BharatiyaVidyaBhavan's
Sardar Patel Institute of Technology
(Autonomous Institute Affiliated to University of Mumbai)

Revision:SPIT-2-19

Master Of Computer Application

Second Year MCA
(Sem. III and Sem. IV)
Effective from Academic Year 2019 -20

Board of Studies Approval: 08/05/2019
Academic Council Approval: 14/05/2019

Raundale.

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SARDAR PATEL INSTITUTE OF TECHNOLOGY
Andheri (W), Mumbai-58.

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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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SYMCA Scheme 2019-20

SEM III						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	T	P	
MCA31	Core and Advanced Java	ICT	3	-	-	3
MCA32	Database Management System	ICT	3	-	-	3
MCA33	Operations Research	M	3	1	-	4
MCA34	Soft Skill Development	BM	3	1	-	4
MCAE35	**Elective-I** MCAE35 A Network Security MCAE35 B Artificial Intelligence MCAE35 C Management Information System MCAE35 D Computer Graphics and Image Processing MCAE35 E Service Oriented Architecture	PE	3	-	-	3
MCAL31	Core and Advanced Java Lab	ICT	-	-	4	2
MCAL32	Database Management System lab	ICT	-	-	4	2
MCAL36	Unified Modeling Language Lab	ICT	-	1	2	2
MCAP31	Mini Project-III	PR	-	-	2	1
	Total		**15**	**3**	**12**	**24**

SEM IV						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			Th	Tu	P	
MCA41	Computational Intelligence -I	ICT	3			3
MCA42	Software Testing and Quality Assurance	ICT	3			3
MCA43	Design and Analysis of Algorithm	ICT	3		-	3
MCA44	User Experience Design	ICT	3	1	-	4
MCAE45	**Elective-II** MCAE45 A Information Security MCAE45 B Natural Language Processing MCAE45 C Enterprise Resource Planning MCAE45 D Multimedia MCAE45 E Semantic Web	PE	3	1	-	4
MCAL41	Computational Intelligence -I Lab	ICT	-	-	4	2
MCAL42	Software Testing and Quality Assurance Lab	ICT	-	-	2	1
MCAL43	Design and Analysis of Algorithm Lab	ICT	-	-	2	1
MCAL46	Mobile programming Lab	ICT	-	-	4	2
MCAP41	Mini Project-IV	PR	-	-	2	1
		Total	**15**	2	**14**	**24**

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Evaluation Scheme 2019-20

SEM III					
Course Code	**Course Name (Theory)**	**Marks**			
		ISE	**MSE**	**ESE**	**Total**
MCA31	Core and Advanced Java	20	20	60	100
MCA32	Database Management System	20	20	60	100
MCA33	Operations Research	20	20	60	100
MCA34	Soft Skill Development	**ISE I** 35	20	**ISE II** 35	attendance 10	100
MCAE35^	**Elective-I** MCAE35 A Network Security MCAE35 B Artificial Intelligence MCAE35 C Management Information System MCAE35 D Computer Graphics and Image Processing MCAE35 E Service Oriented Architecture	20	20	60	100
MCAL31	Core and Advanced Java Lab	40	--	--	40
MCAL32	Database Management System lab	40	--	--	40
MCAL36	Unified Modeling Language Lab	40	--	--	40
MCAP31	Mini Project-III	25	--	25	50
				Total	**670**

SEM IV					
Course Code	**Course Name (Theory)**	**Marks**			
		ISE	**MSE**	**ESE**	**Total**
MCA41	Computational Intelligence -I	20	20	60	100
MCA42	Software Testing and Quality Assurance	20	20	60	100
MCA43	Design and Analysis of Algorithm	20	20	60	100
MCA44	User Experience Design	20	20	60	100
MCAE45 ^	**Elective-II** MCAE45 A Information Security MCAE45 B Natural Language Processing MCAE45 C Enterprise Resource Planning MCAE45 D Multimedia MCAE45 E Semantic Web	20	20	60	100
MCAL41	Computational Intelligence Lab -I	40	--	--	40
MCAL42	Software Testing and Quality Assurance Lab	40	--	--	40
MCAL43	Design and Analysis of Algorithm Lab	40	--	--	40
MCAL46	Mobile programming Lab	40	--	--	40
MCAP41	Mini Project-III	25	--	25	50
				Total	**710**

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SEM-III

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA31	Core and Advanced Java	3		--	3		--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Prerequisite Course codes	MCA11	
	Student will be able to	
Course Outcomes	CO1	To understand various Java programming basic constructs such as abstract data types, encapsulation, inheritance Polymorphism with Exception handling
	CO2	Analyze real time problem for Generic classes with database connection and file handling using JAVA concepts
	CO3	Develop Web Applications using Event handling and GUI programming based on advanced JAVA programming
	CO4	Apply the concepts of EJB and Spring framework to develop an application

Module No.	Unit No.	Topics	Ref	Hrs
1		**Fundamentals of Java Programming**	1,2	4
	1.1	Classes, Instance variables, Methods, Constructors, Access Specifiers, Abstract Classes and Wrapper Classes,		
	1.2	Autoboxing and Unboxing, Inheritance, Polymorphism		
	1.3	Method Overriding, Use of Static, final, super and this keyword		
2		**Packages and Interfaces**	1,2	4
	2.1	Package concept, Creating user defined package, Access control protection		
	2.2	Defining interface, Implementing interface.		
		Generics and Collections		
	2.3	Generics - Generic Class, Creating Generic Classes		
	2.4	Generic Methods, Bounded Type, Collections- Collections and Generics		
	2.5	Collection Classes-Links, Vector, Linked Lists, Maps, HashMap, Wild Cards Lambda Expressions - Lambda Type Inference		
3		**Exception Handling**	1,2	8
	3.1	Exception as objects, Exception hierarch		
	3.2	Exception Keywords - Try, catch, finally, throw, throws		
	3.3	Creating User defined Exceptions, Assertion, Annotations		
		Multithreading		
	3.5	Java thread model, Life Cycle of Thread		
	3.6	Working with Thread class and the Runnable interface, Thread priorities		
		File handling		
	3.7	Input streams and Output streams		
	3.8	FileInputStream and FileOutputStream, Binary and Character streams		
	3.9	Buffered Reader/ Writer, Object serialization and Deserialization		
4		**Event handling and GUI programming**	1, 2	8
	4.1	Comparison of AWT and SWING		
	4.2	Delegation Event Model, Event handling mechanisms, Swing components		
	4.3	Swing Component Hierarchy- Basic and Advanced Components, JApplet Layout managers,		
		Database Programming		

	4.6	JDBC architecture, Types of drivers, Java.sql package		
	4.7	Establishing connectivity and working with connection interface		
	4.8	Working with statement interface, Working with PreparedStatement interface		
	4.9	Working with ResultSet interface,Working with ResultSetMetaData interface.		
5		**Web development using Servlets**	**8**	**6**
	5.1	Introduction to servlets, Servlet vs CGI, Servlet API overview		
	5.2	Servlet Life cycle, Generic servlet, HTTPServlet, ServletConfig, ServletContext		
	5.3	Handling HTTP Request and response –GET /POST method, request dispatching, Using cookies, Session tracking.		
		Web development using JSP		
	5.4	JSP Architecture, JSP Directives, JSP scripting elements		
	5.5	Default objects in JSP,JSP Actions, JSP with beans and JSP with Database		
	5.6	Error handling in JSP, Session tracking techniques in JSP		
6		**Enterprise Java Beans**	**7**	**6**
	6.1	Introduction to Enterprise java beans, Types of EJB		
	6.2	Session bean , entity beans, Message driven beans		
		Introduction to Spring Frameworks	**6**	
	6.3	Introduction to Spring Framework, Spring Architecture,		
	6.4	Spring Aspect of Object Oriented Concepts – Join Point and Point Cuts.		
7		**Hibernate**		
	7.1	ORM, Understanding different components of Hibernate How to persist objects using Hibernate How to use mapping files, configuration files and Session object Instance states	**6**	**6**
	7.2	Transactions in Hibernate Querying with HQL (Hibernate Query Language)		
	7.3	Named and native queries Working with Criteria Interface		
			Total	**42**

References:

[1] Herbert schildt, " The complete reference JAVA2", Tata McGraw Hill , Seventh Edition.
[2] Sharanam Shah and vaishali shah, "Core Java for beginners",SPD, First Edition.
[3] Savalia , "Advance Java Technology" , Dreamtech Press/Wiley India, First Edition.
[4] Kogent Learning Solutions Inc, " Java Server Programming java EE6" , Dreamtech press First Edition.
[5] E.Balaguruswamy, "Programming with Java A Primer", Tata McGraw Hill, Fourth Edition.
[6] Spring 5: End-To-End Programming: Build enterprise-grade applications using Spring MVC, Hibernate, and RESTful APIs Paperback – Import, 21 Dec 2018 by Claudio Eduardo de Oliveira, Dinesh Rajput, Rajesh R V
[7] Enterprise JavaBeans 3.1, 6th Edition Developing Enterprise Java omponents BillBurke, Andrew Rubinger Publisher: O'Reilly Media
[8] Professional Java for Web Applications, 3.92 (13 ratings by Goodreads) Nicholas S. Williams

Sardar Patel Institute of Technology

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA32	Database Management System	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	--	
	Student will be able to	
Course Outcomes	CO1	Design ER diagram and relational database.
	CO2	Apply normalization on given database.
	CO3	Analyze transaction and concurrency control mechanism.
	CO4	Understand storage and security mechanism.
	CO5	Illustrate emerging database systems.

Module	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to DBMS**	1,2	4
	1.1	File system organization		
	1.2	Purpose of Database system		
	1.3	Data models		
	1.4	Codd's rules		
	1.5	DBMS architecture		
2		**ER and Relational model**	1,2	6
	2.1	Entity set & Relationship set		
	2.2	Mapping cardinalities		
	2.3	Designing of ER diagram		
	2.4	EER features		
	2.5	ER to Relational Model Designing		
3		**Query optimization, Normalization and Functional Dependencies**	1,2, 3	9
	3.1	Query processing steps		
	3.2	Evaluation of Query		
	3.3	Relational Optimization		
	3.4	Functional dependency and its types		
	3.5	Normal forms : 1NF, 2NF, 3NF, BCNF		
4		**Transaction Management, Concurrency Control Techniques, Database Recovery Techniques**	1,2, 3	9
	4.1	ACID properties		
	4.2	Transaction states		
	4.3	Serializability and its types		
	4.4	Recoverability		
	4.5	Concurrency control mechanism		
	4.6	Lock based protocol		
	4.7	Timestamp based protocol		
	4.8	Recovery Techniques based on Deferred and Immediate Update		

	4.9	Shadow paging and ARIES recovery algorithm		
5		**Data storage and security**	1,2, 3	4
	5.1	File Organization		
	5.2	RAID levels		
	5.3	Introduction to database security		
	5.4	Discretionary and mandatory access control		
6		**Emerging Database Systems**	1,2, 3	10
	6.1	Client/Server Model (Poor setup, Split database setup)		
	6.2	Distributed Databases (Overview, Types of Distributed databases, Data fragmentation replication and allocation techniques, Query processing and Concurrency control)		
	6.3	Object Based Databases (Overview, Complex data types, Inheritance in SQL, Object identity and Reference types in SQL)		
	6.4	XML (XML documents, Approaches to store XML documents, Extracting XML documents from Relational Database)		
	6.5	Mobile Databases (Overview, Types of Mobile Databases, Synchronization process)		
	6.6	Multimedia Databases (Multimedia architecture requirements, Distributed Multimedia system, Client Server system)		
			Total	**42**

References:

[1] Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill Education, Sixth edition.

[2] Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education, Sixth edition.

[3] C. J. Date, A. Kannan and S. Swamynathan, "*An Introduction to Database Systems"*, Pearson Education, Eighth Edition

Sardar Patel Institute of Technology

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA 33	Operations Research	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE		Total	
		20		20	60		100	

Pre-requisite Course Codes	MCA 25	
	Student will be able to	
Course Outcomes	CO1	Apply Operations research methodology to a broad range of problems in business and industry.
	CO2	Use mathematics and mathematical modelling using computers to forecast the implications of various choices.
	CO3	Solve optimization problems.
	CO4	Think of new methods for solving optimization problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Nature of Operation Research**	1,2	1
	1.1	History ,Nature of Operation Research ,Impact of Operation Research, Application Areas		
2		**Overview of Modeling Approach**	1,2	2
	2.1	Formulating the problem, Constructing a mathematical model, Deriving a solution, Testing a model and the solution		
	2.2	Establishing control over the solution, Implementation issues		
3		**Linear Programming**	3,4,5	13
	3.1	Introduction ,Graphical solution**,** Graphical sensitivity analysis		
	3.2	The standard form of linear programming problems**,** Basic feasible solutions,		
	3.3	Simplex algorithm, Artificial variables		
	3.4	Big M and two phase method		
	3.5	Solution to Problems based on Degeneracy, Alternative optima, Unbounded solution, Infeasible solutions		
4		**Dual Problem**	6,7	5
	4.1	Relation between primal and dual problems		
	4.2	Dual simplex method, Sensitivity analysis		
5		**Transportation Problem**	3,6,7	6
	5.1	Starting solutions. North-west corner Rule – least cost methods		
	5.2	Vogel‟s approximation method, MODI Method		
	5.3	Minimization and Maximization problem		
6		**Assignment Problem & Travelling Salesman Problem**	4,8,10	5
	5.1	Assignment Problem: Hungarian method (Minimization and		

		Maximization)		
	5.2	Traveling Salesman Problem: Branch & Bound technique		
	5.3	Hungarian method		
7		**Sequencing Problem**	**4,7,9**	**3**
	5.1	Two machines n jobs		
	5.2	Three machines n jobs		
	5.3	N machines m jobs		
8		**Replacement Theory**	**9,10**	**4**
	5.1	Replacement of items that deteriorate		
	5.2	Replacement of items that fail group replacement and individual replacement		
9		**Game Theory**	**9**	**3**
	5.1	Two person Zero sum games		
	5.2	Solving simple games.		
			Total	**42**

References:

[1] Taha H. A., "Operation Research-An Introduction" , McMillan Publishing Company, NY
[2] Hillier F., and Lieberman G.J, Holden Day, "Introduction to Operation Research"
[3] P. K. Gupta & Hira, S. Chand, "Operations Research"
[4] Waynel L. Winston Thomson, "Operations Research Applications and Algorithms"
[5] Kambo, N.S., "Mathematical Programming Techniques", McGraw Hill
[6] Ravindran, "Operations Research- Principles and Practice", Wiley Production
[7] L E Prasad, "Operations Research",Cengage Learning
[8] K.V. Mital& Mohan New Age, "Optimization Methods"
[9] KantiSwaroop, Gupta P.K. Man Mohan, Sultan Chand and Sons, "Operations Research"
[10] S.D. Sharma, "Operation Research"
[11] H.M Wagher, "Principles of Operation Research (with applications to managerial decisions)"
,PHI, New Delhi

Tutorial on Operations Research

No.	**Topic**	Number of hours
1	Formulate give linear programing problem & graphical sol..	1
2	Simplex method to solve linear programing problem	1
3	Big M method to solve linear programing problem.	1
4	Solution of assignment problem using Hungerian method.	1
5	Initial basic feasible solution of transportation problem.	1
6	Optimum solution of transportation problem using MODI	1
7	Optimal sequence of 3 machine n job problem	1
8	Optimal sequence of m machine n job problem.	1
9	Replacement of a machine whose maint cost increases with time	1
10	Group replacement policy.	2
11	Game theory problem- Dominance rule	2
12	Game theory problem - Matrix method	1
	Total	14

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA34	Soft Skill Development	3	1	--	3	1	--	4
		Examination Scheme						
		ISE I	MSE		ISE II	Attendance		
		35	20		35	10		

Pre-requisite Course Codes	--	
	Student will be able to	
Course Outcomes	CO1	Develop skills in communication, business correspondence, presentations, group discussions and interviews
	CO2	Apply valuable strategies and interpersonal skills thereby making themselves more productive and better capable to lead others
	CO3	Understand the importance of teamwork and learn to perform to the best of their ability, both individually and as team players

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Soft-Skills Introduction**	1,2,4	02
	1.1	What are Soft Skills? Significance of Soft-Skills – Soft-Skills Vs. Hard Skills - Selling Soft- Skills –		
	1.2	Components of Soft Skills – Identifying and Exhibiting Soft-Skills		
2		**Communication**	1,2,5	08
	2.1	Concept and meaning of communication, methods of communication		
	2.2	verbal and non-verbal communication, barriers to communication, techniques to improve communication.		
	2.3	Communication in a business organization: Internal (Upward, Downward, Horizontal, Grapevine). External Communication		
	2.4	7 C"s of communication. Active Listening, Differences between Listening and Hearing, Critical Listening, Barriersto Active Listening, Improving Listening Practical (Role plays, case studies)		
3		**Written Communication**:	1,2,3	08
	3.1	Principles of Correspondence, language and style in official letter (full block format, modified block format),Business letters (enquiry to complaints and redressal), Applicationletter, CV writing, , E-mail etiquette,		
	3.2	Documentation of Meetings, Notice, Agenda		
	3.3	Practical (Practice on CV, Business Letters, Applications, Notice, Agenda, Minutes of Meetings)		
4		**Presentation techniques**	6,7	12
	4.1	Planning the presentation, Structure of presentation, Preparation, Evidence and Research, Delivering the presentation, handling questions, Time management. Visual aids. Practical - Presentation by students in groups of maximum 3 on Organizational Behavior topics allocated by faculty.		

	4.2	Topics have to cover – Personality: Meaning, Personality Determinants, Traits, Personality types and its, impact on career growth, Personality and Values, Perception and Individual Decision Making. Diversity in Organizations		
	4.3	Attitude: Meaning, Components of Attitude, changing attitude and its impact on career growth Motivation Goal setting: SMART (Specific, Measurable, Attainable, Realistic, Timely) Goals, personal and professional goals		
	4.4	Time Management. Learning in a group, Understanding Work Teams, Dynamics of Group Behavior, Techniques for effective participation Leadership Emotional intelligence		
5		**Public Speaking**	**6,7**	**08**
	5.1	Selecting the topic for public speaking, Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, Delivering the speech Practical (Extempore)		
6		**Group Discussion Skills**	**6,7**	**08**
	6.1	Evaluation components, Do‟s and Don‟ts.Practical (Group Discussions)		
7		**Interview Techniques**	**6,7**	**08**
	7.1	Pre-Interview Preparation, Conduct during,interview, Verbal and non-verbal communication, common mistakes.Practical (Role plays, mock interviews)		
			Total	**42**

References:

[1] Rai& Rai ,"Business Communication (Revised Edition)", Himalaya Publishing House,sixth edition**.**

[2] Chauhan &Sharma, "Soft skills: an integrated approach to maximise Personality" ,Wiley India publications,fifth edition.

[3] Kalia and Shailja Agarwal ,"Business Communication: A practice oriented approach" Wiley Indiapublications,fifth edition.

[4] Meenakshi Raman, Prakash Singh, "Business Communication", Oxford Publication, fourth edition

[5] Stephen Robbins & Judge Timothy,"Organization Behavior", Pearson Education,seventh edition

[6] K. Aswathappa ,"Organizational Behavior: Text, cases & games", Himalaya Publishing House,sixthedition

[7] Pareek, Udai, "Understanding Organizational Behaviour,",Oxford University Press, New Delhi,fourth edition

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE35A	Network Security	3	-	--	3	-	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes	MCA22	
	Student will be able to	
Course Outcomes	CO1	Understand basics of security and Cryptography
	CO2	Analyze secret and public key cryptography
	CO3	Analyze hash function and message digest
	CO4	Explain authentication and its standards
	CO5	Analyze internet security protocols.
	CO6	Understand IDS, VPN and firewall.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction**	2,5	3
	1.1	Types of attacks		
	1.2	Principles of security		
	1.3	Need for security		
	1.4	3 D"s for security		
	1.5	Security Approaches		
2		**Basic of Cryptography**	1,2	4
	2.1	Introduction		
	2.2	Plain text and Cipher text		
	2.3	Substitution Cipher (Ceaser , playfair cipher)		
	2.4	Transposition Cipher (Columnar transposition, Vernam and Book Cipher)		
	2.5	Encryption and Decryption		
	2.6	Symmetric and Asymmetric Cryptography		
	2.7	Possible types of attacks		
3		**Secret key Cryptography**	2,4	7
	3.1	DES		
	3.2	IDEA		
	3.3	AES		
	3.4	Blowfish		
	3.5	Schemes to encrypt large messages: ECB, CBC, OFB, CFB, Multiplication Encryption DES.		
4		**Public key Cryptography**	2,1,4	5
	4.1	RSA		
	4.2	Diffie-Hellmen Key Exchange		

	4.3	Digital Signature		
5		**Hash Functions and Message Digest**	**2,5**	**6**
	5.1	MD2		
	5.2	MD4 &MD5 Comparison		
	5.3	SHA		
	5.4	HMAC		
6		**Authentication and Standards**	**1,2,4**	**6**
	6.1	Types of Authentication (Password, address, cryptographic, smart cards, biometrics, mutual)		
	6.2	KDC working and Multi domain KDC		
	6.3	KerberosV5: names, delegation of rights, ticket lifetime , key version, kerberosV4 vs Kerberos V5		
	6.4	PKI: introduction, PKI trust models, PKI & X.509		
7		**Internet Security Protocols**	**5,1**	**6**
	7.1	SSL		
	7.2	SET		
	7.3	Email Security- PGP, S/MIME		
	7.4	IPSec- AH, ESP		
8		**VPN, IDS and Firewall**	**5,2**	**5**
	8.1	IDS-types and detection models, IDS features, Honeypot		
	8.2	Firewall-Introduction, Types		
	8.3	Virtual Private Network: Introduction, VPN Protocols		
			Total	**42**

References:

[1] William Stallings, "Cryptography and Network Security: Principles and Practice", 5th edition, Pearson.
[2] Atul Kahate , "Cryptography and Network Security ", 3rd Edition, Tata mc grawhill.
[3] Bernard Menezes , "Network Security and Cryptography", 2nd edition , Cengage Learning.
[4] Kauffman , "Network Security", 2nd edition, pearson .
[5] Eric Cole ,"Network Security Bible", 2nd Edition, Wiley.
[6] Behrouz A. Forouzan , "Cryptography and Network Security", TMH
[7] Charles P. Pfleeger , "Security in Computing", Pearson Education.
[8] Matt Bishop, "Computer Security Art and Science" , Addison-Wesley.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE35 B	Artificial Intelligence	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes	--	
	Student will be able to	
Course Outcomes	CO1	Develop a basic understanding of AI building blocks presented in intelligent agents.
	CO2	Choose an appropriate problem solving method and knowledge representation technique.
	CO3	Analyze models for reasoning with uncertainty as well as the expert system
	CO4	Design the AI applications in real world scenario.

Module	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to AI**	1	6
	1.1	Artificial Intelligence : Role of AI in engineering, AI in daily life		
	1.2	Intelligence and Artificial Intelligence		
	1.3	Different task domains of AI		
	1.4	Programming methods, Limitations of AI		
	1.5	**Intelligent Agent:** Agent, Performance Evaluation		
	1.6	Task environment of agent		
	1.7	Agent classification		
	1.8	Agent architecture		
2		**Problem Solving**	1,2, 5	11
	2.1	Problems, problem spaces and search: Define the problem as a state space search, Production systems		
	2.2	Problem characteristics, Production system characteristic		
	2.3	Issues in design of search program		
	2.4	**Uninformed Search Methods:** Breadth First Search (BFS), Depth First Search (DFS) , Depth Limited Search, Depth First Iterative Deepening(DFID),		
	2.5	**Informed Search Methods:** Greedy best first Search, A* Search , Memory bounded heuristic Search.		
	2.6	**Local Search Algorithms and Optimization Problems:** Hill climbing search Simulated annealing, Local beam search, Genetic algorithms.		
	2.7	**Adversarial Search:** Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning.		
3		**Knowledge Representation**	1,3, 5	9
	3.1	Knowledge Representation: Need to represent knowledge		
	3.2	Knowledge representation with mapping scheme		
	3.3	Properties of good knowledge-based system		
	3.4	Knowledge representation issues		
	3.5	AND-OR graph		
	3.6	Types of knowledge		
	3.7	The Wumpus World, The Propositional logic,		
	3.8	First Order Logic: Syntax and Semantic, Inference in FOL,		
	3.9	Forward chaining, backward Chaining.		

4		**Uncertain Knowledge and Reasoning**	**1,3, 5**	**3**
	4.1	Uncertainty, Representing knowledge in an uncertain domain,		
	4.2	The semantics of belief network,		
	4.3	Inference in belief network.		
5		**Planning and Learning**	**1,2, 5**	**8**
	5.1	The planning problem, Planning with state space search		
	5.2	Partial order planning, Hierarchical planning, Conditional Planning.		
	5.3	Learning: Forms of Learning, Inductive Learning, Learning Decision Tree.		
	5.4	Expert System: Introduction, Phases in building Expert Systems, ES Architecture		
	5.5	ES vs Traditional System.		
6		**Applications**	**2,4, 5**	**5**
	6.1	Natural Language Processing(NLP)		
	6.2	Expert Systems		
	6.3	Neutral Network.		
			Total	**42**

References:

[1] Artificial Intelligence, 3rd Edition, Elaine Rich, Kevin Knight, S.B. Nair, Tata McGraw Hill.
[2] Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education
[3] Patrick Henry Winston , "Artificial Intelligence", Addison-Wesley, Third Edition.
[4] N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press.
[5] Deepak Khemani, "A first course in Artificial Intelligence", McGraw Hill edition, 2013.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE35C	Management Information System	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes	---	
	Student will be able to	
Course Outcomes	**CO1**	Understand theoretical aspects of Management Information Systems
	CO2	Know the procedures and practices for performing information system planning and design.
	CO3	Gain knowledge in various Decision Support Systems
	CO4	Understand the implications of Management Information Systems on business

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Management Information Systems**	1,3	7
	1.1	Perspectives on Information Systems, Nature and scope of MIS, Characteristics of MIS, Need and Role of MIS,		
	1.2	Impact of MIS, functions and future of MIS, MIS: A support to the management,		
	1.3	MIS: organization effectiveness, MIS for a digital firm, Case Study		
2		**Strategic Design and Development of MIS**	1,2	7
	2.1	Strategic Management of the Business, Strategic design of MIS,		
	2.2	Business Strategy Implementation, Development of Long Range Plans of MIS, Ascertaining the class of Information,		
	2.3	Determining the Information Requirement, Development and Implementation of MIS,		
	2.4	MIS: Development Process Model, case study.		
3		**Decision Making**	2	8
	3.1	Decision making concepts, Decision Analysis by analytical modelling,		
	3.2	Behavioral concepts in decision making, Organizational decision making		
	3.3	MIS and Decision Making, Case Study		
4		**Information, knowledge, Business Intelligence**	2,4	8
	4.1	Information Concepts, Information :A Quality Product, Classification of the information		
	4.2	Methods of data and information collection, Value of		

		information, General model of a human as a information processor,		
	4.3	Summary of information concepts and their implications, Knowledge and knowledge management systems,		
	4.4	Business Intelligence, MIS , and the Information and Knowledge, Case Study		
5		**E-Commerce: Applications and Issues**	**1,2,4**	**6**
	5.1	Introduction to E-Commerce, Scope of E-commerce,		
	5.2	ECommerce Applications and Issues, case study		
6		**Securing Information Systems**	**1,3,4**	**6**
	6.1	System Vulnerability and Abuse		
	6.2	Business value of security and control		
	6.3	Technology and Tools for protecting Information, Resources, Case study		
			Total	**42**

Recommended Books:

[1] W.S.Jawdekar ,"Management Information Systems- A digital form perspective", TMG Publications , 4th edition

[2] W.S.Jawdekar ,"Management Information Systems- - A global digital Enterprise perspective", TMG Publications, 5th edition

[3] James O,,Brien ,"Management Information System" , TMH ,7th edition

[4] Loudon and Loudon ,"Management Information Systems", Pearson, 11th edition

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE35 D	Computer Graphics and Image Processing	3	-	--	3	-	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes	--	
	Student will be able to	
Course Outcomes	CO1	Demonstrate the algorithms to implement output primitives of Computer Graphics.
	CO2	Apply 2 D transformation techniques.
	CO3	Analyze 3 D transformation techniques.
	CO4	Apply image processing techniques.

Module	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Computer Graphics**	1,2	2
	1.1	Introduction to Computer Graphics		
	1.2	Elements of Computer Graphics, Graphics display systems.		
2		**Output primitives & its Algorithms**	1,2	10
	2.1	Points and Lines		
	2.2	Line Drawing algorithms: DDA line drawing algorithm, Bresenham‟s drawing algorithm		
	2.3	Circle and Ellipse generating algorithms : Mid-point Circle algorithm ,Mid-point Ellipse algorithm		
	2.4	Parametric Cubic Curves :Bezier curves		
	2.5	Fill area algorithms: Scan line polygon fill algorithm ,Inside-Outside Tests, Boundary fill algorithms, Flood fill algorithms		
3		**2D Geometric Transformations & Clipping**	1,2	10
	3.1	Basic transformations, Matrix representation and Homogeneous Coordinates		
	3.2	Composite transformation, shear & reflection. Transformation between coordinated systems		
	3.3	Window to Viewport coordinate transformation, Clipping operations – Point clipping		
	3.4	Line clipping : Cohen – Sutherland line clipping, Midpoint subdivision		
	3.5	Polygon Clipping: Sutherland – Hodgeman polygon clipping, Weiler – Atherton polygon clipping		
4		**Basic 3D Concepts & Fractals**	1,2	6
	4.1	3D object representation methods: B-REP Fractals		
	4.2	Sweep representations, CSG, Basic transformations, Reflection,		

		shear.		
	4.3	Projections – Parallel and Perspective Halftone and Dithering technique.		
	4.4	Self-similarity: Koch Curves/snowflake, Sirpenski Triangle		
5		**Introduction to Image Processing**	**5,3**	**4**
	5.1	Fundamental Steps in Digital Image Processing ,Components of an Image Processing System		
	5.2	Basic Concepts in Sampling and Quantization, Representing Digital Images		
	5.3	Spatial and Gray Level Resolution		
6		**Image Enhancement Technique**	**3,4,5**	**10**
	6.1	Image Enhancement in the Spatial Domain		
	6.2	Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, and Power Law Transformations		
	6.3	Piecewise Linear Transformation Functions: Contrast stretching, Gray-level slicing, Bit plane slicing.		
	6.4	Introduction to Histogram, Image Histogram and Histogram Equalization, Image Subtraction, and Image Averaging		
			Total	**42**

References:

[1] Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education, Second edition.
[2] David F. Rogers, James Alan Adams, "Mathematical elements for computer graphics", McGraw-Hill, Second edition.
[3] Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education, Third Edition
[4] S. Sridhar, "Digital image Processing", Oxford University Press, Second Edition
[5] Anil K. Jain "Fundamentals of digital image processing" Prentice Hall, Second Edition

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE 35 E	Service Oriented Architecture	3	-	--	3	-	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes	MCA11 , MCA23	
	Student will be able to	
Course Outcomes	**CO1**	An ability to comprehend the abilities of middleware and understand it suitability to application.
	CO2	An ability to develop Service Life cycle with real time example as well as identifying its semantics.
	CO3	An ability to analyze business architecture for Service Oriented Enterprise Application based on case study
	CO4	An ability to understand Strategic Architecture in SOA Governance

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Middleware**	1,3	3
	1.1	Generic Middleware, Service Specific Middleware, Working of CORBA.		
	1.2	Client/Server Building, , RPC, Java RMI		
	1.3	Promises and Challenges of SOA, Service Oriented Architecture, Business driven SOA		
2		**Introduction to Service oriented architecture**	1,2	4
	2.1	Service orientation in daily life, Drivers for		
	2.2	Dimensions of SOA, Key components of SOA, Services		
	2.3	Enterprise Service Bus, Orchestration, Prospective of SOA		
	2.4	SOA Perspectives of Standard Bodies, Future Trends		
3		**Getting started with SOA**	1,2	11
	3.1	Overview of SOA Implementation Methodology, SOA Reference Architecture, ,		
	3.2	Business Architecture, Business Processes, Information Design		
	3.3	Service Identification, Service Specification, Service Expectations,		
	3.4	Interaction Model, Service Constraints, Service Location, Services Realization, Buying Services, Outsourcing Services,		
	3.5	Building Services, Summary of Service Identification and Realization Concerns, Service Life Cycle,		
	3.6	The Service Design Process, Top-Down Approaches- Enterprise System Analysis - Business Process Model, Bottom-Up Approaches- Utility Services - Service Enabling,		
	3.7	Middle-Out: The Best of Both, Process Summary – Activities-		

		Artifacts – Repositories - Governance, Process Phases - Architectural Context – Business - Design - Implementation - Test, Practical steps		
	3.8	**Starting with the Business :** Business Architecture, Enterprise Business Architecture, Project Business Architecture,		
	3.9	Value Chain, Business Context, Understanding the Business Motivation Model – Ends - Vision - Desired Results, Means - Mission - Course of Action - Directives		
4		**Service Oriented Enterprise Application**	**1,2,3**	**10**
	4.1	Consideration for service oriented Enterprise Applications- Service Enablement, Service Integration, Service Orchestration, Service Infrastructure		
	4.2	Patterns for SOA- Patterns for Service Enablement, Patterns for Service Integration, Patterns for Service Orchestration, Patterns for Service Infrastructure, Pattern based Architecture for Service oriented Enterprise Applications,		
	4.3	Reference Model of Service Oriented, Java EE Enterprise Application, Technical Architecture, Composite Application,		
	4.4	SOA programming models -Service Component Architecture (SCA), Windows Communication Foundation (WCF), Enterprise SOA Layer and Solution Architecture for Enterprise Application.		
5		**Service Oriented Analysis and Design**	**1,2**	**6**
	5.1	Need for models, Principles of service Design –Reuse, Integration, Agility		
	5.2	Design of Activity Services (or Business Services)		
	5.3	Data Services, Design of Client Services, Design of Bu3.8siness Process Services, Illustration – Loan Approval Business Process, Explanation of Loan Approval Process		
6		**SOA Governance, Security and Implementation**	**1,2,3**	**8**
	6.1	SOA Governance- Strategic Architecture (Process, Technologies, People)		
	6.2	Development of services (Governance of Service Design, Governance of Service Execution, Governance of Service Modification, Technologies for SOA governance)		
	6.3	SOA security (Technologies for SOA security)		
	6.4	Approaches for Enterprise-wide SOA Implementation- Strategy (Due Diligence, AS IS Assessment), TO BE Strategy		
	6.5	SOA Development (Transition Planning, Validation, Proof of Concept, Business Process Model), Service Deployment and Monitoring		
Total				**42**

References :

[1] Michael Rosen, "Applied SOA"

[2] Shankar Kambhampaty, "Service- Oriented Architecture for Enterprise Applications", Wiley publication

[3] G. SudhaSadasivam, "Distributed Component Architecture", Wiley India edition.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL31	Core and Advanced Java Lab	--	--	4	--	--	2	2
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		--	40

Prerequisite Course codes	MCA11	
	Student will be able to	
Course Outcomes	CO1	Understand the basic object oriented features of JAVA and solve problems based on it.
	CO2	Implement Database connectivity and file handling concept in IAVA
	CO3	Understand Web technologies like Servlet and JSP in JAVA and implement real time problem based on it.
	CO4	Apply EJB applications and Struts framework of JAVA to solve real time application.

Expt. No.	Experiment Details	Ref.	Marks
1	Fundamentals of Java Programming	1,2	5
2	Designing a real world problem based on Packages and Interfaces Lambda Expression	1,2	5
3	Implementation of Generics and Collections	1,2	5
4	Design and implementation of Exception handling Multi-threading and File Handling	3	5
5	Event handling and GUI programming Database Programming	4	5
6	Implementation of real world problem based on servlet concept	3	5
7	Implementation of real world problem based on JSP designing concept	4	5
8	Implementation of real world problem based on Spring Frameworks and Hibernate	6,7	5
	Total Marks		40

References:

1. Herbert schildt, " The complete reference JAVA2", Tata McGraw Hill , Seventh Edition.
2. Sharanam Shah and vaishali shah, "Core Java for beginners",SPD, First Edition.
3. Kogent Learning Solutions Inc, "Java Server Programming java EE6", Dreamtech press First Edition.
4. Ivan Byaross, "Commercial web development using java 2.0", BPB, Revised Edition.
5. Marty Hall and Larry Brown , " Core Servlets and Java Server Pages :Vol I: Core
6. Craig Walls, "Spring in Action", 3rd Edition, Manning
7. Spring 5: End-To-End Programming: Build enterprise-grade applications using Spring MVC, Hibernate, and RESTful APIs Paperback – Import, 21 Dec 2018 by Claudio Eduardo de Oliveira, Dinesh Rajput, Rajesh R

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL32	Database Management System Lab	--	--	4	--	--	2	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	-	
	Student will be able to	
Course Outcomes	**CO1**	Apply SQL statements on database.
	CO2	Apply PL/SQL concepts for processing database.
	CO3	Demonstrate MongoDB database.
	CO4	Demonstrate Cassandra Database.

Exp. No.	Experiment details	Ref	Marks
1	**SQL** **Data Definition Language**: Create, Alter, Drop, Rename, Truncate **Data Manipulation Language**: Insert, Update, Delete, Select **Data Control Language**: Grant, Revoke, Roles **Transaction Control Language**: Commit, Rollback, Save point **Constraints**: Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint, Enabling & Disabling **Functions:** Single Row Functions, Character Functions, Number Functions, Date, Functions, Conversion Functions, General Functions, Multiple Row Functions, Group Function	1,2,3	5
2	**SQL SELECT Statements:** Selecting All Columns, Selecting Specific Columns, Column Alias, Concatenation Operator, Arithmetic Operators, Comparison Conditions, Logical Conditions, ORDER BY Clause **Subquery:** Subquery, Types of Subquery, Group Function, Having Clause **Joins**: Equijoins, Non-Equijoins, Joining Three Tables, Self Joins, Left Outer Joins, Right Outer Joins, Full Outer Joins, Cross Joins, Natural Joins Other Concepts: Sequence, View, Index	1,2,3	5

3	**PL/SQL** Programming: Variables, Identifiers, Comment, PL/SQL Block Structure IF Statements: Simple IF Statements, Compound IF Statements IF-THEN-ELSE Statements Loop: Basic Loop, WHILE Loop, FOR Loop **Cursor**: Types of Cursor, Explicit Cursor Life Cycle, Explicit Cursor Attributes **Trigger**: Trigger, Statement Trigger, Row Trigger, Using Conditional Operations **Exceptions**: Block Structure, Exception Handlers, Types of Exceptions **Records**: Table-Based, Cursor-Based, Programmer-Defined	1,2,3	5
4	**PL/SQL** **Functions**: Create Function, Function with Arguments, Executing Function, Dropping Function **Procedures**: Block Structure of Subprogram, Types of Subprograms, Procedure with Parameters, Executing Procedures, Dropping Procedures. **Packages**: Package Specification, Package Body, Creating Package, Execution, Dropping Package	1,2,3	5
5	MongoDB Installation Creating, updating and deleting documents.	4,5	5
6	MongoDB querying, indexing and aggregation.	4,5	5
7	Cassandra Installation	6,7	5
8	Cassandra key space operations, table operations and CURD operations.	6,7	5
		Total Marks	**40**

References:

[1] Dr. P.S. Deshpande, "SQL & PL/SQL for Oracle 11g", Dreamtech Press.
[2] Kevin Loney, "Oracle Database 11g The complete Reference", Oracle Press.
[3] Ivan Bayross, "SQL, PL/SQL: The programming language of Oracle", BPB Publication, Second revised edition.
[4] Kristina Chodorow, "MongoDB : The Definitive Guide", O'Reilly, Second edition.
[5] Kyle Banker and Tim Hawkins, "MongoDB in Action", Manning, Second edition.
[6] Eben Hewitt, "Cassandra : The Definitive Guide", O'Reilly, First edition.
[7] Nishant Neeraj, "Mastering Apache Cassandra", Packt Publishing, Second Edition.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL36	Unified Modeling Language Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	MCA11	
	Student will be able to	
Course Outcomes	CO1	Illustrate the use of UML using industrial CASE tool
	CO2	Construct Behavioral diagrams of UML to model of the Problem.
	CO3	Construct Structural diagram to model the design of software system.
	CO4	Analyze real world problems using UML diagrams

Exp. No.	Experiment Details	Ref.	Marks
1	Study of UML tools	1,2	5
2	Draw use case diagram. Prepare Use case specification document.	1,2	5
3	Draw the behavioral view diagram : Activity diagram	1,2	5
4	Create the Class diagram, Object diagram for given scenario	1,2	5
5	Draw the behavioral view diagram : Sequence diagram	1,2	5
6	Create communication diagram	1,2	5
7	Prepare the implementation view diagram: Component diagram	1,2	5
8	Prepare the environmental view diagram : Deployment diagram	1,2	5
	Total		40

Exp. No.	Tutorials	Ref.	Marks
1	**Study of UML Overview-** The Nature and purpose of Models	1,2	5
2	**Implementing Use Case** -Capturing a System Requirement, Use Case Relationships, Use Case Overview Diagrams	1,2	5
3	**Implementing Activity Diagram** - Essentials, Activities and Actions, Decisions and Merges, Doing Multiple Tasks at the Same Time, Time Events, Objects, Sending and Receiving Signals, Starting an Activity, Ending Activities and Flows, Partitions , Managing Complex Activity Diagrams	1,2	5
4	**Implementing Class and Objects**- What is a Class, Getting Started with Classes in Visibility, Class State: Attributes, Class Behavior: Operations, Static Parts of Your Classes Class Relationships, Constraints, Abstract Classes, Interfaces, Templates, Object Instances, Links, Binding Class Templates	1,2	5
5	**Implementing Sequence Diagram** - Participants, Time, Events, Signals, and Messages, Activation Bars, Nested Messages, Message Arrows	1,2	5
6	**Implementing Communication Diagram** Participants, Links, and Messages, Fleshing out an Interaction with a Communication Diagrams ,Communication Diagrams Versus Sequence Diagrams Building a Timing Diagram from a Sequence Diagram,Applying Participants to a Timing Diagram,States, Time, A Participant's State-Line, Events and Messages, Timing Constraints	1,2	5
7	**Implementing Component** A Basic Component in UML, Provided and Required Interfaces of a Component, Showing Components Working Together, Classes That Realize a Component, Ports and Internal Structure, Black-Box and White-Box Component Views	1,2	5
8	Implementing Deployment Diagram Deploying a Simple System, Deployed Software: Artifacts, What Is a Node?, Hardware and Execution Environment Nodes, Communication Between Nodes, Deployment Specifications, When to Use a Deployment Diagram	1,2	5
	Total Marks		**40**

References:

[1] Grady Booch, James Rumbaugh, Ivar Jacobson "The Unified Modeling Language User Guide ",Addison Wesley (2005) Second edition

[2] Kim Hamilton, **"** Learning UML 2.0", Russell Miles, O'Reilly, second edition.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA P31	Mini Project-III	--	--	2	--	--	01	01
		Examination Scheme						
		ISE			ESE			Total
		25			25			50

Pre-requisite Course Codes :	MCA11, MCA31 , MCA32, MCAL36	
	Student will be able to	
Course Outcomes	CO1	Formulate a real world problem and develop its requirements.
	CO2	Develop a design solution for the identified requirements.
	CO3	Test the prototype against identified requirements.
	CO4	Develop effective communication skills for presentation of project related activities.

Guidelines

1. Project assessment is done by internal and external examiner. The project carries weightage of 50 marks.
2. The internal assessment is done in two phases. Phase I carry 10 marks, Phase II carries 15 marks. Students will be continuously assessed by the internal examiner in the middle of the semester (phase I) and at the end of the semester (phase II).
3. The external examiner will be evaluating the students for 25 marks at the end of the semester.
4. ESE for project shall carry maximum 50 marks in each semester. These 50 marks shall be given by the internal and external examiner together.

Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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SEM IV

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA 41	Computational Intelligence - I	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		Mathematics, Probability ,Programming languages - Java/C++
After successful completion of the course, student will be able to		
Course Outcomes	CO 1	To search and plan suitability of different computational scenarios
	CO 2	To design Neural Networks and Convolutional Neural Networks
	CO 3	To design fuzzy controllers for various applications.
	CO 4	To apply Genetic Programming concept on real time case studies
	CO 5	To create hybrid model using soft computing techniques
	CO 6	To apply computational intelligence technique to solve real world problems

Module No.	Topics	Ref.	Hrs.
1	**Introduction to Computational Intelligence**: Concepts • Introduction to computational intelligence • Adaptation • Self-organization • Computational intelligence systems	4	3
2	**Search and Planning (Artificial Intelligence Perspective)** • Problem spaces and search • Knowledge and rationality • Heuristic search strategies • Search and optimization (gradient descent) • Case studies: Playing chess, Manufacturing scheduling	7	6
3	**Basics of Artificial Neural Networks and Convolutional Neural Networks** • Short History of Neural Networks, Rosenblatt's Neuron • Types of Learning (Supervised, Unsupervised, Reinforcement), Activation Functions • Basic Models of Artificial Neural Network, Basic terminologies and architecture of ANN • Supervised Learning, Linear Separability, • Back-Propagation Network • Basic architecture of CNN	2, 3	10
4	**Fuzzy Controllers** • Crisp Logic, Fuzzy logic • Classical Sets (Crisp Sets),Fuzzy Sets • Classical Relations and Fuzzy Relations, Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relations • Fuzzification, De-fuzzification	2, 3	10

	• Fuzzy Inference Systems (FIS)- Construction and Working Principle of FIS, Methods of FIS		
5	**Genetic Algorithm** • Simple genetic algorithm and operations • Encoding methods, Fitness function, • Working principle	**2,3,4**	**5**
6	**Hybrid Soft Computing Techniques** • Neuro fuzzy hybrid system • Genetic neuro hybrid system • Fuzzy-GA systems	**5, 6**	**5**
7	Application of Soft computing	2,3	3
			42

Recommended Books:

1. S.N.Sivanandam, S.N.Deepa "*Principles of Soft Computing*" 2nd Edition, Wiley Publication.
2. Samir Roy and Chakraborty, "*Introduction to soft computing*", Pearson Edition.
3. Computational Intelligence: Concepts to Implementations by Eberhart and Shi
4. Russell Eberhart and Yuhui Shi – "*Computational Intelligence: Concepts to Implementations*" (2007).
5. Fakhreddine Karray and Clarence de Silva – "*Soft Computing and Intelligent Systems Design*" (2004)
6. Neural network, fuzzy logic and genetic algorithm by Rajshekaran

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA42	Software Testing and Quality Assurance	3		--	3		--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes	MCA12	
	Student will be able to	
Course Outcomes	**CO1**	Solve the problems using Software Testing techniques and Approaches.
	CO2	Apply various Software testing Techniques to find bugs in software
	CO3	Understand test management and automation
	CO4	Apply various Software Quality Assurance Techniques to ensurethe quality in software.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Basics of Software Testing**	**1,3**	**4**
	1.1	Humans, Errors & Testing, correctness vs reliability, Goals of software testing, model for software testing, Life cycle of bugs		
	1.2	Testing & Debugging, Principles of testing, Software testing methodology.		
2		**Testing in the Software Life Cycle & Test Levels**	**1,2**	**6**
	2.1	The General V-Model, Software Testing Life Cycle (STLC), Verification and Validation activities.		
	2.2	Component Test, Integration, Test, System Test, Acceptance Test, Generic types of Testing-Functional, Non Functional		
	2.3	Testing software structure, Regression Testing		
3		**Static Testing**	**2**	**3**
	3.1	Structured Group Examinations – Reviews, General process, Roles and responsibilities, types of reviews, selection criteria. The compiler as a static analysis tool.		
4		**Dynamic Testing**	**1,2**	**8**
	4.1	Black Box Testing- Equivalence Class Partitioning, Boundary Value Analysis,		
	4.2	State Transition Test, Cause Effect Graphing and Decision Table Technique		
	4.3	White Box-Logic Coverage criteria, Control flow testing, Data flow testing. Mutation Testing.		
5		**Test Management**	**1,2**	**6**
	5.1	Test organization, Test Planning, Test plan hierarchy	1	
	5.2	Detailed test design and test specifications.	1	
	5.3	Incident Management – Test Log, Incident Reporting, Classification, Status	2	
6		**Test automation**	**1**	**3**
	6.1	Need for automation, Categorization of testing tools, Selection of testing tools,		
	6.2	Costs incurred in testing tools, Guidelines for automated testing,		
	6.3	Overview of some commercial testing tools		
7		**Software Quality Assurance**	**1,4**	**6**
	7.1	QA v/s QC, Quality assurance during SDLC phases, Quality Management System (QMS)- Benefits, attributes.		
	7.2	Contents of the Software Quality Assurance Plan, SQA: Organization level initiatives, Defect prevention		

	7.3	Capability Maturity model		
8		**Software Measurement & Metrics**	**4**	**6**
	8.1	Measurement during Software Life Cycle Context		
	8.2	Defect Metrics, Metrics for software Maintenance & Requirements		
	8.3	Measurement Principles		
	8.4	Case study for Identifying Appropriate Measures & Metrics for Projects		
		Total		**42**

References:

[1] Naresh Chauhan, "Software Testing" Oxford university press, second edition.
[2] Andreas Spillner, "Software Testing Foundations", Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors, fourth edition
[3] Aditya P. Mathur, "Foundations of Software Testing", Pearson Education, second edition
[4] Nina S. Godbole, "Software Quality Assurance Principles & Practice", Alpha Science Publication, third edition

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA43	Design and Analysis of Algorithms	3		--	3		--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		MCA11, MCA 23
		Student will be able to
Course Outcomes	CO1	Analyze time and space complexity of different algorithms.
	CO2	Demonstrate the applicability of divide & conquer method
	CO3	Apply greedy and dynamic method to given problem.
	CO4	Evaluate backtracking and branch and bound techniques.
	CO5	Demonstrate graph and string matching algorithms.
	CO6	Compare P and NP problems

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to analysis of algorithm**	1,2	4
	1.1	The Role of Algorithms in Computing		
	1.2	Growth of Functions		
	1.3	The substitution method		
	1.4	Recursion tree method		
	1.5	Introduction to time complexity : worst case, best case, average case analysis, space complexity. Asymptotic notations (Big O, Omega, Theta)		
2		**Divide and Conquer**	1	6
	3.1	Binary Search analysis		
	3.2	Merge sort analysis		
	3.3	Quick sort analysis		
	3.4	Matrix multiplication		
3		**Greedy Method & Dynamic Programming**	3,2	6
	4.1	Introduction to Greedy method		
	4.2	Knapsack problem		
	4.3	Minimum cost spanning tree- kruskal and prims algorithm		
	4.4	**Introduction to Dynamic programming**		
	4.5	0/1 Knapsack problem		
	4.6	Matrix Chain Multiplication		
	4.7	Longest Common Subsequence		
	4.8	Optimal Binary Search Tree		
4		**Backtracking**	1	5
	5.1	Introduction to Backtracking method		

	5.2	8 queen problem		
	5.3	Graph coloring		
	5.4	Hamiltonian cycles		
	5.5	The subset sum problem		
5		**Branch and Bound**	**1**	**4**
	6.1	Introduction to Branch and bound technique.		
	6.2	Bounding and FIFO branch and bound		
	6.3	Least Cost search branch and bound .		
	6.4	15 puzzle problem		
	6.5	Travelling salesman problem		
6		**Graph algorithm**	**1,2**	**6**
	7.1	Single source shortest path- Dijkstra's algorithm, Bellman Ford Algorithm		
	7.2	All pair shortest path-Floyd Warshall algorithm, Johnson's Algorithm		
	7.3	Max Flow Algorithm: Ford-Fulkerson method, Maximum Bipartite Matching, Push-relabel algorithm		
7		**String Matching Algorithm**	**3**	**6**
	8.1	Brute Force String matching		
	8.2	Rabin Carp string matching		
	8.3	Knuth-Morris-Pratt algorithm		
	8.4	String Matching with Finite Automata		
8		**Approximation Algorithm**	**3**	**5**
	2.1	P and NP complete problem. P and NP hard problem.		
	2.2	The Vertex-Cover Problem		
	2.3	The set-covering Problem		
			Total	**42**

References:

[1] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C Stein,"Introduction to Algorithms", MIT Press/McGraw Hill,2012

Version, 2/E, PHI Learning, 3rd Edition,

[2] S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis",Addison Wesley, 2000, 3rd edition.

[3] Michael Gooddrich & Roberto Tammassia, "Algorithm design foundation, analysis and internet examples", Second edition , wiley student edition.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA44	User Experience Design	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		MCA 12, MCA 22
		Student will be able to
Course Outcomes	CO1	Understand HMI as basic for UX Design
	CO2	Explain UX design life cycle
	CO3	Analyze UX design process for users
	CO4	Analyze various parameters for design process.
	CO5	Evaluate UX design process
	CO6	Understand UX design for Agile development

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Human Machine Interaction**	6,8	3
	1.1	Introduction		
	1.2	History of User interface designing		
	1.3	Usability		
	1.4	GUI &Web		
	1.5	User interface Design Goals		
2		**UX Design and Life Cycle**	1,2	6
	2.1	What is UX (User Experience), Ubiquitous interaction		

	2.2	A UX process lifecycle template		
	2.3	The system complexity space		
	2.4	Meet the user interface team		
3		**The UX Design Process – Understand Users**	1	7
	3.1	Introduction		
	3.2	The system concept statement		
	3.3	Contextual analysis-Introduction, User work activity gathering		
	3.4	Creating and managing work activity notes		
	3.5	Constructing your WAAD(Work Activity Affinity Diagram)		
	3.6	Formal Requirements Extraction		
	3.7	Abridged method for requirement extraction		
	3.8	User Model (Social Model), Usage Model (Flow Model, Task Interaction Model), Work Environment Model.		
4		**The UX Design Process-thinking, ideation and sketching**	1,3	9
	4.1	Design thinking		
	4.2	Design perspective		
	4.3	User personas, Ideation, Sketching		
	4.4	Mental models		
	4.5	Conceptual model		
	4.6	Storyboards		
	4.7	Wireframes		
5		**The UX Design Process- Prototyping and Evaluation**	1,3	9
	5.1	Fidelity of prototype		
	5.2	To make effective paper prototype		

	5.3	UX Evaluation and Improve UX Goals, Metrics and Targets		
	5.4	UX Evaluation Techniques.- Formative vs Summative		
	5.5	Types of formative and informal summative evaluation methods		
	5.6	Types of evaluation data		
	5.7	Practical Approach to UX Inspection		
6		**UX methods for Agile Development**	1,2	8
	6.1	Introduction		
	6.2	Basics of agile SE method		
	6.3	drawbacks of agile SE method from the UX perspective		
	6.4	A synthesized approach to integrate UX		
	6.5	Four Kinds of Affordance in UX Design		
			Total	**42**

Recommended Books:

[1] Rex Hartson and PardhaPyla ,"The UX Book", MK Publication.
[2] Jesmond Allen and James Chudley ,"Smashing UX Design"**,** John Wiley & Sons.
[3] Russ Unger and Carolyn Chandler , " A Project Guide to UX Design", O"reilly, Series
[4] Lindsay Ratcliffe and Marc McNeill , "Agile Experience Design", Pearson.
[5] William Lidwell, Kritina Holden and Jill Butler , "Universal Principles of Design", Rosenfeild
[6] Wilbert Galitz , "The Essential Guide to User Interface Design", Second Edition, Wiley.
[7] Alan Dix , "Human Computer Interaction", New riders
[8] Dr.Dhananjay Kalbande , Prashant Kanade, Sridari Iyer, " Human Machine Interaction" , wiley.

Tutorial on User Experience Design

Sr. no	**Tutorial name**	**No of hours**
1	Demonstration of Requirement Gathering	1
2	Making Life Cycle Design of Requirement	2
3	Study of Different types of Open Source Software	2
4	Basic Overview of JustInMind Prototype	1
5	Designing the user requirement	2
6	Verifying the Design and ReDesign if required	2
7	Presentation based on Design made	2
8	Case Study based on User Experience Design	2
Total Hours		**14**

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45A	Information Security	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		MCAE35 A
		Student will be able to
Course Outcomes	CO1	Understand the basics of security principles and practices.
	CO2	Explain data and program security
	CO3	Analyze database and operating system security
	CO4	Analyze security of wireless network and web services
	CO5	Understand laws for information security.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Security Principles and Practices**	3	5
	1.1	Information System Security Principles		
	1.2	Threats and Attacks		
	1.3	Classification of threats and assessing damages		
	1.4	Protecting Information Systems Security		
	1.5	Information System Security Engineering Process		
	1.6	Security Policies		
	1.7	standards		
2		**Data and Program Security**	2	7
	2.1	Data Protection		
	2.2	End Point security		
	2.3	Physical Security		
	2.4	Insider threats and data Protection Secure programs		
	2.5	Non-malicious program errors		
	2.6	malicious code		
	2.7	Targeted malicious code		
	2.8	Controls against program threats		
	2.9	Viruses, Virus Countermeasures		
	2.10	Worms		
3		**Operating System Security**	1,2	7
	3.1	Role of Operating systems in Information systems applications		
	3.2	Operating systems Security		
	3.3	Patched Operating systems		
	3.4	Protected Objects and Methods of Protection		
	3.5	Memory Address Protection		
	3.6	Control of Access to General Objects		
	3.7	File Protection Mechanism		
4		**Database Security**	3,2	6
	4.1	Database Security Requirements and Challenges		
	4.2	Database Integrity, Data Security Policies		
	4.3	Sensitive data		
	4.4	Interface		

	4.5	Multilevel database Application Software Controls :Concurrency Control		
	4.6	Cryptograph control		
	4.7	Audit train control		
5		**Software Web Services Security**	**4**	**6**
	5.1	Technologies for web services (XML, SOAP, WSDL & UDDI)		
	5.2	Web Services Security – Token types		
	5.3	XML encryption		
	5.4	XML segment		
6		**Security of Wireless Networks**		**4**
	6.1	An overview of wireless technology		
	6.2	Wired world versus wireless world: putting Wireless Networks in Information Security Context		
	6.3	Attacks on Wireless Networks		
7		**Laws & Legal Framework for Information Security**	**1**	**7**
	7.1	Introduction, Information Security and Law		
	7.2	Understanding the Laws of Information Security		
	7.3	Indian IT Act, Laws of IPR		
	7.4	Patent laws		
	7.5	Copyright Law		
	7.7	Ethical Issues in Information Security: Introduction		
	7.8	Issues in Network enterprises		
	7.9	Computer Ethics and Security and Privacy Policies		
			Total	**42**

References:

[1] Nina Godbole, "Information Systems Security", Wiley India
[2] Eric Cole, "Network Security Bible", Wiley India Edition
[3] C. P. Pfleeger, and S. L. Pfleeger, "Security in Computing", Pearson Education.
[4] Matt Bishop, "Computer Security: Art and Science", Pearson Education .

Tutorials on Information Security

Tut. No	**Topics**	**Hours**
1	Tutorial on Security Principles and Practices	2
2	Tutorial on Data and Program Security	3
3	Tutorial on Operating systems Security	2
4	Tutorial on Database Security	2
5	Tutorial on Software Web Services Security.	3
6	Tutorial on Laws & Legal Framework for Information Security	2
	Total	14

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45B	Natural Language Processing	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		20		20		60		

Pre-requisite Course Codes		MCA11 & MCA23, MCAE35B
		Student will be able to
Course Outcomes	CO1	Apply linguistic phenomena with formal grammars.
	CO2	Analyze word level, syntax and semantic analysis.
	CO3	Apply techniques and pragmatics for NLP applications.
	CO4	Analyze the various NLP algorithms.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction	1,4	3
	1.1	History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing ,		
	1.2	Ambiguity in Natural language , stages in NLP, challenges of NLP ,Applications of NLP- Machine translation,		
	1.3	Question answering system, Information retrieval, Text categorization , text summarization & Sentiment Analysis		
2		Word Level Analysis	1,3,4	11
	2.1	Finite Automata ,Nondeterministic Finite Automata , Nondeterministic Finite Automata with ϵ -transitions		
	2.2	Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology;		
	2.3	Regular expression, finite automata, finite state transducers (FST) ,Morphological parsing with FST ,		
	2.4	Lexicon free FST - Porter stemmer. N –Grams- N-gram language model, Ngram for spelling correction.		
3		Syntax analysis	1,3	8
	3.1	Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging,		
	3.2	Stochastic POS tagging, Issues –Multiple tags & words, Unknown words, class based n –grams.		
	3.3	Context Free Grammar – Constituency , Context free rules & trees, Sentence level construction , Noun Phrase, coordination, agreement, the verb phrase & sub categorization.		
4		Semantic Analysis	1,2,3	8
	4.1	Attachment for fragment of English- sentences, noun phrases,Verb phrases, prepositional phrases,		
	4.2	Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, Wordnet,		
	4.3	Selectional restriction based disambiguation & limitations , Robust WSD – machine learning approach and dictionary based approach		
5		Pragmatics	1,2,3	8
	5.1	Discourse –reference resolution, reference phenomenon , syntactic & semantic constraints on co reference,		
	5.2	preferences in pronoun interpretation , algorithm for pronoun resolution .Text coherence, discourse structure		

6		Applications (preferably for Indian regional languages)	1,2,3,4,5	4
	6.1	Machine translation, Information retrieval.		
	6.2	Question answers system, categorization, summarization, sentiment analysis.		
			Total	**42**

References:

[1] Daniel Jurafsky, James H. Martin "Speech and Language Processing" Second Edition, Prentice Hall, 2008.
[2] Christopher D.Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing ", MIT Press, 1999.
[3] Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
[4] Daniel M Bikel and Imed Zitouni " Multilingual natural language processing applications" Pearson, 2013
[5] Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) " The Handbook of Computational Linguistics and Natural Language Processing " .

Tutorial on Natural Language Processing

Sr.no	Tutorial Topics	No of Hours
1	Tutorial on basics in NLP,	1
2	Tutorial on Applications of NLP	1
3	Tutorial on Morphology analysis	1
4	Tutorial on Lexicon free FST	1
5	Tutorial on Sentiment Analysis	1
6	Tutorial on word level analysis	2
7	Tutorial on Syntax analysis	1
8	Tutorial on Context free grammer.	2
9	Tutorial on Semantic Analysis	1
10	Tutorial on Relations among lexemes & their senses	1
11	Tutorial on Pragmatics	1
12	Tutorial on Applications.	1
	Total	14

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated

Course Code	Course Name	Teaching Scheme (Hrs/ week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45C	Enterprise Resource Planning	3	1	---	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes		MCA14
		Student will be able to
Course Outcomes	CO1	Conceptualize the basic structure of ERP.
	CO2	Identify implementation strategy used for ERP.
	CO3	Apply design principles for various business module in ERP.
	CO4	Apply different emerging technologies for implementation of ERP.

Module No.	Unit No.	Topics	Ref.	Hrs.
1.		**Introduction to Enterprise Resource Planning (ERP)**	1,9	07
	1.1	Information System and Its Components		
	1.2	Value Chain Framework		
	1.3	Organizational Functional Units		
	1.4	Evolution of ERP Systems		
	1.5	Role of ERP in Organization		
	1.6	Three-Tier Architecture of ERP system		
2.		**ERP Implementation Life cycle**	1, 9	06
	2.1	Project Preparation, Initial Costing		
	2.2	Requirement Engineering, ERP Solution Selection		
	2.3	Technical Planning, Change Management and Training Plan		
	2.4	Implementation and Deployment Planning, Configuration		
	2.5	Custom Coding		
3.		**ERP and Related Technologies**	1,9	08
	3.1	Business Processing Reengineering(BPR)		
	3.2	Data Warehousing		
	3.3	Data Mining		
	3.4	On-line Analytical Processing(OLAP)		
	3.5	Supply Chain Management (SCM)		
	3.6	Customer Relationship Management(CRM)		
	3.7	Electronic Data Interchange (EDI)		
4.		**ERP Manufacturing Perspective**	3,4,5	05
	4.1	MRP - Material Requirement Planning, PDM - Product Data Management		
	4.2	BOM - Bill Of Material		
	4.3	MRP - Manufacturing Resource Planning		
	4.4	**DRP - Distributed Requirement Planning**		
5.		**ERP Modules**	3,4,5	05
	5.1	Finance		
	5.2	Plant Maintenance		
	5.3	Quality Management		
	5.4	Materials Management		
6.		**Benefits of ERP**	3,4,5	06
	6.1	Reduction of Lead-Time, On-time Shipment		

	6.2	Reduction in Cycle Time, Improved Resource Utilization		
	6.3	Better Customer Satisfaction, Improved Supplier Performance		
	6.4	Increased Flexibility, Reduced Quality		
	6.5	Costs, Improved Information Accuracy and Design-making Capability		
7.		**Introduction to ERP tools**	**7,8,9**	**05**
	7.1	OpenERP		
	7.2	JD Edwards-Enterprise One		
	7.3	Microsoft Dynamics-CRM Module		
	7.4	SAP.		
			TOTAL	**42**

References:

[1] Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill, 3rd Edition.
[2] Alexis Leon, "Enterprise Resource Planning - Diversified", TMH.
[3] Ravi Shankar & S. Jaiswal, "Enterprise Resource Planning", Galgotia.
[4] Vinod Kumar Garg, N. K. Venkitakrishnan, "Enterprise Resource Planning : Concepts and Practices".
[5] AnnettaClewwto and Dane Franklin, "ERP a Managerial Perspective by S Sadagopan"
[6] Guide to Planning ERP Application, , McGRaw-Hill, 1997.
[7] Jose Antonio , "The SAP R/3 Handbook", McGraw – Hill.
[8] Dr. Ravi Kalakota, "E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft : A Practical Roadmap For Success".
[9] Veena Bansal, "Enterprise Resource Planning - A Managerial Perspective", PEARSON.

Tutorial on Enterprise Resource Planning

Tut. No.	Topic	Hours
1	Case study on architecture of ERP system	1
2	Case study on life cycle of ERP implementation.	1
3	Case study on Supply Chain Management.	2
4	Case study on Customer Relationship Management.	2
5	Case study on Manufacturing Resource Planning.	2
6	Case study on various ERP modules.	2
7	Case study on OpenERP and SAP	2
8	Case study on recent trends in ERP.	2
	Total	14

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45 D	Multimedia	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE		Total	
		20		20	60		100	

Pre-requisite Course Codes		MCAE35 D
		Student will be able to
Course Outcomes	CO1	Perceive multimedia architecture and its latest applications.
	CO2	Implement compression, decompression techniques and different formats for image, audio and video.
	CO3	Plan and develop multimedia projects

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Fundamentals of Multimedia Systems Design-**	1,2,3,4	6
	1.1	An Introduction Multimedia Systems, Design Fundamentals		
	1.2	Elements of multimedia		
	1.3	Multimedia system architecture - High resolution graphics display		
	1.4	IMA Architectural Framework,		
	1.5	Network architecture for multimedia systems		
	1.6	Defining objects for Multimedia systems: Text, Images, Audio and video		
2		**Multimedia Input and Output Technologies**	1,2	8
	2.1	Key Technology Issues, Touch screen, Pen Input		
	2.2	Video and Image Display Systems, Print Output Technologies		
	2.3	Image Scanners		
	2.4	Digital Voice and Audio, Video Images and Animation, Full Motion Video.		
3		**Multimedia File format and standards**	3,4	8
	3.1	RTF, TIFF,RIFF, MIDI		
	3.2	JPEG DIB, AVI, MIDI audio		
	3.3	JPEG & MPEG standards		
	3.4	MIDI Vs Digital Audio, Analog display standards		
	3.5	Digital display standards, Digital video		
4		**Image Compression and Decompression Techniques**	1,3,4	9
	4.1	Compression Techniques- Lossy and Lossless , Entropy encoding		
	4.2	Run length encoding, Huffman coding		
	4.3	JPEG compression process, JPEG methodology, JPEG 2000 standard, Performance comparison of JPEG and JPEG2000		
	4.4	Discrete Cosine Transform, CCITT group 3 1D,3 21D and 4 2D compression		
5		**Audio and Video Compression**	1,3,4	7
	5.1	Audio Compression-Audio/Sound Basic concepts Computer representation of sound		
	5.2	ADPCM in speech coding, MPEG audio		

	5.3	Introduction to digital video: Types – Chromasub sampling, CCIR , HDTV Computer Video format		
	5.4	Motion Compression, Motion Vector Search Technique		
	5.5	Sequential, 2D logarithmic, Hierarchal search		
	5.6	Standards used – H.261,Comparison of MPEG and H.264 , MPEG 1,2,4,7 and File formats – DVI		
6		**Multimedia presentation and Authoring**	**1,2,4**	**4**
	6.1	Multimedia system design & its Issues, Types		
	6.2	Authoring Systems, Design Issues Approaches		
	6.3	User Interface Issues, Architecture		
	6.4	Information characteristics for presentation, Presentation design knowledge		
	6.5	Effective HCI		
			Total	**42**

References:

[1] PrabhatK.Andleigh, KiranThakrar, "Multimedia Systems Design Paperback", Pearson Education India, 2015
[2] TayVaguhan, "Multimedia: Making it Work", McGraw Hill Professional, 2008, Seventh Edition
[3] Li and Ze – Nian , Mark Drew, "Fundamentals of Multimedia", PHI 2005
[4] John F. Koegel Buford, "Multimedia Systems", Pearson Education

Tutorial on Multimedia

Tut. No.	Topic	Hours
1	Case study on various multimedia application tools	1
2	Case study on image scanners	1
3	Case study on full motion videos	2
4	Case study on multimedia file formats and standards	2
5	Case study on image compression techniques	2
6	Case study on audio compression techniques	2
7	Case study on video compression techniques	2
8	Case study on recent trends in multimedia	2
	Total	14

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45 E	Semantic web	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE		Total	
		20		20	60		100	

Pre-requisite Course Codes	MCAL16	
	Student will be able to	
Course Outcomes	CO1	Understand and discuss fundamental concepts, advantages and limits of the semantic web
	CO2	Model and query domain knowledge as ontologies defined using standards such as RDF and OWL
	CO3	Apply the principles of ontological engineering to modelling exercises
	CO4	Understand the applications of semantic web to web services and Web 2.0

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to the Semantic Web**	**1**	**4**
	1.1	The revolution of semantic web, Evolution of web, Need for semantic web		
	1.2	Web 2.0 approach, semantic web approach, benefits of semantic web, Characteristics of SW, SW Vs AI, building blocks of SW		
2		**Introduction to Ontologies**	**1**	**4**
	2.1	Introduction, transfer from DB to ontology, difference between ontology and taxonomy		
	2.2	Types of ontology, why to develop ontology, Ontology development life cycle, advantages, limitation of ontology		
3		**Ontology Languages for the Semantic Web**	**2**	**6**
	3.1	Resource Description Framework (RDF) – Lightweight ontologies Introduction, RDF: Basic Ideas, RDF: XML-Based Syntax RDF Schema: Basic Ideas		
	3.2	RDF Schema: The Language RDF and RDF Schema in RDF Schema, An Axiomatic Semantics for RDF and RDF Schema A Direct Inference System for RDF and RDFS, Querying in SPARQL		
4		**Web Ontology Language: OWL**	**2**	**6**
	4.1	Introduction , OWL and RDF/RDFS , Three Sublanguages of OWL, Description of the OWL Language		
	4.2	Layering of OWL Examples, OWL in OWL ,Future Extensions 150		
5		**Ontology Engineering**	**1, 2**	**6**
	5.1	Introduction, Constructing Ontologies Manually, Reusing Existing Ontologies		
	5.2	Semiautomatic Ontology Acquisition, Ontology Mapping , On-To-Knowledge Semantic Web Architecture		
6		**Logic and Inference: Rules**	**2**	**4**
	6.1	Introduction, Example of Monotonic Rules: Family Relationships Monotonic Rules: Syntax , Monotonic Rules: Semantics		
	6.2	Description Logic Programs (DLP) , Semantic Web Rules Language (SWRL)		

	6.3	Nonmonotonic Rules: Motivation and Syntax , Example of Nonmonotonic Rules: Brokered Trade		
	6.4	Rule Markup Language (RuleML)		
7		**Semantic web and Web 2.0**	**2**	**6**
	7.1	Social and technological development that led to web 2.0, Features of web 2.0 applications		
	7.2	Architecture of web 2.0, Modelling web 2.0		
8		**Applications of Semantic Web**	**2,3**	**6**
	8.1	Introduction, Horizontal Information Products at Elsevier		
	8.2	Openacademia: Distributed Publication Management		
	8.3	Bibster: Data Exchange in a Peer-to-Peer System		
	8.4	Data Integration at Audi		
	8.5	Skill Finding at Swiss Life		
	8.6	Think Tank Portal at EnerSearch		
	8.7	e-Learning, Web Services, Other Scenarios		
			Total	**42**

Instruction for Assignments and Tutorials:
The Term Work Should consist of two tests, One Presentation/Case Study and six assignments based on the recommended syllabus

References:

[1] Dhana Nandini Semantic Web And Ontology ISBN: 978-87-403-0827-3 1 edition Pages : 107

[2] Grigoris Antoniou, Frank van Harmelen A Semantic Web Primer, 2nd Edition The MIT Press; 2 edition (March 31, 2008)

[3] John Domingue, Dieter Fensel, James A. Hendler Handbook of Semantic Web Technologies

[4] Gary B. Shelly, Mark Frydenberg Web 2.0: Concepts and Applications

[5] Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, CRC Press, 2009.

[6] Dean Allemang, James Hendler, Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kauffmann, ISBN-10: 0-12-373556-4.

[7] Geroimenko, Vladimir; Chen, Chaomei (Eds.) 2nd ed., 2006, XIV, 248 p. 108 illus., Hardcover ISBN: 978- 1-85233-976-0, Visualizing the Semantic Web XML-based Internet and Information Visualization, SpringerVerlag London Ltd; 2Rev Ed edition (Oct 2005).

[8] Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management: A Guide to the Future of XML, Web Services and Knowledge Management, John Wiley & Sons (20 Jun 2003)

Tutorial on Semantic Web

Tutorial No.	Tutorial Details	Hours
1	Study of Ontology development life cycle with real time example	2
2	Design of Resource Description Framework with query writing	2
3	Layering of OWL Examples	2
4	Constructing Ontologies Manually, Reusing Existing Ontologies	2
5	Example of Monotonic Rules and Non-monotonic Rules	2
6	Study of Architecture of web 2.0	2
7	Understanding of Applications of Semantic Web	2
	Total	**14**

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL41	Computational Intelligence – I Lab	--	--	4	--	--	2	2
		Examination Scheme						
		ISE		MSE	ESE		Total	
		40		--	--		40	

Pre-requisite Course Codes		Mathematics, Probability ,Programming languages - Java/C++
After successful completion of the course, student will be able to		
Course Outcomes	CO 1	Understand the difference between learning and programming and explore practical applications of Neural Networks (NN).
	CO 2	To design Neural Networks
	CO 3	To analyze the applications which can use fuzzy logic
	CO 4	Understand the basics of genetic algorithm, use of GA operators and its applications.
	CO 5	Appreciate the importance of hybrid approach

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	To design MP neuron for various problems	1,2, 5	5
2	To design Perceptron Neural network	1,2, 5	5
3	To design supervised NN model using BPN	1,2	5
4	Implement Union, Intersection, Complement and Difference operations on fuzzy sets.	1, 2,3,4, 5	5
5	To perform Union, Intersection and Complement operations To implement De-Morgan's Law.	4,5	5
6	To design fuzzy controller	4,5	5
7	Implementation of Simple Genetic Application	4,5	5
8	Color recipe prediction using ANFIS	2,3, 4, 5	5
		Assessment Marks	40

References:

1. Russell Eberhart and Yuhui Shi "Computational Intelligence: Concepts to implementations" (2007).
2. Fakhreddine Karray and Clarence de Silva, "Soft Computing and Intelligent Systems Design" (2004)
3. Andries Engelbrecht – "Computational Intelligence: an Introduction" (2007)
4. S.N.Sivanandam and S.N.Deepa "Principles of Soft Computing" 2nd Edition, Wiley Publication.
5. Samir Roy and Chakraborty, "Introduction to soft computing", Pearson Edition.
6. NN in practice by Hagan

Sardar Patel Institute of Technology

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL42	Software Testing and Quality Assurance Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	MCA42	
	Student will be able to	
Course Outcomes	**CO1**	Apply the fundamental Software Testing techniques, through Manual Testing.
	CO2	To Analyze Automation Testing Tool and observe the benefit for the same.
	CO3	Create test design documents and test reports

Exp. No.	Experiment Details	Ref.	Marks
1	Study of Reviews (Writing Test cases, Testing Framework, Test Document)	1,2	5
2	Construction of CFG & Deriving Test Cases	1,2	5
3	Implementation of Test Cases using Unit Testing, Integration & System Testing	1,2	5
4	State Transition Test, Cause Effect Graphing and Decision Table Technique	1,2	5
5	Study of Automation Tools, Building Test Cases.	3	5
6	Using Base URL to Run Test Cases in Different Domains	3	5
7	Selenium commands-selenese, Matching Text Patterns, Performance Testing Concepts :Load Testing, Stress Testing	3	5
8	Web Driver Implicit & Explicit Wait, Cross Browser Testing, API Testing	3	5
		Total Marks	40

References :

[1] Sandeep Desai, "Software Testing Practical Approach", PHI publication , second edition
[2] Ilene Burnstein , "Practical Software Testing: A Process-Oriented Approach", Springer Professional,2e
[3] David Burns, "Selenium 1.0 Testing Tools" ,PACKT publication, third edition.

Sardar Patel Institute of Technology

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL43	Design and Analysis of Algorithms Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	MCA11 , MCA23	
	Student will be able to	
Course Outcomes	CO1	Implement divide & conquer method
	CO2	Apply greedy and dynamic method to given problem.
	CO3	Implement backtracking and branch and bound techniques.
	CO4	Apply graph and string matching algorithms to given problem

Sr. no	Experiment details	Ref	Marks
1	To implement Divide and conquer method	1,2	5
2	To implement Greedy Technique	1,2	5
3	To implement dynamic algorithms	1,2	5
4	To implement Backtracking algorithm	1,2	5
5	To implement branch and bound algorithm	1,2	5
6	To implement Single source shortest path	1,2	5
7	To implement All pair shortest path	1,2	5
8	To implement String matching algorithm	1,2	5
Total marks			**40**

References:

[1] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms",MIT Press/McGraw Hill, 2012 Version, 2/E, PHI Learning,3rd Edition.

[2] S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design andAnalysis". Addison Wesley, 2000,3rd edition.

Sardar Patel Institute of Technology

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL46	Mobile Programming Lab	--	--	4	--	--	2	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	--	
	Student will be able to	
Course Outcomes	**CO1**	Understand basics of Ionic Native
	CO2	Design and Develop User Interface components using Ionic Native.
	CO3	Develop Application using file handling techniques and API
	CO4	Develop Mobile Applications with database connectivity.

Exp. No.	Experiment Details	Ref.	Marks
1	Introduction: understanding ionic native and installing the development environment.	1,2	5
2	Building app with ionic: understanding SASS[Syntactically awesome style sheet] and angular components, ionic serve and ionic view, ionic CLI.	1,2	5
3	To Implement UI(User Interface) components (Toggle, checkbox, Alert, Action Sheet, Floating action bar button)	1,2	5
4	To implement navigational components (Menus, Navigation, Tabs, etc.)	1,3	5
5	To implement files concept for read/write access to files	1,3	5
6	To implement ionic Native Plugins API	1,3	5
7	To implement HTTP (REST API request)	1,3	5
8	To implement Firebase/SQLite	1,3	5
		Total Marks	**40**

References:

[1] https://ionicframework.com/docs

[2] Learning Ionic - Second Edition, by Arvind Ravulavaru, Packt Publishing, ISBN: 9781786466051

[3] Hybrid Mobile Development with ionic ,Build high performance hybrid applications with HTML,CSS and Javascript, by Gaurav Saini, Packt Publication, ISBN: 9781785286056.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA P41	Mini Project-IV	--	--	2	--	--	01	01
		Examination Scheme						
		Presentation Internal Assessment			External Assessment			Total
		25			25			50

Pre-requisite Course Codes :	MCA11 , MCA 23, MCA31, MCA32	
	Student will be able to	
Course Outcomes	**CO1**	Formulate a real world problem and develop its requirements.
	CO2	Develop a design solution for the identified requirements.
	CO3	Test the prototype against identified requirements.
	CO4	Develop effective communication skills for presentation of project related activities.

Project assessment is done by internal and external examiner. The project carries weightage of 50 marks.

The internal assessment is done in two phases. Phase I carry 10 marks, Phase II carries 15 marks. Students will be continuously assessed by the internal examiner in the middle of the semester (phase I) and at the end of the semester (phase II).

The external examiner will be evaluating the students for 25 marks at the end of the semester.

ESE for project shall carry maximum 50 marks in each semester. These 50 marks shall be given by the internal and external examiner together.