ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.E. SYSTEMS ENGINEERING AND OPERATIONS RESEARCH
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

1. Enable students to appreciate, review and understand the foundations in computing systems and operations research.
2. Enable students to use optimization techniques to enhance systems and to manage enterprise resources using current tools, frameworks and reusable resources.
3. Prepare students to critically analyse existing literature in the area of specialization and develop innovative and research oriented solutions to tackle the identified problems.
4. Enable students to continuously pursue multidisciplinary learning as professional engineers and scientists, to effectively communicate technical information, to function productively in teams and to develop and apply engineering solutions within a global, societal and environmental context.

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PROGRAMME OUTCOMES (PO):

On Successful completion of this program, the students will:

a. Have the capability to apply mathematical knowledge, algorithmic principles, and computer science theory in the modelling and design of computer based systems of varying complexity.
b. Critically analyse a problem, identify, formulate and solve problems in any engineering field using operations research principles, considering current and future trends.
c. Design a system, component or process to meet desired needs within the realistic constraints such as economic, environmental, social, ethical, health, safety and sustainability in the field of systems engineering.
d. Acquire leadership and managerial capabilities in decision making, analysing the alterable and managing the assets.
e. Acquire knowledge in the area of computer networks and database management systems with necessary practical experience.
f. Communicate effectively, both orally and by preparing quality technical documents, with wide range of audiences and function effectively in teams to accomplish common goals.
g. Critically analyse existing literature in the area(s) of specialization and develop innovative and research oriented methodologies to tackle the identified gaps.
h. Demonstrate an ability to engage in life-long learning for professional development.
i. Have ability to develop systems using software tools.
j. Demonstrate the knowledge gained in the selected areas of systems engineering and operations research.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAM EDUCATIONAL OBJECTIVES	PROGRAM OUTCOMES									
	A	B	C	D	E	F	G	H	I	J
1	√	√	√						√	
2	√	√	√	√	√				√	√
3		√					√	√		√
4			√	√	√	√		√	√	√

			A	B	C	D	E	F	G	H	I	J
YEAR 1	SEM 1	Advanced Mathematics for Computing	✓	✓	✓				✓			✓
		Data Structures and Algorithms	✓	✓	✓				✓		✓	✓
		Networking Technologies	✓	✓			✓		✓	✓	✓	✓
		Linear Programming and applications	✓	✓	✓	✓					✓	✓
		Principles of Systems Engineering	✓	✓	✓	✓				✓	✓	✓
		Data Structures and Algorithms Lab	✓	✓	✓				✓		✓	✓
	SEM 2	Advanced Database Management Systems	✓	✓			✓		✓	✓	✓	✓
		Supply Chain Management	✓	✓	✓	✓				✓	✓	✓
		Advances in Operating Systems	✓	✓	✓	✓				✓	✓	✓
		Security Principles and Practices	✓	✓			✓		✓	✓	✓	✓
		Elective I										
		Elective II										
		Advanced Database Management Systems Lab	✓	✓			✓		✓	✓	✓	✓
		Professional Practices			✓			✓	✓			
YEAR 2	SEM 3	Non Linear Programming	✓	✓	✓	✓					✓	✓
		Elective III Elective IV										
		Elective V										
		Project Work (Phase I)	✓	✓	✓		✓	✓	✓	✓	✓	✓
	SEM 4	Project Work (Phase II)	✓	✓	✓		✓	✓	✓	✓	✓	✓

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.E. SYSTEMS ENGINEERING AND OPERATIONS RESEARCH
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI

SEMESTER - I

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA7153	Advanced Mathematics for Computing	FC	4	4	0	0	4
2.	SO7101	Data Structures and Algorithms	PC	3	3	0	0	3
3.	CP7155	Networking Technologies	PC	3	3	0	0	3
4.	SO7102	Linear Programming and Applications	PC	5	3	0	2	4
5.	SO7103	Principles of Systems Engineering	PC	3	3	0	0	3
PRACTICALS								
6.	SO7111	Data Structures and Algorithms Lab	PC	4	0	0	4	2
			TOTAL	**22**	**16**	**0**	**6**	**19**

II SEMESTER

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	SO7251	Advanced Database Management Systems	PC	3	3	0	0	3
2.	SO7201	Supply Chain Management	PC	3	3	0	0	3
3.	CP7153	Advances in Operating Systems	PC	3	3	0	0	3
4.	CP7254	Security Principles and Practices	PC	3	3	0	0	3
5.		Elective I	PE	3	3	0	0	3
6.		Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	SO7211	Advanced Database Management Systems Lab	PC	4	0	0	4	2
8.	CP7162	Professional Practices	EEC	2	0	0	2	1
			TOTAL	**24**	**18**	**0**	**6**	**21**

III SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	SO7301	Non Linear Programming	PC	5	3	0	2	4
2.		Elective III	PE	3	3	0	0	3
3.		Elective IV	PE	3	3	0	0	3
4.		Elective V	PE	3	3	0	0	3
PRACTICALS								
5.	SO7311	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**26**	**12**	**0**	**14**	**19**

IV SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	SO7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS:71

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.E. SYSTEMS ENGINEERING AND OPERATIONS RESEARCH (PART-TIME)
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULUM I TO VI SEMESTERS (PART TIME)

SEMESTER - I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA7151	Advanced Mathematics for Computing	FC	4	4	0	0	4
2.	SO7101	Data Structures and Algorithms	PC	3	3	0	0	3
3.	SO7102	Linear Programming and Applications	PC	5	3	0	2	4
PRACTICALS								
4.	SO7111	Data Structures and Algorithms Lab	PC	4	0	0	4	2
			TOTAL	**16**	**10**	**0**	**6**	**13**

II SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	SO7251	Advanced Database Management Systems	PC	3	3	0	0	3
2.	SO7201	Supply Chain Management	PC	3	3	0	0	3
3.	CP7153	Advances in Operating Systems	PC	3	3	0	0	3
PRACTICALS								
4.	SO7211	Advanced Database Management Systems Lab	PC	4	0	0	4	2
			TOTAL	**13**	**9**	**0**	**4**	**11**

III SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	SO7103	Principles of Systems Engineering	PC	3	3	0	0	3
2.	CP7155	Networking Technologies	PC	3	3	0	0	3
3.		Elective I	PE	3	3	0	0	3
PRACTICALS								
4.	CP7162	Professional Practices	EEC	2	0	0	2	1
			TOTAL	**11**	**9**	**0**	**2**	**10**

IV SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	CP7254	Security Principles and Practices	PC	3	3	0	0	3
2.		Elective II	PC	3	3	0	0	3
3.		Elective III	PE	3	3	0	0	3
			TOTAL	**9**	**9**	**0**	**0**	**9**

V SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	SO7301	Non Linear Programming	PC	5	3	0	2	4
2.		Elective IV	PE	3	3	0	0	3
3.		Elective V	PE	3	3	0	0	3
PRACTICALS								
4.	SO7311	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**23**	**9**	**0**	**14**	**16**

VI SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	SO7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS:71

FOUNDATION COURSES (FC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Advanced Mathematics for Computing	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Data Structures and Algorithms	PC	3	3	0	0	3
2.		Advances in Operating System	PC	3	3	0	0	3
3.		Linear Programming and Applications	PC	3	3	0	0	3
4.		Principles of Systems Engineering	PC	3	3	0	0	3
5.		Networking Technologies	PC	3	3	0	0	3
6.		Data Structures and Algorithms Lab	PC	3	3	0	0	3
7.		Advanced Database Management Systems	PC	3	3	0	0	3
8.		Supply Chain Management	PC	3	3	0	0	3
9.		Advanced Database Technologies Lab	PC	3	3	0	0	3
10.		Non-Linear Programming	PC	3	3	0	0	3
11.		Security Principles and Practices	PC	3	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CP7251	Cloud Computing Technologies	PE	3	3	0	0	3
2.	SO7007	Parallel Programming	PE	3	3	0	0	3
3.	CP7076	Data Mining Techniques	PE	3	3	0	0	3
4.	SO7005	Java and Web Technology	PE	3	3	0	0	3
5.	SO7001	Adhoc and Wireless Sensor Networks	PE	3	3	0	0	3
6.	CP7093	Soft Computing	PE	3	3	0	0	3
7.	CP7072	Big Data Analytics	PE	3	3	0	0	3
8.	CP7154	Multi Core Architectures	PE	3	3	0	0	3
9.	SO7008	System Modelling and Simulation	PE	3	3	0	0	3
10.	SW7251	Software Testing and Quality Assurance	PE	3	3	0	2	4
11.	SO7004	Dynamic Programming	PE	3	3	0	0	3
12.	SO7003	Design Patterns	PE	3	3	0	0	3
13.	SO7006	Mobile Web Application Development	PE	3	3	0	0	3
14.	CP7077	Database Administration and Tuning	PE	3	3	0	0	3
15.	SO7002	Business Process Management	PE	3	3	0	0	3
16.	CP7083	Internet of Things in the Cloud	PE	3	3	0	0	3
17.	CP7089	Real Time Systems Design	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Professional Practices	EEC	2	0	0	2	1
2.		Project Work Phase I	EEC	12	0	0	12	6
3.		Project Work Phase II	EEC	24	0	0	24	12

MA7153 ADVANCED MATHEMATICS FOR COMPUTING L T P C
4 0 0 4

OBJECTIVES:

- To understand the basics of random variables and standard distributions
- To understand the arrival process and various queueing and server models
- To appreciate the use of simulation techniques
- To apply testing of hypothesis to infer outcome of experiments
- To apply mathematical linear programming techniques to solve constrained problems.

UNIT I RANDOM VARIABLES 12

Random variables – Bernoulli, Binomial, Geometric, Poisson, Uniform, Exponential, Erlang and Normal distributions – Function of a Random variable - Moments, Moment generating function.

UNIT II QUEUING MODELS 12

Poisson Process – Markovian Queues – Single and Multi-server Models – Little's formula – Machine Interference Model – Steady State analysis – Self Service Queue.

UNIT III SIMULATION 12

Discrete Event Simulation – Monte – Carlo Simulation – Stochastic Simulation – Applications to Queuing systems.

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Estimation of parameters - Statistical hypothesis – Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion.

UNIT V LINEAR PROGRAMMING 12

Formulation – Graphical solution – Simplex method – Two phase method -Transportation and Assignment Problems.

TOTAL :60 PERIODS

OUTCOMES:

Upon completion of the course, the student will be able to

- Identify the type of random variable and distribution for a given operational conditions/scene
- Study and Design appropriate queuing model for a given problem/system situation
- Simulate appropriate application/distribution problems
- Differentiate/infer the merit of sampling tests.
- Formulate and find optimal solution in the real life optimizing/allocation/assignment problems involving conditions and resource constraints.

REFERENCES:

1. Johnson, R.A. Miller and Freund's," Probability and Statistical for Engineers, Prentice Hall of India Pvt., Ltd., New Delhi, Seventh Edition, 2005.
2. Hamdy A. Taha, "Operations Research: An Introduction", Prentice Hall of India Pvt., Ltd. New Delhi, Eighth Edition, 2007.
3. Jay L. Devore," Probability and Statistics for Engineering and the Sciences", Cengage Learning, Seventh Edition, 2009.
4. Ross. S.M., "Probability Models for Computer Science", Academic Press, 2002.
5. Winston, W.L., "Operations Research", Thomson – Brooks/Cole, Fourth Edition, 2003.
6. Gross D. and Harris C.M., "Fundamentals of Queuing Theory", John Wiley and Sons, New York, 1998.
7. J.Medhi," Stochastic models of Queuing Theory", Academic Press, Elsevier, Amsterdam, 2003

SO7101	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge in data structures and algorithms.
- To apply appropriate data structures and algorithm in program designs.

UNIT I BASICS OF C++ PROGRAMMING 9

Fundamental Data Types – Expressions and Casting – Control Flow – Functions – Pointers – Arrays – Structures – Scope and Namespaces – Classes and Objects – Constructors and Destructors – Memory Allocation – Class Friends and Members.

UNIT II OBJECT ORIENTED DESIGN USING C++ 9

Object Oriented Design Goals and Principles – Inheritance and Polymorphism – Multiple Inheritance – Interfaces and Abstract Classes – Templates – Exceptions – Standard Template Library.

UNIT III ALGORITHMS 9

Mathematical Induction – Asymptotic Notations – Properties of Big-O Notation – Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – NP Completeness – NP-Hard – Recurrence equations – Solving Recurrence Equations – Linear Recursion – Higher order recursion – Memory Representation of Multi-dimensional Arrays – Time-Space Tradeoff.

UNIT IV STACKS AND QUEUES 9

Stacks – Array based Stack implementation – Recursion and Function call implementations – Queues – Array based Queue implementation – Search data structures – Search and Sorting algorithms.

UNIT V LINKED LISTS AND APPLICATIONS 9

Linked Lists – Singly Linked Lists – Double Ended Queues – Singly Linked List based Stack implementation – Doubly Linked List based De-queue implementation – Problem formulation and solution implementation for Data structure and algorithm related applications.

TOTAL = 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Acquire the ability to select better algorithms based on complexity and efficiency.
- Master a variety of advanced data structures and their implementations.
- Apply and implement learned algorithm design techniques and data structures to solve problems.

REFERENCES

1. Bjarne Stroustrup, “The C++ Programming Language”, Addison Wesley, 4th Ed, 2013.
2. E.Horowitz, S.Sahni and Dinesh Mehta, “Fundamentals of Data structures in C++”, University Press, 2007.
3. E.Horowitz, S.Sahni and S.Rajasekaran, “Computer Algorithms/C++”, Second Edition, University Press, 2007.
4. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Ed, PHI Learning, 2009.

CP7155	NETWORKING TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn about integrated and differentiated services architectures
- To understand the working of wireless network protocols
- To study the evolution made in cellular networks
- To get familiarized with next generation networks

UNIT I NETWORK ARCHITECTURE AND QoS 9

Overview of TCP/IP Network Architecture – Integrated Services Architecture – Approach – Components – Services – Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services.

UNIT II WIRELESS NETWORKS 9

IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security – IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security – Profiles

UNIT III CELLULAR NETWORKS 9

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS – Channel Structure on the Air Interface – UTRAN –Core and Radio Network Mobility Management – UMTS Security

UNIT IV 4G NETWORKS 9

LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks –Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10) - 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G

UNIT V SOFTWARE DEFINED NETWORKS 9

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types – Virtualization – Data Plane – I/O – Design of SDN Framework

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Identify the different features of integrated and differentiated services
- Demonstrate various protocols of wireless and cellular networks
- Discuss the features of 4G and 5G networks

REFERENCES:

1. William Stallings, “High Speed Networks and Internets: Performance and Quality of Service”, Prentice Hall, Second Edition, 2002.
2. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014.
3. Savo G Glisic, “Advanced Wireless Networks – 4G Technologies”, John Wiley & Sons, 2007.
4. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015.
5. Martin Sauter, “Beyond 3G - Bringing Networks, Terminals and the Web Together: LTE, WiMAX, IMS, 4G Devices and the Mobile Web 2.0”, Wiley, 2009.
6. Naveen Chilamkurti, Sherali Zeadally, Hakima Chaouchi, “Next-Generation Wireless Technologies”, Springer, 2013.
7. Erik Dahlman, Stefan Parkvall, Johan Skold, “4G: LTE/LTE-Advanced for Mobile Broadband”, Academic Press, 2013.
8. Thomas D.Nadeau and Ken Gray, “SDN – Software Defined Networks”, O’Reilly Publishers, 2013.

SO7102	LINEAR PROGRAMMING AND APPLICATIONS	L	T	P	C
		3	0	2	4

OBJECTIVES

- To introduce the basic concepts and tools in optimization.
- To explore the advanced concepts vertically to get clear understanding and to apply the concepts in engineering and scientific applications.

UNIT I INTRODUCTION 9

Formulation and Graphical Solutions – Solution of Maximization Model –Solution of Minimization Model – Simplex method – Degeneracy – Unbounded Solution –Infeasible Solution – Alternative Optima.

UNIT II ADVANCED LINEAR PROGRAMMING 9

BIG-M method –Two–Phase method – Special cases in the Simplex method –Transportation and Assignment Problems – Revised Simplex Method –Duality in Linear Programming Problems – Dual Simplex method – Bounded variable technique

UNIT III SENSITIVITY ANALYSIS 9

Sensitivity Analysis or Post Optimality Analysis – Changes in the Right hand side – Objective function – Changes affecting feasibility – Changes affecting optimality.

UNIT IV INTEGER PROGRAMMING 9

Knapsack Problem –Cutting plane algorithm – Branch and bound programming – Mixed integer Programming – travelling salesperson problem.

UNIT V CASE STUDIES AND TOOLS 9

Case Studies – Production Planning – Manpower planning – Solving LP problems using TORA/LINDO/LINGO.

TOTAL: 75 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Conceptually understand and emerge toward optimization.
- Optimize effectively through LP methods and tools.

REFERENCES:

1. Hamdy A.Taha, “Operations Research - An Introduction”, Prentice Hall, Ninth Edition, 2010.
2. J.K.Sharma, “Operations Research Theory and applications”, Macmillan, 5th Edition, 2013.
3. Hiller F.S, Liberman G.J, “Introduction to Operations Research”, 9th Edition, McGrawHill, Inc., 2009
4. Ronald L.Rardin, “Optimization in Operations Research”, Pearson Education, Asia, 1997.
5. Jit.S.Chandran, Mahendran P.Kawatra, KiHoKim, “Essentials of Linear Programming”, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
6. Harvey M. Wagner, “Principles of Operations Research with applications to Managerial Decisions”, PHI Learning Private Limited, 2nd Edition, 2009

SO7103	PRINCIPLES OF SYSTEMS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts related to systems engineering with design, analysis, game theory and decision making analysis.

UNIT I SYSTEMS ENGINEERING PROCESSES 9

Systems Engineering – Basic Definitions – System Life cycles – Phases – Steps – Formulation of Issues: – Problem Identification – Scoping – Bounding – Problem definition – Identification of needs – Alterable – Constraints – Value System Design: – Objectives and objective measures – Functional decomposition and analysis – Tools:- Objective hierarchies – Trees – Cross interaction matrix – Functional analysis approaches – Node tree – Context diagram – System decomposition.

UNIT II ANALYSIS OF ALTERNATIVES 9

Generation of Alternatives / System synthesis – Identification of activities and activity measures – Uncertain / Imperfect information – Cross-impact analysis – Hierarchical inference – Logical reasoning inference – Coupled / Uncoupled events – Baye's Model – Event Trees – Probability Trees – Causal loop diagrams – Influence diagrams.

UNIT III STRUCTURAL MODEL & SYSTEM DYNAMICS 9

Structural modeling: – System Dynamics – Structural models – Tree structures – Reachability graph and matrix – System Dynamic Models: – Population models – Urban dynamics – World dynamic models – Economic models.

UNIT IV OPERATIONS RESEARCH AND SYSTEMS ENGINEERING 9

Operations Research – Operations Research and Systems Engineering – Operations research methods – Generating and Screening Actions – Multiple-criteria Decision Making – Multiple participant decision Making – Heuristic Programming

UNIT V DECISION MAKING AND DECSION ANALYSIS 9

Types of decisions: – Descriptive – Prescriptive – Normative – Decision assessment effort types: – Under certainty – Probabilistic uncertainty – Probabilistic imprecision – Information imperfection – Conflict and Co-operation – Prescriptive normative decision assessments – Utility theory

TOTAL = 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will:

- Have the capability to design and analyze the system.
- Acquire decision making ability.
- Be familiar in system engineering design.

REFERENCES:

1. Andrew P.Sage and James E.Armstrong, "Systems Engineering", Wiley InterScience Publications, 2004.
2. Andrew P.Sage, William B.Rouse, "Handbook of Systems Engineering and Management", John Wiley and Sons, 2011.
3. Alexander Kossiakoff, William N.Sweet, "Systems Engineering: Theory & Practice", John Wiley & Sons, 2002.
4. James N.Martin, "Systems Engineering Guidebook: A Process for Developing Systems and Products", CRC Press, 1997.

SO7111 DATA STRUCTURES AND ALGORITHM LAB

L	T	P	C
0	0	4	2

OBJECTIVES

- To acquire the knowledge of object oriented programming.
- To learn the usage of stack and queues.
- To understand the usage of linked list structures for stack and queues.
- To learn the working of various searching and sorting algorithms.

EXPERIMENTS USING C++:

1. Implementation of multi-dimensional structures such as matrices, triangular matrices, diagonal matrices, etc into a one dimensional array (at least two).
2. Implementation of the following Object-oriented principles:
    a. Inheritance.
    b. Multiple Inheritance.
3. Implementation of the following using Arrays:
    a. Stack.
    b. Queue.
4. Implementation of the following using Linked List:
    a. Stack.
    b. Queue.
5. Implementation of recursion and function call implementation using stacks.
6. Implementations of De-queue using Doubly Linked List.
7. Implementations of Searching techniques.
8. Implementations of the following Sorting algorithms:
    a. Quick Sort.
    b. Merge Sort.

TOTAL : 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Design and implement data structures extensively.
- Design algorithms using abstract data structure and various searching and sorting algorithms to solve real-life problems.
- Design and develop efficient algorithms with minimum complexity.

SO7251 ADVANCED DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the underlying principles of Relational Database Management System.
- To understand and implement the advanced features of DBMS.
- To develop database models using distributed databases.
- To implement and maintain an efficient database system using emerging trends.

UNIT I RELATIONAL MODEL **9**

Data Model – Types of Data Models: – Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Structured Query Language – Database Normalization – Transaction Management.

UNIT II PARALLEL AND DISTRIBUTED DATABASES 9

Centralized and Client-Server Architectures – Parallel Systems – Distributed Systems – Parallel Databases – I/O Parallelism – Inter- and Intra-Query Parallelism – Inter- and Intra-operation Parallelism – Distributed Database Concepts: – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.

UNIT III XML DATABASES 9

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.

UNIT IV MULTIMEDIA DATABASES 9

Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.

UNIT V CURRENT ISSUES 9

Active Databases – Deductive Databases – Data Warehousing – Data Mining – Database Tuning – Database Security

TOTAL = 45 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to:

- Design and implement relational databases, distributed databases, XML databases and multimedia databases.
- Implement the concept of database connectivity with the applications.

REFERENCES

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Addison-Wesley, 2011.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006.
4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
5. V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt. Ltd., 2001.

SO7201 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiarize the management of supply chain assembly and role of IT in it.
- To learn about the capability of Inventory management, planning and decision making.

UNIT I INTRODUCTION 9

Introduction to SCM – Development chain – Global Optimization – Managing uncertainty and risk – Evolution of SCM – Issues in SCM – Decision phase – Supply chain drivers and obstacles – SCM complexity.

UNIT II FORECASTING 9

Demand forecasting – Role of forecasting-Characteristics – Basic Approach – Time series method – Measures of forecast error – Aggregate planning in SCM – Aggregate planning using Linear Programming – Excel – Supply and demand planning in supply chain – Managing supply – Demand – Implementing solution.

UNIT III INVENTORY MANAGEMENT AND RISK POOLING 9

Introduction to inventory – Forms of inventory – Single stage control – Economic Order Quantity (EOQ)– Lot size model – Demand uncertainty – Single period model – Review Policies – Risk Pooling – Centralized v/s Decentralized systems – Practical issues – Approaches for future demand.

UNIT IV NETWORK PLANNING AND PROCUREMENT STRATEGY 9

Network design – Inventory positioning and logistics and logistics co-ordination – Resource allocation – Transportation in a supply chain – Outsourcing benefits and risks – Buy/make Decisions – Procurement strategies – E-Procurement.

UNIT V INFORMATION TECHNOLOGY IN SUPPLY CHAIN 9

Enabling supply chain through IT –ERP vendor platforms – Service oriented architecture (SOA) – RFID

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Explain the management of supply chain assembly and role of IT in it.
- Capability of Inventory management, planning and decision making

REFERENCES:

1. Sunil Chopra, Peter Mendil, "Supply chain Management – Strategy, Planning and Operation", Pearson, 5th Edition, 2012.
2. Hartmat Stadtler, Christoper Kilger, "Supply Chain Management and Advanced Planning Concepts, Models, Software and Case Studies", 5th edition, Springer, 2015.
3. Simchi-Levi David, Kaminsky Philip, Simchi-Levi Edith, "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", McGraw Hill, 3rd edition, 2008.
4. Handfield R.B, Nicholas E.L, "Introduction to Supply Chain Management", PHI, 1999.
5. Shapiro, J.F, "Modelling the Supply Chain", Dubury, 2nd Edition 2006.

CP7153	ADVANCES IN OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concepts of distributed systems
- To get an insight into the various issues and solutions in distributed operating systems
- To learn about mobile and real-time operating systems
- To gain knowledge on the design concepts of mainframe operating systems

UNIT I BASICS OF OPERATING SYSTEMS 9

Overview – Synchronization Mechanisms – Processes and Threads – Process Deadlocks – Issues in Distributed Operating Systems – Communication Primitives – Limitations of a Distributed System

UNIT II DISTRIBUTED OPERATING SYSTEMS 9

Lamport's Logical Clocks – Vector Clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized, Distributed and Hierarchical Deadlock Detection Algorithms – Agreement Protocols

UNIT III DISTRIBUTED RESOURCE MANAGEMENT 9

Distributed File Systems – Design Issues – Google File System – Hadoop Distributed File System – Distributed Shared Memory – Algorithms for Implementing Distributed Shared Memory

– Load Distributed Algorithms – Issues in Task Migration – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol

UNIT IV MOBILE AND REAL TIME OPERATING SYSTEMS 9

Basic Model of Real Time Systems – Characteristics – Applications of Real Time Systems – Real Time Task Scheduling – Handling Resource Sharing. Mobile Operating Systems – Architecture – Layers – Microkernel Design – Kernel Extensions – Processes and Threads – Memory Management – File system – Android – iOS

UNIT V MAINFRAME AND LINUX OPERATING SYSTEMS 9

Mainframe – z/OS – Overview of z/OS Facilities – Virtual Storage and other Mainframe Concepts – Workload Management – I/O and Data Management – Supervising the Execution of Work in the System – Cross-memory Services – Characteristics of z/OS. Linux – Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – I/O Management – File System – Interprocess Communication

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of this course, the student should be able to

- Demonstrate the various protocols of distributed operating systems
- Identify the different features of mobile and real-time operating systems
- Discuss the various features of mainframe operating systems

REFERENCES

1. Mukesh Singhal, Niranjan Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.
2. Rajib Mall, “Real-Time Systems: Theory and Practice”, Prentice Hall, 2006.
3. Neil Smyth, “iPhone iOS 4 Development Essentials – Xcode”, Payload Media, Fourth Edition, 2011.
4. Nikolay Elenkov, “Android Security Internals: An In-Depth Guide to Android’s Security Architecture”, No Starch Press, 2014.
5. Jonathan Levin, “Mac OS X and iOS Internals: To the Apple’s Core”, John Wiley & Sons, 2012.
6. Andrew S. Tanenbaum and Herbert Bos, “Modern Operating Systems”, Fourth Edition, Prentice Hall, 2014.
7. Mike Ebbers, John Kettner, Wayne O’Brien, Bill Ogden, “Introduction to the New Mainframe: z/OS Basics”, Third Edition, International Business Machines Corporation, 2011.
8. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley, Eighth edition, 2008.

CP7254 SECURITY PRINCIPLES AND PRACTICES

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the mathematical foundations of security principles
- To appreciate the different aspects of encryption techniques
- To understand the role played by authentication in security
- To appreciate the current trends of security practices

UNIT I CLASSICAL CIPHERS 9

Classical Cryptography- Shift Cipher - Substitution Cipher - Affine Cipher – Cryptanalysis - Cryptanalysis of the Affine Cipher - Cryptanalysis of the Substitution Cipher - Cryptanalysis of the Vigenere sew Cipher - Shannon's Theory

UNIT II SYMMETRIC CIPHERS AND HASH FUNCTIONS 9

Substitution-Permutation Networks - Linear Cryptanalysis - Differential Cryptanalysis - Data Encryption Standard - Advanced Encryption Standard - Modes of Operation -Cryptography Hash Function - Hash Function and Data Integrity - Security of Hash Function - Iterated Hash Functions - Message Authentication Codes

UNIT III PUBLIC-KEY ENCRYPTION TECHNIQUES 9

Introduction to Public–key Cryptography - Number theory - RSA Cryptosystem - Attacks on RSA – El-Gamal Cryptosystem - Shanks' Algorithm - Elliptic Curves over the Reals - Elliptical Curves Modulo a Prime - Signature Scheme – Digital Signature Algorithm

UNIT IV KEY MANAGEMENT 9

Identification Scheme and Entity Attenuation - Challenge and Response in the Secret-key Setting - Challenge and Response in the Public key Setting - Schnorr Identification Scheme - Key distribution - Diffie-Hellman Key - Pre-distribution - Unconditionally Secure key Pre-distribution - Key Agreement Scheme - Diffie-Hellman Key agreement - Public key infrastructure - PKI, Certificates, Trust Models

UNIT V SECURITY PRACTICES 9

Transport-Level Security – SSL – TLS - HTTPS – SSH - Electronic Mail Security - Pretty Good Privacy - IP Security - IP Security Architecture – Authentication Header – Encapsulating Security Payload – Key Management - Legal and Ethical Issues

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Use the mathematical foundations in security principles
- Identify the features of encryption and authentication
- Use available security practices

REFERENCES:

1. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006.
2. William Stallings, "Cryptography and Network Security: Principles and Practices", Sixth Edition, Pearson Education, 2013.
3. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2003.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, Pearson Education, 2007.
5. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007.

SO7211 ADVANCED DATABASE MANAGEMENT SYSTEM LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To implement Relational Database and Perform Query Operations, Update Operations and Report Generation, Active Database Concepts, Distributed Database Concepts, Distributed Database Concepts, XML Databases, ODBC.

SOFTWARE:
Oracle 10 G or Higher / Equivalent

TOPICS TO BE COVERED:

1. **Data Definition Language**
   Create, Alter, Drop, Truncate, Comment, Rename Command Enforcing Integrity Constraints Views, Synonyms, Sequences, Indexes
2. **DML Operations**
3. **Joining Data from Multiple Tables in Queries**
   The join Condition / The Cartesian Product Equijoin**,** Self-join, Outer joins
4. **Set Operations**
5. **Aggregate Functions and the GROUP By Clause**
6. **Using Sub-queries**
7. **Analytic Functions**
8. **Introduction to Procedures and Functions**
   Creating stored PL / SQL objects, procedures, functions
9. **Creating Packages**
10. Creating package specifications and bodies
11. **Creating DML Triggers**
    Triggering events, Trigger behavior
    Correlation identifiers, Multi-statement triggers
    Trigger firing behavior, Enabling / Disabling triggers
12. **Distributed Database Implementation**

TOTAL = 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:

- Design and implement relational database.
- Perform all the query manipulation operations and procedural querying language.
- Design and develop active and distributed databases.

CP7162 **PROFESSIONAL PRACTICES**

L	T	P	C
0	0	2	1

OBJECTIVES:

- To facilitate analysis, design and problem solving skills
- To have a thorough domain knowledge
- To understand the best Industry practices by reading case studies
- To kindle innovative and professional thinking
- To explore possible alternative solutions
- To estimate feasibility, cost, risk and ROI

Identify an application (may be of social relevance) – Understand customer requirements – analyze and understand customers and stakeholders – value additions – innovations and research component – preparing plan / SRS document indicating feasibility, cost, risk, ROI and related design – suggest implementation methodology – perform risk assessment and management

TOTAL : 30 PERIODS

OUTCOMES:
Upon completion of this course, the student should be able to

- Identify and formulate the problem
- Describe the background of the problem
- Assess the needs of stakeholders
- Make estimates like cost, risk, ROI etc., to justify the business opportunity.

- Describe the industry standards and procedures
- Predict the business opportunity
- Suggest system implications

SO7301 NON LINEAR PROGRAMMING

L	T	P	C
3	0	2	4

OBJECTIVES

- To introduce and familiarize non-linear approaches in optimization.
- To conceptualize the real life applications in terms of non-linearity and also to learn MATLAB for solving the same.

UNIT I INTRODUCTION 9

Linear Vs Non-linear Programming – Basic properties of solutions and Algorithms – First order necessary conditions – Examples of unconstrained problems – second-order conditions – convex and concave functions – minimization and maximization of convex functions – saddle points – Jacobian matrix.

UNIT II ONE DIMENSIONAL OPTIMIZATION 9

Descent methods an introduction – Global convergence of Decent Algorithms – Speed convergence – Fibonacci method – Golden section search method – Steepest Descent – Newton's method – Polynomial Approximation method.

UNIT III MULTI-DIMENSIONAL OPTIMIZATION 9

Unconstrained Optimization without derivatives – Conjugate directions – Descent properties of the conjugate Direction method – Conjugate gradient method – Partial conjugate gradient method – Powell's method – Variable metric Algorithms without derivatives – Quasi-Newton method – modified.

UNIT IV UNCONSTRAINED OPTIMIZATION FORCONSTRAINED PROBLEMS 9

Lagrange method – Inequality constraints – KKT conditions – Quadratic programming – Geometric programming – Separable Linear Programming – sequential linear Programming –Feasible Direction method.

UNIT V EVOLUTIONARY PROGRAMMING 9

Genetic Engineering – Genetic operators – reproduction – Crossover – mutation – Selection – Genetic local search – simulated Annealing – Ant colony Optimization – Particle swarm Optimization –Matlab – Simulation of NLP techniques / concepts with Matlab

TOTAL :75 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Applying the concepts of non-linear programming in real life scenarios.
- Provide instant results through MATLAB.

REFERENCES:

1. Hamdy A Taha, "Operations Research - An Introduction", Prentice Hall, Eighth Edition, 2007.
2. David G.Luenberger, "Linear and Nonlinear Programming", Springer Publications, 3rd Edition,2008
3. Rao S S "Optimization -Theory and Applications", Wiley Eastern, New Delhi, 1978.
4. Sivanandam S. N ,Deepa S N, "Principles of Soft Computing" Wiley India Pvt.ltd, 2nd Edition,2007.
5. David E. Goldberg, "Genetic Algorithm in search, Optimization and machine learning", Pearson, 1999.

CP7251	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of cloud and utility computing
- To understand the various issues in cloud computing
- To familiarize themselves with the lead players in cloud
- To appreciate the emergence of cloud as the next generation computing paradigm
- To be able to set up a private cloud

UNIT I INTRODUCTION 9

Evolution of Cloud Computing -System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture -IaaS - On-demand Provisioning - Elasticity in Cloud - Examples of IaaS Providers - PaaS - Examples of PaaS Providers - SaaS - Examples of SaaS Providers - Public , Private and Hybrid Clouds – Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus

UNIT II VIRTUALIZATION 9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

UNIT III VIRTUALIZATION INFRASTRUCTURE 9

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines –Desktop Virtualization – Application Virtualization – Work with AppV – Mobile OS for smart phones – Mobile Platform Virtualization – Collaborative Applications for Mobile platforms

UNIT IV PROGRAMMING MODEL 9

Map Reduce Hadoop Distributed File Systems – Hadoop I/O – Developing Map Reduce Applications – Working of Map Reduce – Types and Formats – Setting up Hadoop Cluster

UNIT V CLOUD INFRASTRUCTURE AND SECURITY 9

Architectural Design of Compute and Storage Clouds - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources - Security Overview – Cloud Security Challenges – Software as a Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Explain the core issues of cloud computing such as security, privacy and interoperability
- Choose the appropriate technologies, algorithms and approaches for the related issues

REFERENCES:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
4. Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes",

Elsevier/Morgan Kaufmann, 2005.
5. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner’s Guide”, McGraw-Hill Osborne Media, 2009.
6. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.
7. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.

SO7007 PARALLEL PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To understand the principles of parallel programming.
- To design and develop efficient parallel algorithms.

UNIT I INTRODUCTION TO PARALLEL PROGRAMMING 9

Introduction to parallel programming - Data parallelism - Functional parallelism - Pipelining - Flynn’s taxonomy - Parallel algorithm design - Task/channel model - Foster’s design methodology - Case studies: Boundary value problem - Finding the maximum - n-body problem - Speedup and efficiency - Amdahl’s law - Gustafson - Barsis’s Law - Karp - Flatt Metric - Isoefficiency metric.

UNIT II MESSAGE PASSING INTERFACE 9

The message-passing model - The message-passing interface - MPI standard - Basic concepts of MPI: MPI_Init - MPI_Comm_size - MPI_Comm_rank - MPI_Send - MPI_Recv - MPI_Finalize - Timing the MPI programs: MPI_Wtime, MPI_Wtick - Collective communication: MPI_Reduce - MPI_Barrier - MPI_Bcast - MPI_Gather - MPI_Scatter - Case studies: The sieve of Eratosthenes - Floyd’salgorithm - Matrix-vector multiplication

UNIT III SHARED-MEMORY PROGRAMMING 9

Shared-memory model – Open MP standard - Parallel for loops - Parallel for pragma - Private variables - Critical sections - Reductions - Parallel loop optimizations - General data parallelism - Functional parallelism - Case studies: The sieve of Eratosthenes - Floyd’s algorithm - Matrix-vector multiplication - Distributed shared-memory programming - DSM primitives

UNIT IV PARALLEL ALGORITHMS – I 9

Monte Carlo methods - Parallel random number generators - Random number distributions - Case studies: Matrix multiplication - Row wise block - Stripped algorithm - Cannon’s algorithm - Solving linear systems - Back substitution - Gaussian elimination - Iterative methods - Conjugate gradient method

UNIT V PARALLEL ALGORITHMS – II 9

Sorting algorithms - Quick sort - Parallel quick sort - Hyper quick sort - Sorting by regular sampling - Fast Fourier transform - Combinatorial search - Divide and conquer - Parallel backtrack search - Parallel branch and bound - Parallel alpha-beta search

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will:

- Be able to design algorithms for parallel systems
- Acquire knowledge in parallel systems and associated concepts.

REFERENCES:

1. Michael J. Quinn, “Parallel Programming in C with MPI and Open MP”, Tata McGraw-Hill Publishing Company Ltd., 2003.
2. B. Wilkinson and M. Allen, “Parallel Programming – Techniques and applications using networked workstations and parallel computers”, Second Edition, Pearson Education, 2005.
3. M. J. Quinn, “Parallel Computing – Theory and Practice”, Second Edition, Tata McGraw-Hill Publishing Company Ltd., 2002.

CP7076	DATA MINING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand data mining principles and techniques and Introduce DM as a cutting edge business intelligence
- To expose the students to the concepts of data warehousing architecture and implementation
- To study the overview of developing areas – web mining, text mining and ethical aspects of data mining
- To identify business applications and trends of data mining

UNIT I INTRODUCTION TO DATA WAREHOUSING 9

Evolution of Decision Support Systems- Data warehousing Components – Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations

UNIT II DATA WAREHOUSE PROCESS AND ARCHITECTURE 9

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

UNIT III INTRODUCTION TO DATA MINING 9

Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

UNIT IV CLASSIFICATION AND CLUSTERING 9

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – , Partitioning methods- k-means- Hierarchical Methods – distance based agglomerative and divisible clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

UNIT V PREDICTIVE MODELING OF BIG DATA AND TRENDS IN DATAMINING 9

Statistics and Data Analysis – EDA – Small and Big Data –Logistic Regression Model - Ordinary Regression Model-Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Evolve multidimensional intelligent model from typical system
- Discover the knowledge imbibed in the high dimensional system
- Evaluate various mining techniques on complex data objects

REFERENCES

1. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann, Third edition, 2011.
2. Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill, Tenth Reprint, 2007.
3. G. K. Gupta, “Introduction to Data Min Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, Third Edition, 2014.
4. Ian.H.Witten, Eibe Frank and Mark.A.Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann, Third edition, 2011.
5. Bruce Ratner, “Statistical and Machine - Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data”, CRC Press, Second Edition, 2012.
6. Mehmed kantardzic, “Data mining: Concepts, Models, Methods, and Algorithms”, Wiley-Blackwell, Second Edition, 2011.
7. Ian Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Third Edition, Morgan Kaufmann, 2011.
8. George M Marakas, “Modern Data Warehousing, Mining and Visualization: Core Concepts”, Prentice Hall, 2002.

SO7005 JAVA AND WEB TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To learn about the concepts of java and it features.
- To learn about the concept of networking, API and GUI in java.
- To learn the concept of advanced java and scripting languages.

UNIT I INTRODUCTION TO JAVA 9

Java Virtual Machine - Reflection - I/O Streaming - Filter and Pipe Streams - Byte Codes - Byte Code Interpretation - Dynamic Reflexive Classes - Threading - Java Native Interfaces.

UNIT II NETWORKING, APPLETS and GUI 9

RMI and RMI-IIOP - Custom sockets - Object serialization - Retrieving Data with URLs - Sockets for clients - Sockets for servers - Secure Sockets - UDP datagrams and sockets - Multicast Sockets - Applets - Developing GUI Applications.

UNIT III ENTERPRISE JAVA 9

Java Beans Enterprise - Java Beans - Distributed Object models – URL Connection class - Protocol Handlers - Content Handlers - Distributed garbage collection - Interface definition language.

UNIT IV SCRIPTING LANGUAGES 9

HTML - JavaScript and VB Script - Control Structures - Functions - Arrays - Objects - DHTML - Cascading style sheets - Object model and collections - Event model - Filters and Transitions - Data binding with tabular control - XML Technology

UNIT V SERVER SIDE PROGRAMMING 9

Servlets - Java Server Pages - JDBC - Case study: Deploying n-tier application.

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Write programs using java
- Develop web applications.

REFERENCES

1. Herbert Schildt, “Java - The Complete Reference”, 9th Edition, McGraw-Hill, 2014.
2. Robert Sebesta, “Programming with world wide web”, Pearson Education, 8th Edition,2015
3. Cay Horstmann and Gary Cornell, “Core Java”, Volume1 & Volume2, Pearson Education, 9th Edition, 2012.
4. Bryan Basham, Kathy Sierra, Bert Bates, “Head First Servlets and JSP”, O'Reilly Media 2004
5. Deitel and Deitel, “Internet and World Wide Web : How to program”, Pearson Education Publishers, 5th Edition, 2011

SO7001	ADHOC AND WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the issues in the design of wireless ad hoc networks
- To understand the working of protocols in different layers of mobile ad hoc and sensor networks
- To expose the students to different aspects in sensor networks
- To understand various security issues in ad hoc and sensor networks and solutions to the issues

UNIT I MAC & ROUTING IN AD HOC NETWORKS 9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

UNIT II TRANSPORT & QOS IN AD HOC NETWORKS 9

TCP’s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols –Zig bee – Topology Control – Routing Protocols

UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control – In-network processing – Operating systems for wireless sensor networks – Examples.

UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS 9

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Identify different issues in wireless ad hoc and sensor networks
- Analyze protocols developed for ad hoc and sensor networks
- Identify different issues in wireless ad hoc and sensor networks
- Identify and critique security issues in ad hoc and sensor networks

REFERENCES

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, “Ad-Hoc Mobile Wireless Networks”, Auerbach Publications, 2007.
2. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, Wiley India Private Limited, 2011.
3. Erdal Çayirci ,Chunming Rong, “Security in Wireless Ad Hoc and Sensor Networks”, John Wiley and Sons, 2009.
4. C. Siva Ram Murthy and B.S. Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
5. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks: Theory and Applications”, World Scientific Publishing, Second Edition, 2011.
6. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, Wiley India Private Limited, 2014.
7. Adrian Perrig, J.D. Tygar, “Secure Broadcast Communication: In Wired and Wireless Networks”, Kluwer Academic Publishers, Springer, 2002.

CP7093	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the key aspects of Soft computing and Neural networks
- To study the fuzzy logic components
- To gain insight onto neuro fuzzy modeling and control
- To know about the components and building block hypothesis of genetic algorithm
- To gain knowledge in machine learning through Support Vector Machines

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS 9

Introduction to Genetic Algorithms (GA) – Applications of GA - Building block hypothesis-Representation – Fitness Measures – Genetic Operators-. GA based Machine Learning.

UNIT III NEURAL NETWORKS 9

Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

UNIT IV FUZZY LOGIC 9

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT V NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Discuss on machine learning through neural networks
- Apply knowledge in developing a Fuzzy expert system
- Model Neuro Fuzzy system for clustering and classification
- Discover knowledge to develop Genetic Algorithm and Support vector machine based machine learning system

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2002.
2. Kwang H.Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.
5. David E.Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1989.
6. Mitchell Melanie, “An Introduction to Genetic Algorithm”, MIT Press, 1996.
7. S.N.Sivanandam, S.N.Deepa, “Introduction to Genetic Algorithms”, Springer, 2008 edition.

CP7072 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand big data analytics as the next wave for businesses looking for competitive advantage
- To understand the financial value of big data analytics and to explore tools and practices for working with big data
- To understand how big data analytics can leverage into a key component
- To learn about stream computing
- To know about the research that requires the integration of large amounts of data

UNIT I INTRODUCTION TO BIG DATA 9

Analytics – Nuances of big data – Value – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data - Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big data Analytics - Big data characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration tools – Greenplum – Informatica

UNIT II LAMBDA CALCULUS AND DATA ANALYSIS 9

Lambda notation for functions – syntax – curried functions – parametric polymorphism – lambda reduction – alpha reduction – beta reduction – beta abstraction – extensionality theorem – delta reduction – reduction strategies – normal forms – Church-Rosser Theorems – pure lambda calculus – constants – arithmetic – Evolution of analytic scalability - Convergence – parallel processing systems –– map reduce – enterprise analytic sand box – analytic data sets – Analytic

methods - analytic tools – Cognos – Microstrategy - Pentaho. Analysis approaches – Statistical significance – business approaches

UNIT III STREAM COMPUTING 9

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Real time Analytics Platform(RTAP) applications IBM Infosphere – Big data at rest – Infosphere streams – Data stage – Statistical analysis – Intelligent scheduler – Infosphere Streams

UNIT IV PREDICTIVE ANALYTICS AND VISUALIZATION 9

Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models – Normal – Deviations from normal patterns – Normal behaviours – Expert options – Variable entry - Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

UNIT V FRAMEWORKS AND APPLICATIONS 9

IBM for Big Data – Map Reduce Framework - Hadoop – Hive – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Hbase – Impala – Analyzing big data with twitter – Big data for Ecommerce – Big data for blogs.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of this course, the student should be able to

- Use Hadoop, Map Reduce Framework
- Suggest areas to apply big data to increase business outcome
- Contextually integrate and correlate large amounts of information automatically to gain faster insights

REFERENCES

1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2013.
2. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier, Second Edition, 2015.
3. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, Second Edition, 2007.
4. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley and SAS Business Series, 2012.
6. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill, 2012.
7. Paul Zikopoulos, Dirk de Roos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, “Harness the Power of Big data - The big data platform”, McGraw Hill, McGraw-Hill Osborne Media, 2012.
8. Glenn J. Myatt, “Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining”, John Wiley & Sons, Second Edition, 2014.
9. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
10. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Elsevier, Third Edition, 2011.
11. Greg Michaelson, “An introduction to functional programming through lambda calculus”, Dover Publications, 2011.

CP7154 **MULTI CORE ARCHITECTURES** **L T P C**
3 0 0 3

OBJECTIVES

- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters
- To understand the different multiprocessor issues
- To expose the different types of multicore architectures
- To understand the design of the memory hierarchy

UNIT I FUNDAMENTALS OF COMPUTER DESIGN AND ILP **9**

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Limitations of ILP – Multithreading – SMT and CMP Architectures – The Multicore era.

UNIT II MEMORY HIERARCHY DESIGN **9**

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT III MULTIPROCESSOR ISSUES **9**

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT IV MULTICORE ARCHITECTURES **9**

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computers, Cloud Computing – Architectures and Issues – Case Studies.

UNITV VECTOR, SIMD AND GPU ARCHITECTURES **9**

Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Identify the limitations of ILP and the need for multicore architectures
- Discuss the issues related to multiprocessing and suggest solutions
- Point out the salient features of different multicore architectures and how they exploit parallelism
- Critically analyze the different types of inter connection networks
- Design a memory hierarchy and optimize it

REFERENCES:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, 5th edition, 2012.
2. Darryl Gove, “Multicore Application Programming: For Windows, Linux, and Oracle Solaris”, Pearson, 2011.
3. David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kauffman, 2010.
4. Wen– mei W. Hwu, “GPU Computing Gems”, Morgan Kaufmann / Elsevier, 2011

SO7008 SYSTEMS MODELLING AND SIMULATION L T P C
3 0 0 3

OBJECTIVES:

- To obtain sufficient knowledge to model any given system.
- To simulate the modeled system for performance study.

UNIT I INTRODUCTION 9

System definition - Types and characteristics - Need for modeling and simulation - Types of Simulation - Introduction to discrete event simulation - Single server - Multiserver Exercises - System modeling - Simple Petrinets

UNIT II MODELLING APPROACHES 9

Modeling concurrent systems - Analysis of Petrinets - Finite state Automata and Regular Expressions - Relationship - FSA with silent transitions - Pumping lemma for regular sets - Analysis using DFS and model checking.

UNIT III QUEUING MODELS 9

Characteristics of queuing systems - Notations - Types of Queues - Markovian model - Non-Markovian model - Queuing Networks - Applications of queuing systems.

UNIT IV SIMULATION DATA 9

Methods for generating random numbers - Testing of random numbers - Methods of generating random variants - Problem formulation - input modeling - Verification and Validation - Output1ZX Analysis.

UNIT V CASE STUDY 9

NS2 - Simulation of Computer Systems - Simulation of Computer Networks - Simulation of Mobile Networks - Simulation of Manufacturing and Material Handling Systems

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Modeling any given system with rationality.
- Predicting the behavior through fine grained analysis.

REFERENCES:

1. Jerry Banks “Discrete-event system simulation”, Pearson Education, 2009.
2. Fitzgerald, John, Larsen, PeterGorm, “Modeling Systems; Practical Tools and Techniques in software development”, Cambridge University Press, 2009.
3. Hopcroft, John E, Motwani, Rajeev, Ullman, Seffrey D, “Introduction to automata theory, languages and computation”, Pearson/Addison Wesley, 3rd Edition, 2007.
4. Donald Gross and Carl M. Harris, “Fundamentals of Queuing theory”, 2nd Edition, John Wiley and Sons, New York (1985).
5. Hamdy A Taha, “Operations Research an Introduction”, Prentice Hall, Eighth Edition, 2007.
6. Jeofrey Gordon “System Simulation”, Prentice Hall of India, 2009.

SW7251 SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	2	4

OBJECTIVES

The student should be able to

- Know what is software and the usage of different types of softwares.
- Know the Quality Metrics of various Softwares.
- Know the methodologies in making Software.
- Test the product finally to check the product Quality.

UNIT I INTRODUCTION 9

Introduction to Software Quality - Challenges – Objectives – Quality Factors – Components of SQA – Contract Review – Development and Quality Plans – SQA Components in Project Life Cycle – SQA Defect Removal Policies – Reviews.

UNIT II TESTING METHODOLOGIES 9

Basics of Software Testing – Test Generation from Requirements – Finite State Models – Combinatorial Designs - Test Selection, Minimization and Prioritization for Regression Testing – Test Adequacy, Assessment and Enhancement.

UNIT III TEST STRATEGIES 9

Testing Strategies – White Box and Black Box Approach – Integration Testing – System and Acceptance Testing – Performance Testing – Regression Testing - Internationalization Testing – Ad-hoc Testing – Website Testing – Usability Testing – Accessibility Testing.

UNIT IV TEST AUTOMATION AND MANAGEMENT 9

Test plan – Management – Execution and Reporting – Software Test Automation – Automated Testing tools - Hierarchical Models of Software Quality – Configuration Management – Documentation Control.

UNIT V SQA IN PROJECT MANAGEMENT 9

Project progress control – costs – quality management standards – project process standards – management and its role in SQA – SQA unit.

TOTAL : 45 + 30 = 75 PERIODS

OUTCOMES

At the end the student will be able to

- Analyze the product Quality.
- Use various testing methods.
- Assess Quality standards.

REFERENCES

1. Daniel Galin, “Software quality assurance – from theory to implementation”, Pearsoneducation, 2009
2. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
3. Aditya Mathur, “Foundations of software testing”, Pearson Education, 2008
4. Ron Patton, “Software testing” , second edition, Pearson education, 2007
5. Srinivasan Desikan, Gopalaswamy Ramesh, “Software testing– principles andpractices”, Pearson education, 2006
6. Alan C Gillies, “Software Quality Theory and Managementll”, Cengage Learning, Second edition,2003 .
7. Robert Furtell, Donald Shafer, and Linda Shafer, "Quality Software ProjectManagement", Pearson Education Asia, 2002.

SO7004 **DYNAMIC PROGRAMMING** **L T P C**
3 0 0 3

OBJECTIVES:

- To make more specific linear and non-linear approaches that suits both stochastic and deterministic applications.
- To analyze systems to ensure optimal and faster results.

UNIT I INTRODUCTION AND APPLICATIONS OF DYNAMIC PROGRAMMING **9**

Characteristics of Dynamic Programming Problems – Formulation – Examples – Disadvantages of Dynamic Programming – Bellman's Principal of Optimality of Dynamic Programming – Applications of Dynamic Programming–Capital Budgeting Problem – Reliability Improvement Problem (Shortest path Problem) – Minimizing Scheduling problem –Optimal Subdividing Problem solution of LPP through Dynamic Programming.

UNIT II DETERMINISTIC DYNAMIC PROGRAMMING **9**

Introduction – Mathematical description – Principal of Optimality – Recursive computation – Multistage Forward and Backward Recursion – Selected Dynamic Programming Applications– Cargo loading model – work force size model – equipment replacement model – investment model – inventory models – Problem of Dimensionality.

UNIT III PROBABILISTIC DYNAMIC PROGRAMMING **9**

Introduction – Distribution of effort example – New product introduction, – Elementary inventory model – optimal Batch size model – Stochastic regeneration Model–Equipment Replacement – Sales Forecasting problem – Applicability and Computational feasibility.

UNIT IV DYNAMIC PROGRAMMING IN MARKOV CHAINS **9**

Introduction – Stochastic Shortest– Route Model – Unbounded horizon with discounting equivalent Average Return – Linear Programming Approach – Computational considerations – Markov chain version of the equipment replacement model.

UNIT V RISK AND UNCERTAINTY **9**

Terminology and Classification – Decision making under risk – Multistage Optimization under Risk – Markovian Decision Processes – A variable stage Stochastic Problem – Uncertainty and Adaptive Optimization – Gambling with unknown Probabilities – Two-Person – Zero-Sum Games – Games in Extensive.

- **TOTAL: 45 PERIODS**

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Discriminate the concepts of various optimization approaches.
- Choosing appropriate dynamic programming concept for a model.

REFERENCES:

1. Hamdy A.Taha, "Operations Research – An Introduction", PHI Learning Private Limited, Eighth Edition, 2007.
2. Harvey M.Wagner, "Principles of Operations Research with applications to Managerial Decisions", PHI Learning Private Limited, 2nd Edition, 2009.
3. Ronald L.Rardin, "Optimization in Operations Research", Pearson Education, 1997.

SO7003 DESIGN PATTERNS L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept of patterns
- To learn various design patterns.
- To learn the usage of design patterns to keep code quality high.

UNIT I INTRODUCTION 9

History and Origin of Patterns – Introduction to OOAD - Apply Design Patterns – Prototype – Testing.

UNIT II DESIGN PATTERNS 9

Kinds of Pattern – Quality and Elements – Patterns and Rules – Creativity and Patterns – Creational Patterns – Structural Patterns – Behavioural Patterns, Factory Patterns.

UNIT III FRAMEWORKS 9

State and Strategy of Patterns. Singleton, Composite, Functions and the Command Patterns, Adaptor, Proxy Pattern, Decorator Pattern – Pattern Frameworks and Algorithms

UNIT IV CATALOGS 9

Pattern Catalogs and Writing Patterns, Anti-Patterns, Pattern Community, Pattern Based Software Development.

UNIT V CASE STUDIES 9

A7E - case study in utilizing architectural structures, WWW - case study in interoperability, Air Traffic Control – case study in designing for high availability, Celsius Tech – case study in product line development

TOTAL : 45 PERIODS

OUTCOMES:

Upon successful completion of the course, the student will be able to

- Comprehend most important design patterns
- Apply design patterns to design innovative software.
- Familiarize real time applications developed with case studies.

REFERENCES

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design patterns: Elements of Reusable object-oriented software”, Pearson; First Edition, 2012.
2. James W- Cooper, Addison-Wesley,”Java Design Patterns – A Tutorial”, 2003.
3. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, “Head First Design Patterns”, O'Reilly, 2004.
4. Craig Larman, "Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and the unified process”, Second Edition, Prentice Hall, 2001.
5. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

SO7006 MOBILE WEB APPLICATION DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

- To develop applications for current and emerging mobile computing devices
- To performing tasks at all stages of the software development life-cycle from inception through to implementation and testing
- To understand the impact of user characteristics, device capabilities, networking infrastructure and the deployment environment, on the specified requirements of a software project.

UNIT I INTRODUCTION 9

Preliminary Considerations – Cost of Development – Importance of Mobile Strategies in Business World –Mobile Web Presence – Mobile Applications – Marketing – Web Services for Mobile Devices – Creating Example Web Service _ Debugging Web Service

UNIT II MOBILE USER INTERFACE DESIGN 9

Effective Use of Screen Real Estate – Understanding Mobile Application Users – Understanding Mobile Information Design – Understanding Mobile Platforms – Using the Tools for Mobile Interface Design.

UNIT III MOBILE WEB APPLICATION DEVELOPMENT 9

Choosing a Mobile Web Option – Adaptive Mobile Website – Responsive Web Design -.Mobile Web Applications with HTML 5 – CSS3 – Web Services - Sample Mobile Web Applications.

UNIT IV APPLICATION DEVELOPMENT 9

Getting to know the Android User Interfaces – Designing Your User interface using Views – Displaying Pictures and Menus with Views – Using Image views to Display pictures – Using menus with views – Data Persistence – Saving and loading user performances – Persisting data to files – Creating and using Data bases– Content Providers.

UNIT V MESSAGING, NETWORKING, LOCATION BASED SERVICES 9

SMS Messaging, Sending E-mail – Networking – Downloading Binary Data, Text Files- Accessing Web Services – Performing Asynchronous Calls – Location Based Services – Displaying Maps – Getting Location Data – Creating your own services – Communicating between a service and an activity – Binding activities to Services

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- To identify the limitations and challenges of working in a mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
- To apply the different types of application models/architectures used to develop mobile software applications.
- To design, implement and deploy mobile applications using an appropriate software development environment.
- To work within the capabilities and limitations of a range of mobile computing devices.

REFERENCES:

1. Jeff McWherter and Scott Gowell , Professional Mobile Application Development, Wrox 2012.
2. Simchi-Levi, David, Kamisnky, “Designing and managing the supply chain: Concepts, Strategies and case studies”, McGraw Hill, 3rd edition, 2008.
3. Mobile Web Development by Nirav Mehta, Packet Publishing, 2008
4. Lyza Danger Gardner and Jason Grigsby, Head First Mobile Web, O’Relliy 2012.
5. Wei – Meng Lee, Beginning Android Application Development, Wiley 2011
6. Charlie Collins, Michael Galpin and Matthias Kappler, Android in Practice, Dream Tech. 2012
7. Jonathan SimonHead First Android Development, O’Relliy 2012.

CP7077 DATABASE ADMINISTRATION AND TUNING

L	T	P	C
3	0	0	3

OBJECTIVES

- To design and implement relational database solutions for general applications
- To develop database scripts for data manipulation and database administration
- To understand and perform common database administration tasks such as database monitoring, performance tuning, data transfer, and security
- To balance the different types of competing resources in the database environment so that the most important applications have priority access to the resources

UNIT I INTRODUCTION TO DATABASE ADMINISTRATION 9

Database Administration - DBA Tasks - DBMS Release Migration - Types of DBAs - Creating the Database Environment – Defining the organizations DBMS strategy - Installing the DBMS - Upgrading DBMS Versions and Releases

UNIT II DATABASE SECURITY, BACKUP AND RECOVERY 9

Database Users - Granting and Revoking Authority - Authorization Roles and Groups - Using Views for Security - Using Stored Procedures for Security – Auditing - External Security - Backups - Recovery - Determining Recovery Options - Types of Recovery – DBA Tools – DBA Rules of Thumb

UNIT III FUNDAMENTALS OF TUNING 9

Review of Relational Databases – Relational Algebra – Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Operating Systems Considerations – Hardware Tuning

UNIT IV INDEX TUNING AND QUERY OPTIMIZATION 9

Types of Queries – Data Structures – B+ Tree - Hash Structures – Bit Map Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Comparison of Indexing and Hashing Techniques. Optimization Techniques - Tuning Relational Systems - Parameter Cache - Query Tuning – Triggers – Client Server Mechanisms – Objects, Application Tools and Performance –Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases

UNIT V TROUBLE SHOOTING 9

Query Plan Explainers – Performance Monitors – Event Monitors – Finding “Suspicious” Queries – Analyzing a Query’s Access Plan – Profiling a Query Execution – DBMS Subsystems

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Understand advanced features of databases in design, administration, and applications
- Provide techniques to improve the performance of a database
- Optimize the use of existing resources within the database environment

REFERENCES:

1. Craig S. Mullins, “Database Administration: The Complete Guide to Practices and Procedures”, Addison-Wesley Professional, 2012.
2. Dennis Shasha and Philippe Bonnet, “Database Tuning, Principles, Experiments and Troubleshooting Techniques”, Elsevier Reprint, 2005.
3. Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill, 2010.
4. Thomas Connoly and CarlolynBegg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Fifth Edition, Pearson Education, 2009.

SO7002	BUSINESS PROCESS MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn business process structure, framework and management.

UNIT I ORGANIZATIONAL STRUCTURE 9

Structure of the Organization- Nature and Types of Organization – Organizational structures – Organizational Relationships – Formalization – Centralization – Forms and Outcomes – IT Industry and Organizational structures – Organizational Improvement – Emergence of Business Process Reengineering (BPR)

UNIT II BUSINESS PROCESS MANAGEMENT 9

Iceberg Syndrome – Change Management and performance measurement – Business Process Management – Significance of improving business process – Management of business process – Use of external BPM experts – Organization Strategy – Process architecture

UNIT III THE FRAMEWORK - I 9

Critical implementations aspects for a BPM Solution – Structured approach to implementing BPM – BPM Implementation framework – Organization approach to BPM implementations – Framework phases – Process –centric organization – Scenarios in implementing BPM – Iterative approach

UNIT IV THE FRAMEWORK - II 9

Organization strategy phase – Process architecture phase – Launch pad phase – Understand phase – Innovate phase – Develop phase – People phase – Implement phase – Realize value phase – Sustainable performance phase – Project Management – People change management – Leadership

UNIT V BPM AND THE ORGANIZATION 9

BPM maturity – BPM maturity model – Application of the BPMM model – Embedding BPM within the organization – Knowledge management and information technology – Process Modeling and formulation using a BPM suite in an organization as a case study.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Understand the life cycle of a business process in an organization.
- Model and optimize the business process flow in an organization.

REFERENCES:

1. John Jeston and Johan Nelis, Business Process Management: Practical Guidelines to Successful Implementations, 2nd Edition, Butterworth-Heinemann, An imprint of Elsevier, 2009.
2. Mathias Weske, Business Process Management: Concepts, Languages, Architectures, 2nd Edition, Springer, 2012.
3. T.A. Venkatachalam, C.M. Sellappan, Business Process, PHI Learning Private Ltd, 2011

CP7083	INTERNET OF THINGS IN THE CLOUD	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Internet of things and protocols
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things
- To understand the concepts of Web of Things
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing

UNIT I INTRODUCTION 10

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT II IOT PROTOCOLS 8

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

UNIT III WEB OF THINGS 10

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT IV INTEGRATED 9

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects – Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

UNIT V APPLICATIONS 8

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to

- Identify and design the new models for market strategic interaction
- Design business intelligence and information security for WoB
- Analyze various protocols for IoT
- Design a middleware for IoT
- Analyze and design different models for network dynamics

REFERENCES

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.
4. Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to

the Smart Grid and Building", Wiley, 2012.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

CP7089 REAL TIME SYSTEMS DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn real time operating system concepts and the associated issues & techniques.
- To understand design and synchronization problems in Real Time System.
- To understand the evaluation techniques present in Real Time System.

UNIT I REAL TIME SPECIFICATION AND DESIGN TECHNIQUES 9

Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

UNIT II SOFTWARE REQUIREMENTS ENGINEERING 9

Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modelling language – organizing the requirements document – organizing and writing documents – requirements validation and revision.

UNIT III INTERTASK COMMUNICATION AND MEMORY MANAGEMENT 9

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

UNIT IV REAL TIME DATABASES 9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two – phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems

UNIT V PROGRAMMING LANGUAGES 9

Assembly language – procedural languages – OO languages – Brief survey of languages – Faults, Failures and bugs – Fault Tolerance – Software integration – refactoring Real time code.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of this course, the student should be able to

- Understand principles of real time systems design.
- Make use of architectures and behavior of real time operating systems and database in real time applications.

REFERENCES

1. C.M. Krishna, Kang G. Shin, "Real-Time Systems", McGraw-Hill International Editions, 1997.
2. Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 3rd Edition, 2004.
3. Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2009.

4. Stuart Bennett, “Real Time Computer Control-An Introduction”, Prentice Hall of India, 1998.
5. R.J.A Buhur, D.L Bailey, “An Introduction to Real-Time Systems”, Prentice Hall International, 1999.
6. Allen Burns, Andy Wellings, “Real Time Systems and Programming Languages”, Pearson Education, 2003.