Programme: B.Sc.				Semester: V	
Course: **ELEMENTS OF OPERATIONS RESEARCH I**				Course Code: BH.USACOR501	
Teaching Scheme				**Evaluation Scheme (Theory)**	
Lecture (Periods per week)	**Practical (Periods per week per batch)**	**Tutorial (Periods per week per batch)**	**Credits (Theory +Practical)**	**Continuous Internal Assessment (CIA)**	**End Semester Examination (ESE)**
4	4	--	2+2	**Marks: 40**	**Marks: 60**

Pre-requisites: nil

Course Objectives:

1. **To introduce students to various deterministic optimization techniques.**
2. **To introduce students to Mathematical Economics.**
3. **Students will be able to quantify the relationship between entropy and information.**
4. **Students will be able to solve basic problems in financial mathematics.**

Course Outcomes:

1. **Students will be able to solve examples and Practical use of Mathematical Economics.**
2. **Students will be able to quantify the relationship between entropy and information.**
3. **Students will be able to understand the basics of the finance and security market.**

Detailed Syllabus: (per session plan)

Unit	Description	Periods
I	**Mathematical Economics:** Behaviour of Demand and Supply, Demand functions. Cost and Revenue functions. The elasticity of a function, Elasticity of (i) Demand (ii) Supply. • Normal conditions of (i) demand (ii) Supply with respect to cost. Features of perfect competition. • Monopoly (including effects of taxation and subsidy), Duopoly. • Production function. Euler's theorem linear homogeneous production functions, Cobb-Douglas production function, CES production function. • The elasticity of substitution. Input-Output Analysis a) The Inter-Industry Accounting System, b) Assumptions, c) Closed Model, d) Dynamic Model.	15
II	**INFORMATION THEORY** Introduction. Fundamental Theorem of Information Theory. Measures of Information. Properties of Entropy Function. Communication System. Memory less channel, Binary Symmetric channel, channel matrix, joint, marginal and conditional Entropies.	15

	$H(X, Y)=H(X/Y) + H(Y) = H(Y/X) + H(X)$ $H(X) \geq H(X/Y)$ Channel capacity, Efficiency and Redundancy, Encoding, Shannon – Fano Encoding Procedure.	
III	MATHEMATICS OF FINANCE –I Simple and compound interest, Present value, Annuities, Present value of Annuities with all variations/types. Application to investment decisions (1) Payback Method, (2) Net present value Method (NPV), (3) Internal Rate of Return Method. (4) Average Rate of Return	15
IV	MATHEMATICS OF FINANCE-II Securities Market: 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). Index, nifty, beta value. Simple problems. Mutual Funds (M.F.): 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 (i) Averaging of price under the systematic Investment Plan (SIP), (ii) Systematic Withdrawal Plan (SWP), (iii) Systematic Transfer Plan (STP)	15
	Total	**60**

Reference Books:

1. Damodar Gujrathi, Sangeetha S: Basic Econometrics, Fourth edition, McGraw-Hill Companies.
2. Greene William: Econometric Analysis, First edition, McMillan Publishing Company.
3. Ingels Franklin M : Information and Coding Theory : Intext Educational Publishers.
4. Shankaran Sunder : Indian mutual funds hands book. A guide for industry professionals and intelligent investors.
5. Mathematics for Finance: An Introduction to Financial Engineering (Springer Undergraduate Mathematics Series), by Marek Capiński, Tomasz Zastawniak**.**
6. Introduction To Information Theory**,** by C. E. Shannon.

List of Topics for the practicals: BASED ON THEORY DISTRIBUTION OF TOPICS FOR PRACTICALS

SEMESTER-V COURSE CODE USACOR5P1

Sr.No.	**Topic of the Practical**	**No. of pract.**
1	Mathematical Economics - I	1
2	Mathematical Economics - II	1
3	Information Theory	1
4	Mathematics of Finance -I	**1**
5	Investment Analysis	**1**

6	Securities	**1**
7	Mutual Fund	**1**

Details of Conduct of Practical Examination (Evaluation Scheme): At the end of the semester, examinations of 3 hours duration and 80 marks shall be held for each course. 20 marks for laboratory work and journal (80+20 =100)

Details of Continuous Internal Assessment (CIA)

For continuous internal assessment, it is proposed to hold one class test (for 20 marks) and one assignment /project/survey conduction & data presentation using

data visualization techniques, learnt in a course to be given (for 20 marks) on topics which they may explore on their own (under due guidance by teacher).

Any other information: Batch size of practical batch/Tutorial batch as prescribed by University of Mumbai.

Programme: B.Sc.				Semester: VI	
Course: **ELEMENTS OF OPERATIONS RESEARCH II**				Course Code: BH.USACOR601	
Teaching Scheme				**Evaluation Scheme (Theory)**	
Lecture (Periods per week)	**Practical (Periods per week per batch)**	**Tutorial (Periods per week per batch)**	**Credits (Theory +Practical)**	**Continuous Internal Assessment (CIA)**	**End Semester Examination (ESE)**
4	4	--	2+2	**Marks: 40**	**Marks: 60**

Pre-requisites: nil

Course Objectives:

1. **To introduce students to Statistical Quality control and Acceptance sampling.**
2. **To introduce students to Python programming language and Python IDEs.**
3. **Students will be able to use the Python programming language for data manipulation, scientific computing and visualisation.**

Course Outcomes:

1. **Students will be able to solve problems based on Quality control.**
2. **Students will be able to solve problems based on Acceptance Sampling.**
3. **To acquaint the students with Python programming language and Python IDEs.**
4. **Student will learn Python programming language that includes libraries for data manipulation, scientific computing and visualisation.**

Detailed Syllabus: (per session plan)

Unit	Description	Periods
1	**Control Charts:** Principles of control. Process quality control of attributes and variables. Xbar, R, p, c, np charts, their uses. p-chart with variable sample size. Problems involving setting up standards for future use.	15
2	**Acceptance Sampling:** Lot Acceptance Sampling Plans by Attributes: Single Sampling Plans (without curtailment). OC function and OC curves. AQL, LTPD, ASN, ATI, AOQ, Consumer's risk, Producer's risk. Double Sampling Plan (without curtailment). OC function and OC curves. Introduction to Six sigma limits	15

3	**Basics Of Python:** Introduction to Python programming language and its various IDEs. Use of Python Jupyter IDEs. Python concepts: Expressions, values, types, variables, programs & algorithms. Data structures: List, set, dictionary (mapping), tuple, graph (from a third-party library) List slicing (sublist), list comprehension (shorthand for a loop) Mutable and immutable data structures Distinction between identity and (abstract) value (About data or How to import & export data in python) Testing and debugging: Test design, coverage, & adequacy Debugging strategies: divide & conquer, the scientific method	15
4	**Statistical Analysis and Visualization in Python** Descriptive Statistics: Summary statistics, Correlation and simple regression. Statistical hypothesis testing: Normality Check, parametric and non - parametric tests. One-way and Two-way ANOVA. Visualization (graphing/plotting results): Diagrammatic and Graphical representation of data using different libraries in Python (Matplotlib and Seaborn).	15
	Total	**60**

Reference Books:

1. E.L. Grant. (2nd edition) McGraw Hill, 1988.: Statistical Quality Control
2. Duncan. (3rd edition) D. Taraporewala sons & company.: Quality Control and Industrial Statistics
3. Bertrand L. Hansen, (1973), Prentice Hall of India Pvt. Ltd.: Quality Control: Theory and Applications
4. Douglas Montgomery, Arizona State University. John Wiley & Sons, Inc. (6th Edition): Statistical Quality Control
5. Gupta S.C., Kapoor V.K., Fundamentals of Applied Statistics, Sultan Chand &Sons
6. Think Python, 2nd edition, by Allen B. Downey
7. Introduction to Computation and Programming Using Python, third Edition, by John V. Guttag

List of Topics for the practicals:

USACOR6P2 : PRACTICALS BASED ON THEORY
DISTRIBUTION OF TOPICS FOR PRACTICALS

	SEMESTER-VI COURSE CODE USACOR6P2	
Sr.No	Topic of the Practical	No. of Practs
1	Control Charts For Variables	1
2	Control Charts For Attributes	1

3	Single Sampling Plan	1
4	Double Sampling Plan	1
5	Basics Of Python - I	1
6	Descriptive Statistics with Python	1
7	Data Visualization in Python	1

Details of Conduct of Practical Examination (Evaluation Scheme): At the end of the semester, examinations of 3 hours duration and 80 marks shall be held for each course. 20 marks for laboratory work and journal (80+20 =100). Practical Examination based on Python to be conducted in Computer Laboratory.

Details of Continuous Internal Assessment (CIA)

For continuous internal assessment, it is proposed to hold one class test (for 20 marks) and one assignment /project/survey conduction & data presentation using data visualization techniques, learnt in a course to be given (for 20 marks) on topics which they may explore on their own (under due guidance by teacher).

Any other information: Batch size of practical batch/Tutorial batch as prescribed by University of Mumbai.