on course
1	Graphical solution with sensitivity
2	Two Phase Method
3	Duality And Dual Simplex
4	Sensitivity Analysis using Simplex Method
5	Information Theory
6	Security Market
7	Derivatives
8	Investment Analysis and Mutual Funds

REFERENCES

1. Kantiswaroop and Manmohan Gupta.: Operations Research 4th 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 11th edition, KedarNath Ram Nath& Company.
4. Taha H A.: Operations Research 6th 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 7th edition
7. Gupta R K. :Linear Programming , 2nd Edition
8. Gupta M P and Sharma J K.: Linear programming for management : 1st 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
	TOTAL	40

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	Any TWO subparts out of Three subparts	16	Unit I
2	Any TWO subparts out of Three subparts	14	Unit II
3	Any TWO subparts out of Three subparts	16	Unit III
4	Any TWO subparts out of Three subparts	14	Unit IV
	TOTAL	60	

Practical Examination Pattern:

A) Internal Examination: 40%- 40 Marks

Particulars	Marks
Journal	10
Experimental tasks/Project/Assignments	30
Total	40

B) External Examination: 60%- 60 Marks**Semester End Practical Examination:**

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

Particulars	Paper
EXAM	RUSACORP501
Total	60

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

Course	RUSACOR501		
	Internal	External	Total
Theory	40	60	100
Practical	40	60	100

Course Code: RUSACDA601

Course Title: DATA ANALYSIS WITH PYTHON

Academic year 2022-23

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
	A student completing this course will be able to:
CO 1	Basics of Python programming
CO 2	Write codes for Statistical functions/ tests using Python
CO 3	Application of Python to statistics

Learning Outcomes:

Students should be able to

- Handle data files in Python
- Describe Numpy, Pandas, Strings, List, Tuples and Dictionaries in Python
- Express different decision making statements and Functions
- Draw various types of graphs and diagrams using python
- Apply python to small sample test and large sample test

DETAILED SYLLABUS

Unit		Title: Paper IV – Data Analysis using Python	No. of lectures
Unit 1		Introduction to PYTHON Software	15
	1.1	Python Setup Python Arithmetic: Basic operators	
	1.2	Basic Data Types, Variables, Lists, Tuples and Strings, Dictionaries and sets Derive new variable/function Summary statistics	
Unit 2		Numpy, Pandas and Data Exploration	15
	2.1	numpy arrays: Creating arrays creating n-dimensional arrays using np.array and array operations(indexing and slicing, transpose, mathematical operations) pandas data frames: Creating series and data frames and Operations on series and data frames Reading and writing data: From and to Excel and CSV files. Merging, sorting, sub-setting of Data files	
	2.2	Control statements: if, if-else, if-elif, while loop, for loop Defining functions: def statement Text data operations: len, upper, lower, slice, replace, contains, Frequency Tables	
Unit 3		Descriptive statistics and Statistical Methods	15
	3.1	Plotting: using “matplotlib”(Histograms, Box plots, Scatter plot, Barplot, Line plot) Descriptive Statistics: mean, median, mode, min, max, quantile, standard deviation , variance, skew, kurtosis, correlation Probability distributions: (using scipy.stats) computations of probabilities, Cumulative probabilities, quantiles and drawing random sample using functions for following distributions:	
	3.2	Simulation from distributions, Binomial, Poisson, Hyper geometric, Normal, Exponential, Uniform, Graphs of pmf/pdf by varying parameters for above distributions	
Unit 4		Inferential Statistics	15
	4.1	Hypothesis testing and T-Tests: (using scipy.stats, math) Large sample test , ttest_1sample, ttest_ind(2 sample test),	

		ttest_rel(paired), Type I and Type II error	
	4.2	Chi-square tests: (using scipy.stats) chisquare, chi2 ANOVA: (using scipy.stats) f_oneway	
	4.3	Linear regression: from sklearn import linear model and use linear model. Linear regression function.	

DISTRIBUTION OF TOPICS FOR PRACTICALS

Course Code RUSACDAP601	
Sr. No	Practical based on course
1	Python basics on data types
2	Descriptive Statistics
3	Probability Distributions: Discrete
4	Probability Distributions: Continuous
5	Data visualization
6	Testing of Hypothesis
7	ANOVA
8	Regression analysis

REFERENCES

- Python for Data Analysis by O'Reilly Media (Second Edition) (2017)
- How to think like a computer scientist learning with Python by Allen Downey. (2002)
- Python for Data Analysis by Armando Fernandgo. (2017)

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
	TOTAL	40

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	Any TWO subparts out of Three subparts	16	Unit I
2	Any TWO subparts out of Three subparts	14	Unit II
3	Any TWO subparts out of Three subparts	16	Unit III
4	Any TWO subparts out of Three subparts	14	Unit IV
	TOTAL	60	

Practical Examination Pattern:**A) Internal Examination: 40%- 40 Marks**

Particulars	Marks
Journal	10
Experimental tasks/Project/Assignments	30
Total	40

B) External Examination: 60%- 60 Marks**Semester End Practical Examination:**

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

Particulars	Paper
EXAM	RUSACORP601
Total	60

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

Course	RUSACOR601		
	Internal	External	Total
Theory	40	60	100
Practical	40	60	100
