

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. 	15 Lectures

		<ul style="list-style-type: none"> Measures of Information. Properties of Entropy Function. 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) 	15 Lectures



		<ul style="list-style-type: none"> ➤ Systematic Withdrawal Plan (SWP) ➤ Systematic Transfer Plan (STP) 	
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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
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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		Total
	Internal	External	
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
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: – 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 crating 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
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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:

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
