Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal
Course of Study and Scheme of Examination
B.E. Information Technology
SEMESTER – VIII

Revised Syllabus and Scheme of Examination Effective from July 2010-11

S. No.	Course Category	Course Code (New)	Name of Course	Hours Per week			CREDITS	Distribution of Marks					
								Theory Exam	Practical Block	Internal Assessment			Total
										MST	TW	Total	
				L	T	P	C	I	II			III	I+II+III
1	DC-24	IT 801	Information Security	3	1	2	6	100	50	20	30	50	200
2	DC-25	IT 802	Soft Computing	3	1	2	6	100	50	20	30	50	200
3	DCO(E)-III	Refer table below	Elective III	3	1	0	4	100	--	20	--	20	120
4	DCO(E)-IV	Refer table below	Elective-IV	3	1	0	4	100	--	20	--	20	120
5	DC-26	IT 803	Major Project-II	0	0	8	8	--	100	--	200	200	300
6	NECC-11	IT 804	Self Study	0	0	2	2	--	--	--	30	30	30
7	NECC-12	IT 805	Seminar/Group Discussion etc.	0	0	2	2	--	--	--	30	30	30
Total				**12**	**4**	**16**	**32**	**400**	**200**	**80**	**320**	**300**	**1000**

* Student will undertake industrial training in the summer break, after VI semester in assessed in VII semester,
MST-Mid Semester Test, **TW**- Term Work.

ELLECTIVE-I							
IT 830	Component based Software Engineering	IT 831	Real Time System	IT 832	Image Processing	IT 833	Artificial Intelligence
ELLECTIVE-II							
IT 840	Data Mining and Warehousing	IT 841	Cyber law and Forensic	IT 842	Adhoc Network	IT 843	Operation Research

Note :- 1. Minimum strength of **Ten Students** is required to offer an Elective in the College in a particular Academic Session.
2. Choice of Elective Course ones made for an examination cannot be changed for future examinations.

Course Contents

Category of Course	Course Title	Course Code	Credits-6C			Theory Paper (ES)
			L	T	P	Max. Marks-100
Departmental Core DC-24	Information Security	IT 801	3	1	2	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Information Security

Unit I: Basic of Cryptography, secret key cryptography, Types of attack, Substitution ciphers, Transposition ciphers, block ciphers and steam ciphers, Confusion and Diffusion, Data encryption standard, round function, modes of operation, cryptanalysis, brute force attack, Security Goals (Confidentiality, Integrity, Availability).

Unit II: Public key Cryptography, Modulo arithmetic, Greatest common divisor, Euclidean algorithm, RSA algorithm, hash function, attack on collision resistance, Diffie hellman key exchange, Digital signature standard, elliptic curve cryptography.

Unit III: Authentication: One way Authentication, password based, certificate based, Mutual Authentication ,shared secret based, Asymmetric based, Authentication and key agreement, centralized Authentication, eavesdropping, Kerberos, IP security overview:- security association & Encapsulating security payload ,tunnel and transfer modes, internet key exchange protocol, Secure Socket Layer(SSL), Transport Layer Security (TLS).

Unit IV: Software vulnerabilities: Phishing Attacks, buffer overflow vulnerability, Format String attack, Cross Site Scripting, SQL injection Attacks, Email security:- Security services of E-mail ,Establishing keys, Privacy ,Authentication of the source, Message integrity ,Non-Repudiation, Viruses, Worms, Malware.

Unit V: Web Issue: Introduction, Uniform Resource Locator/uniform resource identify, HTTP, Cookies, Web security problem, Penetration Testing, Firewalls:- functionality, Polices and Access Control, Packet filters, Application level gateway, Encrypted tunnel, Security architecture, Introduction to intrusion detection system.

References:-

- Bernard Menezes, " Network Security and Cryptography", CENGAGE Learning.
- Charlie Kaufman, " Network Security", PHI.
- Forouzan, "Cryptography & Network Security", TMH
- Randy Weaver, " Network Infrastructure Security", Cengage Learning.
- Atual Kahate, " Cryptography and Network Security", TMH.
- William Stalling, " Cryptography and Network security", Pearson.

List of Experiment:-

- Study of Network Security fundamentals - Ethical Hacking, Social Engineering practices.
- System threat attacks - Denial of Services.
- Sniffing and Spoofing.
- Web Based Password Capturing.
- Virus and Trojans.
- Anti-Intrusion Technique – Honey pot.
- Symmetric Encryption Scheme – RC4.
- Block Cipher – S-DES, 3-DES.
- Asymmetric Encryption Scheme – RSA.
- IP based Authentication.

Course Contents

Category of Course	Course Title	Course Code	Credits-6C			Theory Paper (ES)
			L	T	P	
Departmental Core DC-25	Soft Computing	IT 802	3	1	2	Max. Marks-100 Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Soft Computing

Unit I: Introduction to Neural Network: Concept, biological neural network, evolution of artificial neural network, McCulloch-Pitts neuron models, Learning (Supervise & Unsupervise) and activation function, Models of ANN-Feed forward network and feed back network, Learning Rules- Hebbian, Delta, Perceptron Learning and Windrow-Hoff, winner take all.

Unit II: Supervised Learning: Perceptron learning,- Single layer/multilayer, linear Separability, Adaline, Madaline, Back propagation network, RBFN. Application of Neural network in forecasting, data compression and image compression.

Unit III: Unsupervised learning: Kohonen SOM (Theory, Architecture, Flow Chart, Training Algorithm) Counter Propagation (Theory , Full Counter Propagation NET and Forward only counter propagation net), ART (Theory, ART1, ART2). Application of Neural networks in pattern and face recognition, intrusion detection, robotic vision.

Unit IV: Fuzzy Set: Basic Definition and Terminology, Set-theoretic Operations, Member Function, Formulation and Parameterization, Fuzzy rules and fuzzy Reasoning, Extension Principal and Fuzzy Relations, Fuzzy if-then Rules, Fuzzy Inference Systems. Hybrid system including neuro fuzzy hybrid, neuro genetic hybrid and fuzzy genetic hybrid, fuzzy logic controlled GA. Application of Fuzzy logic in solving engineering problems.

Unit V: Genetic Algorithm: Introduction to GA, Simple Genetic Algorithm, terminology and operators of GA (individual, gene, fitness, population, data structure, encoding, selection, crossover, mutation, convergence criteria). Reasons for working of GA and Schema theorem, GA optimization problems including JSPP (Job shop scheduling problem), TSP (Travelling salesman problem), Network design routing, timetabling problem. GA implementation using MATLAB.

References:-

- S.N. Shivnandam, “Principle of soft computing”, Wiley.
- S. Rajshekaran and G.A.V. Pai, “Neural Network , Fuzzy logic And Genetic Algorithm”, PHI.
- Jack M. Zurada, “Introduction to Artificial Neural Network System” JAico Publication.
- Simon Haykins, “Neural Network- A Comprehensive Foudation”
- Timothy J.Ross, “Fuzzy logic with Engineering Applications”, McGraw-Hills 1.

List of Experiment:-

- Form a perceptron net for basic logic gates with binary input and output.
- Using Adaline net, generate XOR function with bipolar inputs and targets.
- Calculation of new weights for a Back propagation network, given the values of input pattern, output pattern, target output, learning rate and activation function.
- Construction of Radial Basis Function Network.
- Use of Hebb rule to store vector in auto associative neural net.
- Use of ART algorithm to cluster vectors.
- Design fuzzy inference system for a given problem.
- Maximize the function $y = 3x^2 + 2$ for some given values of x using Genetic algorithm.
- Implement Travelling salesman problem using Genetic Algorithm.
- Optimisation of problem like Job shop scheduling using Genetic algorithm.

Course Contents

Category of Course	Course Title	Course Code	Credits-4 C			Theory Paper (ES)
			L	T	P	Max. Marks-100
DCO(E)-III	Component Based Software Engineering	IT 830	3	1	0	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Component Based Software Engineering

Unit I: Introduction to Component Based Development: Definition of Software Component and its Elements, The Component Industry Metaphor, Component Models and Component Services: Concepts and Principles, An Example Specification for Implementing a Temperature Regulator Software Component.

Unit II: Case for Components: The Business Case for Software Components, COTS Myths and Other Lessons Learned in Component-Based Software Development, Roles for Component-Based Development, Common High Risk Mistakes in Component-Based Software Engineering, CBSE Success Factors: Integrating Architecture, Process, and Organization

Unit III: Software Component Infrastructure: Software Components and the UML, Component Infrastructures: Placing Software Components in Context, Business Components, Components and Connectors: Catalysis Techniques for Defining Component Infrastructures, an Open Process for Component-Based Development, Designing Models of Modularity and Integration.

Unit IV: Management of CBD: Measurement and Metrics for Software Components, The Practical Reuse of Software Components, Selecting the Right COTS Software: Why Requirements are important, Build vs. Buy, Software Component Project Management Processes, The Trouble with Testing Software Components, Configuration Management and Component Libraries, The Evolution, Maintenance and Management of Component-Based Systems

Unit V: Component Technologies: Overview of the CORBA Component Model, Transactional COM+ Designing Scalable Applications, The Enterprise JavaBeans Component Model, Choosing Between COM+, EJB, and CCM, Software Agents as Next Generation Software Components,

References:-

- Component Software ,Clemens Szyperski, Addison-Wesley Professional; 2 edition ,, 2002, ISBN-10: 0201745720, ISBN-13: 978-0201745726
- Component-Based Software Engineering: Putting the Pieces Together George T. Heineman, William T.Councill, Addison-Wesley Professional, 2001 ISBN 1`0: 0201704854,ISBN-13:9780201704853
- G Sudha Sadasioam, “Computer-based Technology”, Wiley India, 1st Edition 2008.

Course Contents

Category of Course	Course Title	Course Code	Credits-4 C			Theory Paper (ES)
			L	T	P	Max. Marks-100
DCO(E)-III	Real Time Systems	IT 831	3	1	0	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Real Time Systems

Unit I: Introduction to real time systems, structure, issues, task classes, performance measures for real time systems-their properties, traditional measures, cost functions and hard deadlines. Estimation of program run time-source code analysis, accounting for pipelining and caches.

Unit II: Task Assignment and Scheduling-Rate monotonic scheduling algorithm, Preemptive earliest deadline first algorithm, Using primary and alternative tasks. Task Assignment-Utilization balancing algorithm, next fit for RM(Rate monitoring) scheduling, Bin packing assignment algorithm for EDF, Myopic offline scheduling(MOS) algorithm, Focused addressing and bidding(FAB) algorithm, Buddy strategy, Assignment with precedence conditions.

Unit III: Programming Languages & Tools- Desired language characteristics,, data typing, control structures, hierarchical decomposition, packages, run time error handling, Overloading and genetics, Multitasking, Low level programming, Fex, Euclid, Run time support.

Unit IV: Real time Communication-Communication media, network topologies. Protocols-Contention based, Token based, Stop-and-Go, Polled bus, Hierarchical round robin, deadline based.

Unit V: Fault Tolerance Techniques- Fault, fault types, fault detection, fault and error containment, hardware and software redundancy, time redundancy, information redundancy. Reversal checks, Malicious or Byzantine failures, Integrated failure handling.

References:-

- C.M Krishna and Kang G. Shin, Real Time Systems, TMH
- Stuart Bennelt, Real time computer control and introduction, Pearson education, 2003
- Jane W.S Liu, Real time systems, Mc-Graw Hill

Course Contents

Category of Course	Course Title	Course Code	Credits-4C			Theory Paper (ES)
			L	T	P	Max. Marks-100
DCO(E)-III	Image Processing	IT 832	3	1	0	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Image Processing

Unit I: Image representation, fundamental steps in image processing, image model. Sampling & quantization. Neighbors of a pixel, connectivity and distance measures. Basic transformations and perspective transformations. Two dimensional Fourier transform, Discrete Fourier transform and their properties. Fast Fourier transform, Walsh Transform, Hadamard transform and Discrete Cosine transform.

Unit II: Image Enhancement: Intensity transformations, histogram processing, Image subtraction, image averaging, Spatial filtering-smoothing and sharpening filters, frequency domain filtering methods-low pass filtering, high pass filtering, median filtering.

Unit III: Image compression: Redundancy and its types. Image compression model, variable length coding, bit plane coding, constant area coding, run length coding, lossless and lossy predictive coding, transform coding.

Unit IV: Image restoration and Segmentation: Degradation model, effect of diagonalisation on degradation, algebraic approach. Detection of discontinuities by point, line and edge detection. Edge linking, graph theoretic techniques, thresholding techniques, region oriented segmentation.

Unit V: Representation & Description: Chain codes, polygonal approximations, signatures, boundary segments, skeleton, boundary descriptors, shape descriptors regional descriptors, image morphology-dilation, erosion, opening, closing, thickening, thinning, skeleton, pruning,, hit or miss transform.

References:-

- R.C Gonzalez & Richard E Wood, "Digital Image Processing" ,Addison Wesley Publishing
- Anil K Jain, "Fundamentals of Digital image processing". PHI.
- Sonka, Hlavac, Boyle, "Digital image processing and computer vision", cengage learning, India Edition.
- B Chanda, D. Dutta Majumder, "Digital image Processing and Analysis", PHI.

Course Contents

Category of Course	Course Title	Course Code	Credits-4C			Theory Paper (ES)
			L	T	P	Max. Marks-100
DCO(E)-III	Artificial Intelligence	IT 833	3	1	0	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Artificial Intelligence

Unit I: Meaning and definition of artificial intelligence, Various types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search. Techniques, other Search Techniques like hill Climbing, Best first Search. A* algorithm, AO* algorithms etc, and various types of control strategies.

Unit II: Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving, inferencing, monotonic and non-monotonic reasoning.

Unit III: Probabilistic reasoning, Baye's theorem, semantic networks, scripts, schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Unit IV: Game playing techniques like minimax procedure, alpha-beta cut-offs etc, planning, Study of the block world problem in robotics, Introduction to understanding and natural languages processing.

Unit V: Introduction to learning, Various techniques used in learning, introduction to neural networks, applications of neural networks, common sense, reasoning, some example of expert systems.

References:-

- Rich E and Knight K, “Artificial Intelligence”, TMH, New Delhi.
- Nelsson N.J., “Principles of Artificial Intelligence”, Springer Verlag, Berlin.

Course Contents

Category of Course	Course Title	Course Code	Credits-4C			Theory Paper (ES)
			L	T	P	Max. Marks-100
DCO(E)-IV	Data Mining and Warehousing	IT 840	3	1	0	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Data Mining and Warehousing

Unit I: Data Warehousing: Need for data warehousing , Basic elements of data warehousing, Data Mart, Data Warehouse Architecture, extract and load Process, Clean and Transform data, Star ,Snowflake and Galaxy Schemas for Multidimensional databases, Fact and dimension data, Partitioning Strategy-Horizontal and Vertical Partitioning.

Unit II: Data Warehouse and OLAP technology, Multidimensional data models and different OLAP Operations, OLAP Server: ROLAP, MOLAP, Data Warehouse implementation ,Efficient Computation of Data Cubes, Processing of OLAP queries, Indexing data.

Unit III: Data Mining: Data Preprocessing ,Data Integration and Transformation, Data Reduction, Discretizaion and Concept Hierarchy Generation , Basics of data mining, Data mining techniques, KDP (Knowledge Discovery Process), Application and Challenges of Data Mining, Introduction of Web Structure Mining, Web Usage Mining, Spatial Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.

Unit IV: Mining Association Rules in Large Databases: Association Rule Mining, Single-Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, Fp-Growth Algorithm, Time series mining association rules, latest trends in association rules mining.

Unit V: Classification and Clustering Distance Measures, Types of Clustering, K-Means Algorithm, Decision Tree Induction, Bayesian Classification, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Partitioning methods, Outlier Analysis.

Reference:-

- P.Ponnian, “Data Warehousing Fundamentals”, John Weliey.
- Han,Kamber, “Data Mining Concepts & Techniques”, M.Kaufman.
- M.H.Dunham, “Data Mining Introductory & Advanced Topics”, Pearson Education.
- Ralph Kimball, “The Data Warehouse Lifecycle Tool Kit”, John Wiley.
- M.Berry , G.Linoff, “Master in Data Mining”, John Wiley.
- W.H.Inmon, “Building the Data Ware houses”, Wiely Dreamtech.
- E.G. Mallach , “The Decision Support & Data Warehouse Systems”, TMH

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Category of Course	Course Title	Course Code	Credits-4C			Theory Paper (ES)
			L	T	P	
DCO(E)-IV	Cyber Law & Forensic	IT 841	3	1	0	Max. Marks-100 Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Cyber Law & Forensic

Unit I: Cyber world: an overview, internet and online resources, security of information, digital signature, intellectual property (IP), historical background of IP, IPR governance, National patent offices, the world intellectual property organization (WIPO).

Unit II: Introduction about the cyber space, cyber law, regulation of cyber space, scope of cyber laws: e-commerce; online contracts; IPRs (copyright, trademarks and software patenting), e-taxation; e-governance and cyber crimes, cyber law in India with special reference to Information Technology Act, 2000.

Unit III: Introduction to computer and cyber crimes. Cyber crimes and related concepts, distinction between cyber crimes and conventional crimes, Cyber criminals and their objectives. Kinds of cyber crimes cyber stalking; cyber pornography, forgery and fraud, crime related to IPRs, cyber terrorism; computer vandalism etc. Cyber forensics, computer forensics and the law, forensic evidence, computer forensic tools.

Unit IV: Regulation of cyber crimes, Issues relating to investigation, issues relating to jurisdiction, issues relating to evidence, relevant provisions under Information Technology Act 2000, Indian penal code, pornography Act and evidence Act etc.

Unit V: Copyright issues in cyberspace: linking, framing, protection of content on web site, international treaties, trademark issues in cyberspace: domain name dispute, cyber squatting, uniform dispute resolution policy, computer software and related IPR issues.

References:-

- Nelson, Phillips, “Computer Forensics and Investigations”, Cengage Learning India.
- Vinod V. Sople, “Managing Intellectual Property” PHI Learning Private Limited.
- Dr.R.K.Tiwari P.K.Sastri,K.V. Ravikumar, “Computer crime and Computer Forensics”, First Edition 2002, Select publishers.
- NIIT, Understanding Forensics in IT, PHI Learning.
- IT Act 2000 Details www.mit.gov.in
- Simpson, “Ethical Hacking and Network Defense”, Cengage Learning India

Course Contents

Category of Course	Course Title	Course Code	Credits-4C			Theory Paper (ES)
			L	T	P	
DCO(E)-IV	Ad Hoc Networks	IT 842	3	1	0	Max. Marks-100 Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Ad Hoc Networks

Unit I: Introduction :Introduction-Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, GSM, GPRS, PCS, WLAN and UMTS, Components of Packet Radios, Routing in PRNETs, Route calculation, Pacing techniques, Ad Hoc Wireless Networks, Heterogeneity in Mobile Devices, Wireless Sensor Networks, Traffic Profiles, Types of Ad Hoc Mobile Communications, Types of Mobile Host Movements, Challenges Facing Ad Hoc Mobile Networks.

Unit II: Ad Hoc wireless MAC protocols- Introduction, Synchronous and asynchronous MAC protocols, Problem in Ad Hoc channel access, Receiver-initiated and sender-initiated MAC protocols, Existing Ad Hoc MAC protocols, Ad Hoc Routing Protocols- Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols: Table-Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Cluster Switch Gateway Routing (CSGR), Source-Initiated On-Demand Approaches - Ad Hoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Signal Stability Routing (SSR) Location-Aided Routing (LAR), Power-Aware Routing (PAR), Zone Routing Protocol (ZRP).

Unit III: Multicast routing In Ad Hoc Networks : Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols, Mesh-Based Multicast Routing Protocols, Summary of Tree-and Mesh-Based Protocols - Energy-Efficient Multicasting, Multicasting with Quality of Service Guarantees, Application Dependent Multicast Routing, Comparisons of Multicast Routing Protocols.

Unit IV: Transport Layer, Security Protocols : Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Unit V: QoS and Energy Management : Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classifications of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks, Energy Management in Ad Hoc Wireless Networks – Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.

References Books:-

- C. Siva Ram Murthy and B.S. Manoj “Ad Hoc Wireless Networks: Architectures and Protocols”, Pearson Education.
- C.K. Toh, “Ad Hoc Mobile Wireless Networks: Protocols and Systems”, Pearson Education.
- George Aggelou, “Mobile Wireless Networks”, Tata McGraw- Hill.
- Charles E. Perkins, Ad Hoc Networking, Pearson Education.

Course Contents

Category of Course	Course Title	Course Code	Credits-4C			Theory Paper (ES)
			L	T	P	Max. Marks-100
DCO(E)-IV	Operational Research	IT 843	3	1	0	Min. Marks-35 Duration-3 Hrs.

Branch : Information Technology, VIII Semester
Course: Operational Research

Unit I: Introduction to Linear Programming, Solution by Graphical and Simplex Method, Concept of Degeneracy and Duality, Artificial Variable Techniques : Big-M Method, Two Phase Method , Solution of Transportation Problems by North-West Corner Method, Lowest Cost Entry Method, Vogel's Method, Non-Degenerate Basic Feasible Solution, Assignment Model

Unit II: Integer Programming: Relationship to Linear Programming, Branch and Bound, Cutting Plane Techniques: General Cutting Planes , Dynamic Programming: Introduction, Bellman's Principle of optimality, Applications of dynamic programming, Critical Path Method, PERT

Unit III: Replacement, Introduction, Replacement of items that deteriorate with time when money value is not counted and counted, Replacement of items that fail completely, group replacement. Games Theory: Introduction, Minimax (maximin), Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, 2 X 2 games, dominance principle– m X 2 & 2 X n games.

Unit IV: Inventory : Introduction , Single item – Deterministic models, Purchase inventory models with one price break and multiple price breaks shortages are not allowed , Stochastic models demand may be discrete variable or continuous variable, Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

Unit V: Waiting Lines: Introduction, Single Channel, Poisson arrivals, exponential service times with infinite population and finite population models, Multi channel, Poisson arrivals, exponential service times with infinite population single channel Poisson arrivals: (M/M/1 : ∞ /FCFS), (M/M/1 : N/FCFS), (M/E_k/1 : ∞/FCFS), (M/M/S : ∞/FCFS)

References:-

- Ravindran , "Operation Research: Principles and practice", Wiley India , 2ed.
- S.D.Sharma-Kedar Nath Ramnath & Co, "Operations Research"
- J.K.Sharma, "Operation Research", MacMilan.
- Taha, "Introduction to O.R", PHI.
- Rattindra P. Sen, "Operations Research: Algorithms and applications", PHI Learning.
- Purna Chandra, "Optimization in Engineering", Scitech publication.