

**Bharatiya Vidya Bhavan's**

# **Sardar Patel Institute of Technology**

(Autonomous Institute Affiliated to University of Mumbai)



## **Master of Computer Applications**

**(Sem. I and Sem. VI)**

**Effective from Academic Year 2017 -18**



# Sardar Patel Institute of Technology

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

## Preamble:



Concept of academic autonomy is based on the argument that Institutions can undertake the work expected of them by all stakeholders such as Students, Parents, University, Industry, Society in general, only if they have freedom of choice and action.

We at S.P.I.T. would like to believe that this freedom of choice and action as far as academics is concerned will make us more Proactive in our offerings.

An academic autonomy is as good as its Curricula and execution of it is as well as its faculty. S.P.I.T. is confident of succeeding on both the fronts.

In the first offering we have tried to pro-actively bridge the ever discussed "Industry-academic gap" by way of our SCOPE program. The issue about sensitizing students to social needs is being addressed by special activity based courses. Liberal arts courses have been introduced to enhance functionality of both sides of brain. In all this the professional core has not been overlooked. Thus the curricula are designed to achieve multi dimensional outcomes.

The evaluation mechanism is tuned for assessing the attainment of the designed outcomes and is designed as a fair mechanism.

As our learning cycle begins from July 2017, I wish to place on record that entire S.P.I.T. staff and faculty will work with singular focus and commitment towards the success of this endeavour.

**Dr. Prachi Gharpure**

**Principal, S.P.I.T.**



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India (Autonomous Institute Affiliated to University of Mumbai)

## From the Desk of Dean Academics



Greetings and congratulations to all the students, teaching and supporting staff of Sardar Patel Institute of Technology for getting autonomous status to the institute from the year 2017-18. In particular congratulations to all the First Year students of Master of Computer Applications who secured admission to autonomous Sardar Patel Institute of Technology. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Indian Society and Industries.

In the proposed curriculum we have made an attempt to provide opportunity for students to develop themselves with the knowledge, skill and ethical behavior required for global career. The curriculum model is outcome based that focuses on learning by doing. This is achieved through activity based learning, minor projects, problem solving and innovative styles of pedagogy. Various steps are taken to transform teaching-learning process to make learning a joyful experience for students.

MCA program curriculum is designed to meet the growing demand for skilled qualified professionals in the field of applications of computers. It is a post graduate course and to be inclined more towards application development and thus has more emphasis on latest programming languages and tools to develop better and faster applications. As the Information Technology and the software industry are dynamic and fast growing, courses are designed keeping in view the requirements of industry. The courses aim at the understanding of the fundamentals of computing among the students so that they can compete in the present-day global situation. First year courses are particularly designed by keeping in mind the enrollment of students' diverse academic background. The MCA program prepares students to take up positions as system analysts, systems designers, Programmers and managers in any field related to information technology. The designed curriculum, therefore, aims at imparting comprehensive knowledge with equal emphasis on theory and practice. There is a scope in the curriculum for MCA students to spend significant time in industry to know the insights of working of Information Technology sector.

Sardar Patel Institute of Technology also initiated Skill development programme called SCOPE (Skill Certification for Outcome-Based Professional Education) to enhance employability, innovation and research culture in the institute. SCOPE is primarily for B.Tech. students but MCA students are also welcome to enroll for these certification courses of their choice from any of the department. Some of the courses under SCOPE will be delivered in co-ordination with industries. We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units. Faculty of S.P.I.T. deserves a special appreciation for their relentless efforts in designing curriculum and assessment instruments which will bring transformation in the quality and transparency in assessment of learners.

Looking forward for your active cooperation and constructive feedback to create vibrant and joyful learning environment at Sardar Patel Institute of Technology.

**Dr. Surendra Singh Rathod**  
**Professor and Dean Academics**



# Sardar Patel Institute of Technology

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## Message from Head of the Department



The Board of Studies at Sardar Patel Institute of Technology considered the need to enhance the quality of technical education so as to enable the post-graduates to successfully meet the challenges and the requirements of the 21st century. Keeping this need in mind, it has designed the MCA scheme of instruction and courses that would be relevant to society and are qualitative in contemporary terms. In today's world, post-graduates are facing numerous challenges like rapid change in technologies/methods, emergence of new career opportunities, use of computers in each profession and social/environmental concerns. These challenges require appropriate guidance of education and research in all the disciplines. By

looking at these challenges, the objective of this scheme is to develop professionals with competencies, intellectual skills and knowledge that will equip them to contribute to society. The integrated teaching methodology allows understanding of interaction between the different business areas required for IT enabled industries.

The scheme is developed as per AICTE, UGC guidelines and it also fulfills the Program Specific Criteria for curriculum development stipulated by IEEE, ACM and CSI. The MCA syllabus is designed considering various modes of effective teaching-learning and assessment that reflect in its interdisciplinary approach required for advanced application course. There is appropriate distribution of units and credits among Mathematics, Management and trending Computer/IT Technologies. According to this scheme, every student undergoes approximately 28 hours of learning per week for credits in a semester. More emphasis is laid on laboratory practices and mini projects every year. The scheme offers a wide range of electives from the second year of study and continuous research on latest trending technologies. The proposed courses are relevant and are tuned as per the requirement of IT Industry and research organizations. This scheme has been proposed after detailed deliberations and associating senior experts from leading academic institutions and also engaging various stakeholders. It is expected that this scheme will evolve and significantly improve in the years to come.

**Dr. Pooja Raundale**

**Head, MCA Department**

**Domain wise List of Courses Identified:**

<b>Information and Communication Technology (ICT):</b>	
MCA11	Object Oriented Programming
MCA12	Software Engineering
MCA L11	OOP Lab
MCAL16	Web Technology Lab
MCA L17	LINUX Lab
MCA21	Operating System
MCA22	Computer Networks
MCA23	Data Structures
MCAL22	Computer Networks Lab
MCAL23	Data Structures Lab
MCAL26	Python Programming Lab
MCA31	Core and Advanced Java
MCA32	Database Management System
MCAL31	Core and Advanced Java Lab
MCAL32	Database Management System Lab
MCAL36	Unified Modelling Language Lab
MCA41	Dataware housing and Mining & Business Intelligence
MCA42	Software Testing and Quality Assurance
MCA43	Design and Analysis of Algorithm
MCA44	User Experience Design
MCAL41	Dataware housing and Mining & Business Intelligence Lab
MCAL42	Software Testing and Quality Assurance Lab
MCAL43	Design and Analysis of Algorithm Lab
MCAL46	Mobile programming Lab
MCA501	Advanced web technology & Dot Net
MCA502	Wireless & Mobile Technology
MCA503	Soft Computing
MCA504	Distributed computing and Cloud Computing
L501 Lab I	AWT + Dot Net
L502 Lab II	Wireless & Mobile Technology + Mini project
<b>Business Management (BM):</b>	
MCA14	Principles of Management
MCA15	Banking and Finance
MCA24	Software Project Management
MCA34	Soft Skill Development
<b>Mathematics (M):</b>	
MCA13	Discrete Mathematics
MCA25	Probability and Statistics
MCA33	Operations Research

Professional Electives (PE):

- Student will select a track MCAEXXA or ELXXB or ELXXC or ELXXD or ELXXE or ELXXF
- Courses in a particular track are co-related
- Student can change the elective choice at the end of Semester III or before start of Semester IV

<b>MCAE35<sup>^</sup> Elective-I</b>	
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
<b>MCAE45<sup>^</sup> Elective-II</b>	
MCAE45 A	Information Security
MCAE45 B	Soft Computing
MCAE45 C	Enterprise Resource Planning
MCAE45 D	Multimedia
MCAE45 E	Semantic web
<b>MCAE505<sup>^</sup> Elective-III</b>	
MCA5051	Cyber Security
MCA5052	Multimedia Technology
MCA5053	Information System security and Audit
MCA5054	Bioinformatics
MCA5055	Software Quality Assurance
<b>Project (PR):</b>	
MCAP11	Mini project-I
MCAP21	Mini Project-II
MCAP31	Mini Project-III
MCAP41	Mini Project-IV
PR501	Mini Project
<b>Summer/Internship Project (SP):</b>	
MCASP2	Summer Project
MCASP4	Summer Course on Current Technology in Industry
MCASP6 .1	Internship – Project
MCASP6 .2	Internship –Seminar

## FYMCA Scheme

<b><u>Scheme for M.C.A (SEM I to SEM VI)</u></b>						
<b>SEM I</b>						
Course Code	Course Name	Group	Teaching Scheme (Hrs/week)			Credits
MCA11	Object Oriented Programming	ICT	3	1		4
MCA12	Software Engineering	ICT	3	1		4
MCA13	Discrete Mathematics	M	3	1		4
MCA14	Principles of Management	BM	3	1	-	4
MCA15	Banking and Finance	BM	3	1	-	4
MCA L11	Object Oriented Programming Lab	ICT	-	-	4	2
MCAL16	Web Technology Lab	ICT	-	-	4	2
MCAL17	LINUX Lab	ICT	-	-	4	2
MCAP11	Mini project-I	PR			2	1
	<b>Total</b>		<b>15</b>	<b>5</b>	<b>14</b>	<b>27</b>
<b>SEM II</b>						
Course Code	Course Name	Group	Teaching Scheme (Hrs/week)			Credits
MCA21	Operating System	ICT	4	--		4
MCA22	Computer Networks	ICT	4	--		4
MCA23	Data Structures	ICT	3	1		4
MCA24	Software Project Management	BM	3	1		4
MCA25	Probability and Statistics	M	3	1	-	4
MCAL22	Computer Networks Lab	ICT			4	2
MCAL23	Data Structures Lab	ICT			4	2
MCAL26	Python Programming Lab	ICT	-	-	4	2
MCAP21	Mini Project-II	PR			2	1
	<b>Total</b>		<b>17</b>	<b>3</b>	<b>14</b>	<b>27</b>
<b>MCASP2 Summer Project [to be evaluated in Sem III]</b>		SP				

### SYMCA Scheme

<b>SEM III</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>Group</b>	<b>Teaching Scheme (Hrs/week)</b>			<b>Credits</b>
MCA31	Core and Advanced Java	ICT	4	-	-	4
MCA32	Database Management System	ICT	3	1	-	4
MCA33	Operations Research	M	3	1	-	4
MCA34	Soft Skill Development	BM	4	-	-	4
MCAE35^	<b>Elective-I</b> 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			4	2
MCAP31	Mini Project-III	PR			2	1
<b>MCASP2</b>	<b>Summer Project</b>	SP	-	-	-	2
	<b>Total</b>		<b>17</b>	<b>2</b>	<b>14</b>	<b>28</b>
<b>SEM IV</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>Group</b>	<b>Teaching Scheme (Hrs/week)</b>			<b>Credits</b>
MCA41	Data warehousing and Mining & Business Intelligence	ICT	3	1		4
MCA42	Software Testing and Quality Assurance	ICT	3	1		4
MCA43	Design and Analysis of Algorithm	ICT	3	1	-	4
MCA44	User Experience Design	ICT	3	1	-	4
MCAE45^	<b>Elective-II</b> MCAE45 A Information Security MCAE45 B Soft Computing MCAE45 C Enterprise Resource Planning MCAE45 D Multimedia MCAE45 E Semantic Web	PE	3	-	-	3
MCAL41	Data warehousing and Mining & Business Intelligence Lab	ICT	-	-	4	2
MCAL42	Software Testing and Quality Assurance	ICT	-	-	2	1
MCAL43	Design and Analysis of Algorithm	ICT	-	-	2	1
MCAL46	Mobile programming Lab	ICT	-	-	4	2
MCAP41	Mini Project-IV	PR	-	-	2	1
	<b>Total</b>		<b>15</b>	<b>4</b>	<b>14</b>	<b>26</b>
	<b>MCASP2 Summer Project [to be evaluated in Sem IV]</b>	SP				



### TYMCA Scheme

<b>SEM V</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>GR</b>	<b>(L)</b>	<b>(T)</b>	<b>(P)</b>	<b>C</b>
MCA501	Advanced web technology & Dot Net	ICT	4	--	--	4
MCA502	Wireless & Mobile Technology	ICT	4	--	--	4
MCA503	Soft Computing	ICT	4	--	--	4
MCA504	Distributed computing and Cloud Computing	ICT	4	--	--	4
<b>Elective II ( SELECT ANY ONE)</b>						
MCA5051	Cyber Security	ICT	4	--	--	4
MCA5052	Multimedia Technology	ICT	4	--	--	4
MCA5053	Information System security and Audit	ICT	4	--	--	4
MCA5054	Bio-informatics	ICT	4	--	--	4
MCA5055	Software Quality Assurance	ICT	4	--	--	4
L501	Lab I-AWT + Dot Net	ICT	--	--	6	3
L502	Lab II- Wireless & Mobile Technology + Mini project	ICT	--	--	6	3
PR501	Summer Project	SP	--	--	--	2
		Total	20	-	12	28
<b>SEM VI</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>GR</b>	<b>(L)</b>	<b>(T)</b>	<b>(P)</b>	<b>C</b>
MCA SP 6.1	INTERNSHIP – Project	SP	--	--	30	15
MCA SP 6.2	Seminar Paper	SP	--	--	--	01
					Total	16

### Credits domain wise

S.N.	Domain	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total
1	Information Communication Technology	14	18	14	22	22	-	<b>90</b>
2	Business Management	8	4	4	-	-	-	<b>16</b>
3	Mathematics	4	4	4	-	-	-	<b>12</b>
4	Project	1	1	3	1	2	16	<b>24</b>
5	Professional Elective	-	-	3	3	4	-	<b>10</b>
		<b>27</b>	<b>27</b>	<b>28</b>	<b>26</b>	<b>28</b>	<b>16</b>	<b>152</b>

Typical credit and load structure for MCA Programme:

Semester	Units/Week			Total Units/ Week	Total Credits
	L	T	P		
I	15	5	14	34	27
II	17	3	14	34	27
III	17	2	14	33	28
IV	15	4	14	33	26
V	20	-	12	32	28
VI	-	-	-	-	16
Total Credits					152

### **Odd Semester**

Semester	Units/Week			Total Units/ Week	Total
	L	T	P		
I	15	5	14	34	15+5+42=62
III	17	2	14	32	17+2+42= 61
V	20	-	12	32	20+0+36=56
Total					179

### **Even Semester**

Semester	Units/Week			Total Units/ Week	Total
	L	T	P		
II	17	3	14	34	17+3+42=62
IV	15	2	14	31	15+2+42=59
Total					121

**F.Y.M.C.A**

**Scheme for M.C.A (SEM I to SEM II)**

**SEM I**

<b>Course Code</b>	<b>Course Name</b>	<b>Group</b>	<b>Teaching Scheme (Hrs/week)</b>			<b>Credits</b>
MCA11	Object Oriented Programming	ICT	3	1		4
MCA12	Software Engineering	ICT	3	1		4
MCA13	Discrete Mathematics	M	3	1		4
MCA14	Principles of Management	BM	3	1	-	4
MCA15	Banking and Finance	BM	3	1	-	4
MCA L11	Object Oriented Programming Lab	ICT	-	-	4	2
MCAL16	Web Technology Lab	ICT	-	-	4	2
MCAL17	LINUX Lab	ICT	-	-	4	2
MCAP11	Mini project-I	PR			2	1
	<b>Total</b>		<b>15</b>	<b>5</b>	<b>14</b>	<b>27</b>

**SEM II**

<b>Course Code</b>	<b>Course Name</b>	<b>Group</b>	<b>Teaching Scheme (Hrs/week)</b>			<b>Credits</b>
MCA21	Operating System	ICT	4	--		4
MCA22	Computer Networks	ICT	4	--		4
MCA23	Data Structures	ICT	3	1		4
MCA24	Software Project Management	BM	3	1		4
MCA25	Probability and Statistics	M	3	1	-	4
MCAL22	Computer Networks Lab	ICT			4	2
MCAL23	Data Structures Lab	ICT			4	2
MCAL26	Python Programming Lab	ICT	-	-	4	2
MCAP21	Mini Project-II	PR			2	1
	<b>Total</b>		<b>17</b>	<b>3</b>	<b>14</b>	<b>27</b>
<b>MCASP2 Summer Project [to be evaluated in Sem III]</b>		SP				

SEM I

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA11	Object Oriented programming	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	---	
Course Outcomes	CO1	Develop algorithmic thinking and problem-solving techniques to apply it to programming
	CO2	Construct programs using basic control structures.
	CO3	Make use of arrays functions pointers concepts to solve problems.
	CO4	Apply object oriented programming concepts like inheritance, polymorphism and exception handling to solve problems.
	CO5	Construct the solutions using File handling and Standard Template Library

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Problem Solving Methodology and Techniques</b>	2	3
	1.1	Understanding of the problem, Identifying minimum number of inputs required for output, Step by step solution for the problem		
	1.2	Breaking down solution into simple steps, Identification of arithmetic and logical operations required for solution		
	1.3	Using Control Structure: Conditional control and looping (finite and infinite)		
2		<b>An Overview of Computers and Programming Languages</b>	1,3	2
	2.1	Why Do We Need Object-Oriented Programming?-Procedural Languages vs Object-Oriented Approach		
	2.2	Characteristics Of Object-Oriented Language (Objects, Classes, Abstraction, Overloading, Inheritance, and Polymorphism)		
3		<b>Basic Elements of C++</b>	1,3,4	3
	3.1	C++ character set, C++ Tokens (Identifiers, Keywords, Constants, Operators), Structure of a C++ Program (include files, main function); Header files – iostream.h, iomanip.h; cout, cin		
	3.2	Use of I/O operators (<< and >>), Use of endl and setw(), Cascading of I/O operators, Error Messages; Use of editor, basic commands of editor, compilation, linking and execution		

	<b>3.3</b>	Standard input/output operations from C language: gets(), puts() of stdio.h header file, Data Types in C++, Scope And Storage Classes.		
<b>4</b>		<b>Control Structures (Selection and Repetition)</b>	1,3	3
	<b>4.1</b>	Conditional Operators, Logical Operators, If, If-Else		
	<b>4.2</b>	If-Else Ladder, Switch, Loops And Controls(for, while, do-while), Nested Loop		
<b>5</b>		<b>Functions</b>	1,3,4	5
	<b>5.1</b>	Function Structure, Objects As Function Arguments, Returning Objects From Functions, Passing Arguments To Functions,		
	<b>5.2</b>	Returning Values From Functions, Reference Arguments, Recursion, Inline Functions, Default Arguments,		
	<b>5.3</b>	macros, friend function, static functions, Constructors, Destructors		
<b>6</b>		<b>Arrays, Strings and Pointers</b>	1,3	6
	<b>6.1</b>	Arrays as class Member Data, Arrays of object, String,		
	<b>6.2</b>	The standard C++ String class, Addresses and pointers, The address of operator and pointer and arrays		
	<b>6.3</b>	Memory management: New and Delete, pointers to objects, Pointers to objects, this pointer, Pointer to functions		
<b>7</b>		<b>Overloading and Inheritance</b>	1,3,5	7
	<b>7.1</b>	Overloaded Functions, Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords.		
	<b>7.2</b>	Inheritance: Concept of inheritance. Derived class and based class. Derived class constructors, member function, class hierarchies, public and private inheritance		
	<b>7.3</b>	Aggregation : Classes within classes, inheritance and program development		
<b>8</b>		<b>Exception Handling</b>	1,3,5	4
	<b>8.1</b>	Introduction of Exception handling–throw, catch,		
	<b>8.2</b>	Re-throw an exception , specifying exceptions etc.		
<b>9</b>		<b>Templates and Introducing STL (Standard template library)</b>	1,3	5
	<b>9.1</b>	Class templates, function templates,		
	<b>9.2</b>	Overloading of template function		
	<b>9.3</b>	Introduction to STL, components of STL,		
	<b>9.4</b>	Containers		
	<b>9.5</b>	Iterators and function objects		
<b>10</b>		<b>Managing Console I/O operations and Working with files</b>	1,3	4
	<b>10.1</b>	C++ streams, unformatted / formatted I/O operations,		
	<b>10.2</b>	Managing output with manipulators, creating/ opening / closing / deleting files,		
	<b>10.3</b>	File pointers and their manipulators, random access to file,		
	<b>10.4</b>	Errors handling during file operations, command line arguments.		
			<b>Total</b>	<b>42</b>

**References :**

- [1] Robert Lafore, "Object-Oriented Programming In C++", Sams Publishing, Fourth Edition
- [2] Walter Savitch, "Problem solving with C++", Pearson/Addison-Wesley, Sixth Edition
- [3] Balaguruswamy, "Object Oriented Programming with C++", McGraw Hill Education, Fourth edition
- [4] Bjarne Stroustrup, "C++ programming language", Third edition
- [5] Joyce Farrell, "Object-Oriented Programming Using C++", Thomson/Course Technology, Fourth Edition



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA12	Software Engineering	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		--
Course Outcomes	CO1	Identify process model for given Problem
	CO2	Design and Develop Software Project
	CO3	Formulate Project Plan & apply estimation techniques.
	CO4	Evaluate quality of software and its maintenance.

Module No.	Unit no.	Topics	Ref.	Hrs.
<b>1</b>		<b>Introduction to Software Engineering</b>	1	3
	1.1	The evolving role of software, Importance software engineering, Changing nature of software, Software Myths.		
<b>2</b>		<b>Software Process Models</b>	1,2	6
	2.1	Software Process Models:-Waterfall Model. Evolutionary Process Model: Prototype and Spiral Model. Incremental Process model: Iterative approach, RAD, JAD model. Concurrent Development Model. Agile Development: Extreme programming, Scrum		
<b>3</b>		<b>Software Analysis</b>	1,2	4
	3.1	Feasibility Study and its type , Software requirement specification		
	3.2	Requirement Elicitation: Interviews, Questionnaire, Brainstorming, Facilitated Application Specification Technique(FAST)		
<b>4</b>		<b>Software Project Planning</b>	1	5
	4.1	Measures ,Metrics and Indicators, Software Measures : Size oriented, Function Oriented, Software Project Estimation, Decomposition Techniques, LOC based, FP based, Empirical Estimation: COCOMO, COCOMO-II		
<b>5</b>		<b>Software scheduling and tracking</b>	1,2	4
	5.1	Relationship between people and effort: Staffing level estimation, effect of schedule change on cost		
	5.2	Selecting software engineering tasks: Degree of rigor, task set selector		
	5.3	Task network schedules: Work breakdown structure, task network/activity network Gantt chart, pert chart, CPM,Earned Value Analysis		
<b>6.</b>		<b>Software Design Activities</b>	1,2	5

	6.1	Design Concepts :Abstraction ,Modularity, Cohesion and Coupling		
	6.2	Function oriented design : structured design Methodology		
	6.3	Architectural Design : What is Architecture ,why is Architecture important Architectural design and Pattern		
<b>7</b>		<b>Software Testing</b>	1,2	3
	7.1	Software testing fundamentals ,Black box and white box testing, types of Testing : Unit ,Integration ,Validation and system testing, Overview of Non functional testing types		
<b>7</b>		<b>Software Risk management</b>	1,2	3
	7.1	Risk strategies, Software risks, Risk Identification, Projection, RMMM		
<b>8</b>		<b>Software Quality Management</b>	1,3	3
	8.1	Quality Concepts, SQA activities, Software reviews,FTR, Software reliability and measures, SQA plan		
<b>9</b>	9.1	<b>Software Change Management</b>	1,3	3
	9.2	Software Configuration Management, elements of SCM, SCM Process, Change Control		
<b>10</b>		<b>Software Reliability and Maintenance</b>	1,3	3
	10.1	Software reliability , Reliability metrics , Reliability growth modeling , Refactoring		
	10.2	Software reverses engineering , Software maintenance cost , Estimation of maintenance cost		
			<b>Total</b>	<b>42</b>

#### References :

- [1] Roger Pressman ,”Software Engineering” , Tata McGraw Hill ,sixth edition.
- [2] Pankoj Jalote, ,”Software Engineering”, Wiley Publication, fourth edition.
- [3] KK Agarwal, Software Engineering, New age Publication, third edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA 13	Discrete Mathematics	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

<b>Pre-requisite Course Codes</b>	Basic Knowledge of Mathematics.	
<b>Course Outcomes</b>	<b>CO1</b>	Develop mathematical and logical thinking
	<b>CO2</b>	Analyze number of logical possibilities and probability of events.
	<b>CO3</b>	Formulate problems of graphs, trees and recursive relation.
	<b>CO4</b>	Construct Grammars, languages and theoretical designs

Module	Unit	Topics	Ref.	Hrs.
<b>1</b>		<b>Mathematical Logic</b>	<b>1,3</b>	<b>5</b>
	<b>1.1</b>	Propositions and logical operations, Conditional Statements		
	<b>1.2</b>	Methods of Proof , Mathematical Induction,		
	<b>1.3</b>	Mathematical Statements , Logic and Problem Solving		
<b>2</b>		<b>Set, Relation and Function</b>	<b>1,2,3</b>	<b>7</b>
	<b>2.1</b>	<b>Set Theory:</b> Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identities on sets, pigeonhole principle.		
	<b>2.2</b>	<b>Relation:</b> Definition, types of relation, composition of relations, domain and range of a relation, pictorial Representation of relation, properties of relation, partial ordering relation, Relations and digraphs, Paths in Relations and Digraphs, Properties of Relations , Equivalence Relations, 3Operations on Relations, Partially Orders Sets, Hasse diagram, Lattice		
	<b>2.3</b>	<b>Function:</b> Definition and types of function, composition of functions, recursively defined functions.		
<b>3</b>		<b>Graph and Tree</b>	<b>2,4</b>	<b>4</b>
	<b>3.1</b>	Graph terminology, types of graph connected graphs, components of graph, Representation of Graph		
	<b>3.2</b>	Adjacency matrix, Adjacency list		
	<b>3.3</b>	Euler graph and Circuits, Hamiltonian path and circuits		
	<b>3.4</b>	Subgraphs and Subgraph isomorphism, Tree		

<b>4</b>		<b>Combinatorics and Recurrence Relation</b>	<b>1,2,4</b>	<b>8</b>
	<b>4.1</b>	Recursive mathematical definitions, basics of counting		
	<b>4.2</b>	Introduction to permutations and combinations, inclusion-exclusion		
	<b>4.3</b>	Recurrence relation - Fibonacci series, Tower of Hanoi		
	<b>4.4</b>	Lines in a plane Homogenous linear equations with constant coefficients, Particular Solution, Total Solution		
	<b>4.5</b>	Divide and Conquer Recurrence Relations (Fast Multiplication of Integers, Fast matrix Multiplication)		
<b>5</b>		<b>Regular Grammar (RG)</b>	<b>5,6</b>	<b>8</b>
	<b>5.1</b>	Regular Grammar		
	<b>5.2</b>	Regular Expression (RE): Definition, Equivalence and		
	<b>5.3</b>	Equivalence of RG and FA and Conversions,		
	<b>5.4</b>	Equivalence of RE and FA and Conversions.		
<b>6</b>		<b>Finite Automata</b>	<b>5,6</b>	<b>10</b>
	<b>6.1</b>	Deterministic and Nondeterministic Finite Automata ( DFA and NFA ), Definitions, Languages, Transitions ( Diagrams, Functions and Tables)		
	<b>6.2</b>	Eliminating epsilon transitions from NFA,DFA		
	<b>6.3</b>	NFA applications: Reductions and Equivalence		
	<b>6.4</b>	FSM with output: Moore and Mealy machines.		
<b>Total</b>				<b>42</b>

#### References:

- [1] Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw Hill, 4<sup>th</sup> Edition
- [2] Kolman, Busby, Ross, "Discrete Mathematical structures", PHI, 4<sup>th</sup> Edition
- [3] Tremblay and Manohar, "Discrete Mathematical Structure", Tata McGraw Hill
- [4] C. L .Liu, "Elements of Discrete Mathematics", TMH 20002<sup>nd</sup> Edition.
- [5] J.E.Hopcraft, R. Motwani and J.D.Ullman, "Introduction to Automata Theory languages & Computation", Pearson Education Asia.
- [6] K.L.P.Mishra, N. Chandrashekharan, "Theory of Computer Science", PHI

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		<b>3</b>	<b>1</b>	<b>--</b>	<b>3</b>	<b>1</b>	<b>--</b>	<b>4</b>
<b>MCA14</b>	<b>Principles of Management</b>	<b>Examination Scheme</b>						
		<b>ISE</b>		<b>MSE</b>		<b>ESE</b>		
		<b>10</b>	<b>30</b>	<b>100 (60% Weightage)</b>				

Pre-requisite Course Codes	--	
<b>Course Outcomes</b>	CO1	To understand management evolution and management's four functions: planning, organizing, leading, and controlling.
	CO2	To understand social responsibility and ethical issues involved in business situations
	CO3	How organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.
	CO4	Develop leadership styles to anticipate the consequences of each leadership style.
	CO5	Analyze both qualitative and quantitative information to isolate issues and formulate best control methods

Module No.	Unit No.	Topics	Ref.	Hrs.
<b>1</b>		<b>Management- Introduction</b>	1,2	4
	<b>1.1</b>	What is management, how is management defined, is management art or science?		
	<b>1.2</b>	Role of managers, Mintezberg's set of Ten Roles, managerial skills		
	<b>1.3</b>	The P-O-L-C framework		
<b>2</b>		<b>The Evolution of Management Thought</b>	1,2,3	6
	<b>2.1</b>	Management Classical approach: Classical thought of management, Henry Fayol's universal Process theory		
	<b>2.2</b>	Behavioral and human relations approach Management		
	<b>2.3</b>	The modern Theory: Chester Barnard and social systems theory, Quality school of management		
	<b>2.4</b>	Kaizen approach, Reengineering approach		
<b>3</b>		<b>Management Framework</b>	2,3,4	6
	<b>3.1</b>	Vision, Mission and values: Role played by vision and mission, values, stakeholders, Identifying key stakeholders		
	<b>3.2</b>	Personality and attitude: Role of personality and attitude in organization, importance of personality,		
	<b>3.3</b>	The Big-5 Personality Traits , Work Attitude and		

		Behavior:		
	<b>3.4</b>	Positive work attitude, Job Satisfaction, Organizational commitment		
<b>4</b>		<b>Planning</b>	2,3	4
	<b>4.1</b>	Nature, Types and steps of planning, Importance of planning; The strategic planning process,		
	<b>4.2</b>	Nature of objectives, Management by Objectives (MBO); Nature and purpose of strategies and policies		
	<b>4.3</b>	Major kinds of strategies and policies, Effective implementation strategies		
<b>5</b>		<b>Decision Making</b>	2,3	4
	<b>5.1</b>	The importance and limitations of rational decision making, Decision making under certainty,		
	<b>5.2</b>	Risks and uncertainty, Factors affecting decision making,		
	<b>5.3</b>	Decision making styles, Decision making Tools		
<b>6</b>		<b>Organizational Structure</b>	1,2,3	4
	<b>6.1</b>	Importance of organizing, Principals of organizing,		
	<b>6.2</b>	Types of Organizational structure		
	<b>6.3</b>	The Organizational Process		
<b>7</b>		<b>Human Factors, Motivation and Leadership</b>	1,4	4
	<b>7.1</b>	Human factors in managing, Motivation and motivators; Styles and functions of leadership		
	<b>7.2</b>	Special motivational techniques, Defining Leadership, Ingredients of leadership,		
	<b>7.3</b>	Trait approach to leadership, Situational or contingency approaches to leadership		
<b>8</b>		<b>Communication</b>	1,2,4	4
	<b>8.1</b>	Definition of communication, The communication process,		
	<b>8.2</b>	Barriers and breakdowns in communication; Towards effective communication		
	<b>8.3</b>	Electronic media in communication.		
<b>9</b>		<b>Change Management</b>	2,4	4
	<b>9.1</b>	Need of Change, Organizational Change factors (Internal environment and external Environment),		
	<b>9.2</b>	Planning Organizational change, Resistance to changes		
	<b>9.3</b>	Impact of change, Overcoming Resistance to change		
<b>10</b>		<b>Comparative Management</b>		2
	<b>10.1</b>	Special features of management Japan, China and Germany.		
			<b>Total</b>	<b>42</b>

### References:

- [1] Koontz Harold & Weihrich Heinz, "Essentials of Management", MGH, 8th edition.
- [2] Tripathi, P. C. & Reddy, P.N, "Principles of management", Tata McGraw Hill, tenth edition.
- [3] Ramasuamy.V.S. & Namakumari, S., "Marketing Management: Planning implementation and control", Mcmillan & Co, Seventh Edition

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA15	Banking and Finance	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Mathematics	
Course Outcomes	Student will be able to	
	CO1	Demonstrate broad and coherent knowledge of the theoretical and professional disciplines of banking, finance, investment analysis, portfolio management, accountancy, economics, quantitative methods, law, and the Financial Services Industry
	CO2	Integrate technical and conceptual knowledge, and interpersonal skills to work effectively within the Financial Services Industry
	CO3	Communicate and explain specialized technical advice, knowledge and ideas, to professionals and non-experts involved with the Financial Services Industry
	CO4	Work collaboratively with others to solve applied problems

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Banking and Banking Operations</b>	1	4
	1.1	Evolution, meaning, importance, indigenous bankers- Functions, Modern banking, Commercial banks- Structure, Functions, RBI Monetary policy, instruments of monetary policy-bank rate, CRR, SLR, Repo rate, reverse Repo rate		
	1.2	Banker-customer relations, Know Your Customer(KYC) guidelines, Different deposit products, services rendered by banks, Mandate and Power of Attorney, Banker's lien-right of set off, garnishee order, income tax attachment order etc.		
	1.3	Utility of loans and advance, type of loans-secured and unsecured, demand loan, term loan, cash credit, overdraft, student loans, auto loans, personal loans, business loans, consolidated loans		
2		<b>Banking and Financial institutions in India</b>	2,4	4
	2.1	Commercial Banks, Cooperative Banks, Regional Rural Banks, Agriculture and Rural Development Banks (SLDBs), Development Banks and NBFCs		
	2.2	Bank's constitution, Functions, Working and Evolution.		
	2.3	Reserve Bank of India: Traditional and Developmental Functions and Working. Objectives, Instruments of Monetary Policy		

<b>3</b>		<b>Financial markets and Capital Markets in India</b>	<b>2,4</b>	<b>10</b>
	<b>3.1</b>	Structure, institution and operating mechanism and its role in Economic Development. Developed and Underdeveloped Markets,		
	<b>3.2</b>	Money Market in India: Importance, features instruments. Measures to strengthen money market in India.		
	<b>3.3</b>	Recommendations of the working group on money market, Report of the task force on money market and mutual funds.		
	<b>3.4</b>	New issue market and stock exchange, importance of stock exchanges: National stock exchange, methods of floating new issues, types of shares and debentures		
	<b>3.5</b>	The Securities and Exchange Board of India (SEBI), need for establishment of SEBI. Objectives and role of SEBI, Capital Market reforms		
<b>4</b>		<b>Credit Rating in India</b>	<b>1,3</b>	<b>5</b>
	<b>4.1</b>	Why and what is credit rating, credit rating institutions in India, limitation to rating, depository services, factoring, leasing and hire purchase		
	<b>4.2</b>	Venture capital, securitization of assets, portfolio management, risk and return, reforms in banking and finance,		
	<b>4.3</b>	Reports of the committees; Chakravarty committee, Narsimham committee I & II		
<b>5</b>		<b>Deposit Accounts</b>	<b>1,3</b>	<b>4</b>
	<b>5.1</b>	Opening Operations and Closure of a] Fixed Deposit Account b] Recurring Account c] Savings Account d] Current Account e] Deposit Schemes for NRIs. Other Deposit Schemes,		
	<b>5.2</b>	Mandate and Power of Attorney – Nomination Facility – Insurance of Bank Deposits		
<b>6</b>		<b>Banking Services</b>	<b>1,3</b>	<b>6</b>
	<b>6.1</b>	Remittances – Safe Custody – Safe Deposit Vaults – Collection Facility – MICR Clearing ATMs – Credit cards and Debit Cards – Travellers’ Cheques – Gift Cheques		
	<b>6.2</b>	Ombudsman and Customer Services – Fraud Detection and Control Accounting conventions, basic accounting principles,		
	<b>6.3</b>	bank reconciliation statements, procedure leading to preparation of final accounts, self-balancing ledgers		
	<b>6.4</b>	Accounting in banking companies under computer environment – Introduction to accounting standards		
<b>7</b>		<b>Lending Schemes</b>	<b>1,3</b>	<b>5</b>
	<b>7.1</b>	Socio – Economic and poverty alleviation programmes/Self-employment schemes: DRI, IRDP,SEEUY,SEPUP		
	<b>7.2</b>	Micro Financing: Financing of self-help groups by banks and NGOs – Women Entrepreneurs, Small borrowers, SSIs		
	<b>7.3</b>	Personal and Consumer loans, Housing Finance, Agriculture finance, Loan syndication, Federal Financing.		
<b>8</b>		<b>Foreign Exchange</b>	<b>1,3</b>	<b>4</b>
	<b>8.1</b>	Concept of Foreign Exchange (FE), Principles of foreign exchange, Meaning of foreign trade, Commercial terms		
	<b>8.2</b>	Documents used in the delivery of goods and payments,		



		Instruments of International Remittances: Drafts, Mail and Telegraphic Payment Orders		
	<b>8.3</b>	Collection of Bills of exchange both clean and documentary covering exports and imports, letters of credit		
			<b>Total</b>	<b>42</b>

**References:**

- [1] Indian Institute of Banking and Finance, “Principles and Practices of Banking”, Macmillan Publication
- [2] Khan M Y., “Indian Financial System”, Tata McGraw Hill, Delhi
- [3] P.N. Varshney, “Banking Law and Practice”, Sultan Chand & sons
- [4] H.R.Machiraju, “Indian Financial System”, Vikas Publishing House

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL11	Object Oriented Programming Lab	--	--	4	--	--	2	2
		Examination Scheme						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	--	
Course Outcomes	CO1	Demonstrate C++ operators, control structures, built-in data types and standard library functions
	CO2	Implement dynamic memory management techniques with pointers, constructors, destructors etc.
	CO3	Implement functions, function overloading, operator overloading, virtual functions and polymorphism
	CO4	Demonstrate inheritance with the understanding of early and late binding, usage of exception handling
	CO4	Demonstrate File handling and Standard Template Library

Exp. No.	Experiment details	Ref	Marks
1	<b>Implement Various Control Structures:</b> a. If statement b. Switch case statement and do while loop c. For loop d. While loop	1,2,3	10
2	<b>Functions &amp; Recursion:</b> a. Recursion b. function c. Inline Functions d. Call by reference & Call by Value	1,2	10
3	Constructors & Destructors, Understand Pointer Arithmetic, Use of "this" Pointer.	1,2	10
4	<b>Implement Inheritance and Function Overriding:</b> a. Multiple inheritance –Access Specifiers b. Hierarchical inheritance – Function Overriding Virtual Function	1,2	10
5	<b>Exception handling</b>	1,2,3	10
6	<b>File handling</b>	1,2,3	10
7	<b>Friend Function &amp; Friend Class.</b> a. Friend Function b. Friend class	1,2,3	10
8	<b>Class Templates</b>	1,2	10
<b>Total Marks</b>			<b>80</b>

**References:**

- [1] Steve Oualline, "Practical C++ Programming.", O'Reilly & Associates, Inc., First Edition.
- [2] Steve Oualline, "Practical C++ Programming (Nutshell Handbook)", O'Reilly Media; First Edition
- [3] Madhusudan Mothe, "C++ Programming: A practical approach Pearson Education", First Edition

Course Code	Course Name	Teaching Scheme (Hrs/ week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA L16	Web Technology Lab	--	--	4	--	--	2	2
		<b>Examination Scheme</b>						
		<b>Term work</b>		<b>Practical</b>		<b>Oral</b>		<b>Total</b>
		<b>80</b>		<b>10</b>		<b>10</b>		<b>100</b>

Pre-requisite Course Codes	Basic understanding of programming fundamentals	
Course Outcomes	CO1	Develop static web sites using HTML5,CSS3 and Client side scripting.
	CO2	Develop responsive, mobile-first web sites using Bootstrap.
	CO3	Build dynamic web sites using open source technology.
	CO4	Apply PHP framework to build dynamic website.

Exp. No.	Experiment Details	Ref.	Marks
1.	<b>Introduction to web technologies, HTML &amp; HTML5:</b> Concept of www, protocols: HTTP, SHTTP, web browser and web server. Basics of HTML, HTML and HTML5 elements, form designing, HTML Graphics, HTML Media. (Programming assignments based on above topics)	1,2	10
2.	<b>Cascading Style Sheets3:</b> Introduction to CSS, types of CSS, syntax and structure. Introduction to CSS3, CSS3 modules: Selectors, Box model, backgrounds and borders, Image values and replaced content, text effects, 2D/ 3D transformations, animations, multiple column content, user interface (Programming assignments based on above topics)	1,2,8	10
3.	<b>Java script and JQuery:</b> Introduction to Java script, variable, number and array, functions, pop up boxes, event handling, form validation, Introduction to DOM. JQuery basics, jQuery Effects, jQuery HTML (Programming assignments based on above topics)	3,4,8	10
4.	<b>AJAX :</b> Making a server request, loading HTML scriptlets from server, AJAX events, AJAX style file upload. (Programming assignments based on above topics)	5,9	10
5.	<b>Bootstrap:</b> Bootstrap: Introduction to Bootstrap, Bootstrap Grid System, Bootstrap Grid System, Container Layouts. Bootstrap CSS: Typography, code, tables, forms, buttons, images, icons. Bootstrap Layout components. Bootstrap JavaScript plugins.	6	10
	<b>PHP and MySQL:</b>		

6.	Configuration and installation of PHP, basic syntax of PHP, expressions, statements, arrays, strings, functions, regular expression, form validation. File handling: File operations - create, write, read, copy, move, delete, update and upload file. Database: SQL Query, DDL and DML queries. PHP connection to database server. Database operations – create, select, insert, update, delete, & join operation. Session management – using cookies & sessions. AJAX with PHP and My SQL. (Programming assignments based on above topics)	7,8,9	10
7.	<b>PHP Framework:</b> Laravel: Introduction, Setting up a development environment, First application, Eloquent ORM, Testing.	10	10
8.	<b>Mini Project:</b> Maximum two students in a group.	All	10
<b>TOTAL</b>			<b>80</b>

#### References:

- [1] DT Editorial Services, “HTML 5, Black Book”, dreamtech Press, 2<sup>nd</sup> Edition.
- [2] Ben Frain, “Responsive web design with HTML5 and CSS3”, Packt, 2<sup>nd</sup> Edition.
- [3] Michael Morrison, “Head First JavaScript”, O’Reilly publication, 2007.
- [4] Jonathan Chaffer, Karl Swedberg, “Learning jQuery”, Packt, Shroff Publication, 4<sup>th</sup> Edition.
- [5] Bayross, Ivan, Shah, “AJAX for Beginners”, Shroff Publication, 1<sup>st</sup> Edition.
- [6] Jake Spurlock, “Bootstrap”, O’Reilly publication, 2013.
- [7] Jesus Caspagnetto, Etal, “Professional PHP Programming”, Wrox Publication.
- [8] Nixon, Robin, “Learning PHP, MySQL, & JavaScript: with jQuery, CSS & HTML5”, Shroff Publication, 4<sup>th</sup> Edition.
- [9] Harwani, “Developing Web Applications in PHP and AJAX”, McGrawHill, 2010.
- [10] Martin Bean, “Laravel 5 Essentials”, Packt publication, 2015.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL17	LINUX Lab	--	--	4	--	--	2	2
		Examination Scheme						
		Term Work		Practical		Oral		Total
		80		10		10		100

<b>Prerequisite Course codes</b>	--	
<b>Course Outcomes</b>	<b>CO1</b>	To understand the basic system configuration and installation.
	<b>CO2</b>	To apply linux commands for user administration process management
	<b>CO3</b>	To demonstrate various editors and software management configuration.
	<b>CO 4</b>	To implement network configuration and server

Expt. No.	Experiment Details	Ref.	Marks
1	Introduction to basic system configuration and Installation	1,3,6	10
2	Basic Linux Commands and user Administration	1,3,6	10
3	Linux User Administration and Process Management	1,3,6	10
4	Linux Editors	1,6	10
5	Software Management	1,6	10
6	Linux Network Configuration	1,6	10
7	FTP server	1,6	10
8	DHCP server	1,6	10
<b>Total Marks</b>			<b>80</b>

### References:

- [1] Kogent Learning solutions, "Linux Lab: Hands on Linux", dreamtech, edition 2000.
- [2] Yashwant Kanetkar , "Unix Shell Programming", BPB Publications, Second Edition.
- [3] Christopher Negus, " Linux Bible", Wiley Publications ,Ninth Edition.
- [4] Richard Blum and Christine Bresnahan , "Linux Command Line and Shell Scripting Bible", Wiley Publications, Third Edition.
- [5] Richard Petersen, "Linux Programming A Beginner"s Guide" ,Tata McGraw Hill Education.
- [6] Red Hat Linux Enterprise Linux 7 System Administrator's Guide.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA P11	Mini Project	--	--	--	--	--	--	<b>02</b>
		<b>Examination Scheme</b>						
		<b>Presentation Internal Assessment</b>			<b>External Assessment</b>			<b>Total</b>
		<b>25</b>			<b>25</b>			<b>50</b>

<b>Pre-requisite Course Codes :</b>	Programming language	
<b>Course Outcomes</b>	Student will be able to	
	<b>CO1</b>	Formulate a real world problem and develop its requirements.
	<b>CO2</b>	Develop a design solution for the identified requirements.
	<b>CO3</b>	Test the prototype against identified requirements.
	<b>CO4</b>	Develop effective communication skills for presentation of project related activities.

<b>Evaluation Scheme</b>
<ol style="list-style-type: none"> <li>1. Project assessment is done by internal and external examiner. The project carries weightage of 50 marks.</li> <li>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).</li> <li>3. The external examiner will be evaluating the students for 25 marks at the end of the semester.</li> <li>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.</li> </ol>

**SEM II**



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA21	Operating System	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

<b>Prerequisite Course codes</b>	-	
<b>Course Outcomes</b>	<b>CO1</b>	Classify different types of operating system designs
	<b>CO2</b>	Analyse process management, I/O management, memory management functions of Operating System
	<b>CO3</b>	Employ process scheduling and disk scheduling algorithms.
	<b>CO4</b>	Explore file management and protection and security concepts.

Module No.	Unit No.	Topics	Ref.	Hrs
<b>1</b>		<b>Introduction to operating System</b>	<b>1</b>	<b>5</b>
	<b>1.1</b>	Overview of all system softwares: Compiler, Assembler, Linker, Loader,		
	<b>1.2</b>	Operating system, OS services and Components		
	<b>1.3</b>	Types of OS-Batch, multiprocessing, multitasking, timesharing		
	<b>1.4</b>	Distributed OS ,Real time OS, virtual machines		
	<b>1.5</b>	System Calls ,types of System calls, Buffering, Spooling		
<b>2</b>		<b>Process and Thread Management</b>	<b>2</b>	<b>10</b>
	<b>2.1</b>	Concept of process and threads, Process states, Process management		
	<b>2.2</b>	Context switching, Interaction between processes and OS, Multithreading		
	<b>2.3</b>	CPU scheduling algorithms, multiprocessor scheduling algorithms		
	<b>2.4</b>	Real time scheduling algorithms		
<b>3</b>		<b>Concurrency Control</b>	<b>3</b>	<b>8</b>
	<b>3.1</b>	Concurrency and Race Conditions		
	<b>3.2</b>	Mutual exclusion requirements, Software and hardware solutions		
	<b>3.3</b>	Semaphores, Monitors, Classical IPC problems and solutions		
	<b>3.4</b>	Deadlock, Characterization, Detection, Recovery, Avoidance and Prevention		
<b>4</b>		<b>Memory Management</b>	<b>5</b>	<b>10</b>
	<b>4.1</b>	Memory partitioning, Swapping, Paging, Segmentation		

	4.2	Virtual memory, Overlays, Demand paging, Performance of Demand paging,		
	4.3	Virtual memory concepts		
	4.4	Page replacement algorithms, Allocation algorithms		
<b>5</b>		<b>Mass Storage Structure</b>	<b>3</b>	<b>7</b>
	5.1	Secondary-Storage Structure, Disk structure		
	5.2	Disk scheduling, Disk management, Swap-space management, Disk reliability		
	5.3	Stable storage implementation, Introduction to clock, Clock hardware, Clock software		
<b>6</b>		<b>File systems</b>	<b>3</b>	<b>4</b>
	6.1	File concept, File support, Access methods, Allocation methods		
	6.2	Directory systems, File protection, Free space management		
<b>7</b>		<b>Protection &amp; Security</b>	<b>5</b>	<b>4</b>
	7.1	Protection- Goals of protection, Domain of protection, Access matrix, Implementation of access matrix		
	7.2	Revocation of access rights Security- The security problem, Authentication, One-Time passwords, Threats		
<b>8</b>		<b>Case Study</b>		<b>4</b>
	8.1	Study of different Operating, Systems(Linux, Windows, Android OS, iOS)		
			<b>Total</b>	<b>52</b>

### References:

- [1] Silberschatz and Galvin , “Operating System Concepts” , Wiley ,9th Edition .
- [2] William Stallings , “Operating Systems (5th Ed) – Internals and Design Principles” , Prentice Hall, 2000.
- [3] Andrew S Tanenbaum , “Modern Operating Systems” , Prentice Hall India, 1992,Third Edition.
- [4] Gary Nutt, NabenduChaki, SarmishthaNeogy, “Operating Systems”, Pearson ,3rd Edition.
- [5] Andrew S. Tanenbaum, AlbertS. Woodhull , “Operating Systems Design & Implementation Andrew”, Pearson, Third Edition.
- [6] Achyut S. Godbole, “ Operating Systems”, Tata McGraw Hill ,Second Edition.
- [7] D.M.Dhamrdhere , “Operating Systems” , Tata McGraw Hill, Second Edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA22	Computer Networks	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		--
Course Outcomes	CO1	Understand the fundamental concepts of Digital communication in Computer Networks.
	CO2	Recognize the different Internetworking devices, topologies and their functions
	CO3	Analyze the various Protocols, Services and features of the layered architecture of Networking.
	CO4	Illustrate the various TCP /IP Algorithms.

Module No.	Unit no.	Topics	Ref.	Hrs.
1		<b>Introduction to digital communication</b>	1	5
	1.1	Signal propagation, signal types, signal parameters		
	1.2	Channel effects on transmission –attenuation, effects of limited bandwidth, delay distortion, noise		
	1.3	Multiplexing -FDM ,TDM		
	1.4	Data rate limits-Nyquist’s theorem , Shannon’s theorem		
2		<b>Basics of Computer Network</b>	1,2	4
	2.1	Topology & types of topologies, types of networks		
	2.2	LAN, MAN, WAN, types of communications (Asynchronous and synchronous)		
	2.3	Modes of communications(simplex, half duplex, full duplex)		
	2.4	Switching Techniques -Circuit switching, Message switching ,Packet switching		
3		<b>Networking models</b>	1,2	5
	3.1	Design issues of the layer, ISO-OSI Reference Model, Internet Model (TCP/IP),		
	3.2	Comparison of ISO-OSI & TCP/IP Model.		
	3.3	Connectivity Devices : Passive & Active Hubs, Switch, Bridges,Gateways.		
4		<b>Physical Layer</b>		3
	4.1	Wired media – Twisted Pair ,Coaxial Cable ,Fiber Optics	1,2,3	
	4.2	Wireless media - The electromagnetic Spectrum ,Radio Transmission ,Microwave transmission ,Infrared Waves		
5		<b>Data Link Layer</b>	1,2,3	8
	5.1	Error Detection and Correction Techniques		

	5.2	Multiple Access Protocols, LAN Addresses and ARP & RARP , PPP: The Point-to-Point Protocol		
	5.3	Medium access sub layer : ALOHA (Pure, slotted, reservation) Carries Sense Multiple Access Protocols, Collision free Protocols		
	5.4	Ethernet standards – IEEE 802.3, 802.5, FDDI, 802.6.08		
<b>6</b>		<b>Network Layer</b>	<b>1,2,3</b>	<b>6</b>
	6.1	Network Layer Design issues		
	6.2	Routing Algorithm – Distance Vector and Link state routing –Routing protocols -RIP, OSPF, BGP, IGRP, Congestion control algorithms: Open Loop congestion control, Closed Loop congestion control.		
	6.3	IP Addressing Subnets, IP – IPv4, IPv6, Internet Control Management Protoocl, Internet Group Management Protocol.		
	6.4	Address mapping -ARP, RARP, BOOTP, DHCP,NAT and its type		
<b>7</b>		<b>Transport layer</b>	<b>1,2,3</b>	<b>6</b>
	7.1	The TCP protocol and the TCP Segment Header, UDP		
	7.2	Congestion Control algorithm		
	7.3	Quality of Service: Introduction, Queue Analysis, QoS Mechanisms, Queue management Algorithms, Feedback, Resource, Reservation.		
<b>8</b>		<b>Application layer</b>	<b>1,2,3</b>	<b>5</b>
	8.1	Principles of Application Layer Protocols, The Web and HTTP		
	8.2	FTP, Telnet ,Simple Network Management Protocol		
	8.3	Electronic Mail in the Internet (SMTP, MIME, POP3, IMAP), DNS		
<b>Total</b>				<b>42</b>

### References:

- [1] Behrouz Forouzan, "Data communication and Networking ", Tata McGraw Hill edition, Fourth Edition.
- [2] Andrew Tanenbaum, "Computer Networks", PHI, Fifth Edition.
- [3] Behrouz Forouzan, " TCP/IP Protocol Suite" , Tata McGraw Hill edition, Third Edition. Third Edition, 2005, Addison-Wesley.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA23	Data Structures	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weight age)		

Pre-requisite Course Codes	Object Oriented Programming Concepts (MCA11)	
Course Outcomes	CO1	Compare Efficiency of various sorting algorithms.
	CO2	Make use of searching and hashing techniques for efficient data retrieval and data mapping.
	CO3	Apply various operations of Linear data structures to solve problems from different domains.
	CO4	Apply creative thinking to solve problems from different domains using Nonlinear data structures.

Module	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction</b>	1,2,3	3
	1.1	Introduction to Data Structures		
	1.2	Types of Data Structures		
	1.3	ADT (Abstract Data type)		
	1.4	Introduction to Time complexity and Space complexity		
	1.5	Asymptotic notations (Big O, Omega, Theta)		
2		<b>Sorting Techniques</b>	1,2,3	5
	2.1	Internal Sorting Techniques (Bubble sort, Insertion sort, Selection Sort, Radix Sort, Quick sort, Heap Sort)		
	2.2	External Sorting Techniques (Merge Sort)		
	2.3	Complexity calculation of Sorting Techniques using Asymptotic notations		
3		<b>Searching and Hashing Techniques</b>	1,2,3	5
	3.1	Sequential search, Binary search, Interpolation Search		
	3.2	Hashing Techniques (Direct, Subtraction, Modulo Division, Mid square, Digit Extraction, Folding, Double hashing)		
	3.3	Collision resolution techniques (Linear probe, Quadratic probe, Key offset, Chaining)		
4		<b>Linked list</b>	1,2,3	8
	4.1	Linked List as an ADT, Linked List Vs. Arrays		
	4.2	Types of Linked List: Singly, Doubly, Circular		
	4.3	Operations of Linked List (Insert, delete, traverse, count, search)		
	4.4	Application of Linked List: Polynomial addition and Subtraction,		

		Sparse Matrix.		
<b>5</b>		<b>Stack</b>	<b>1,2,3</b>	<b>5</b>
	<b>5.1</b>	The Stack as an ADT, Stack operations		
	<b>5.2</b>	Array Representation of Stack , Linked list Representation of Stack		
	<b>5.3</b>	Application of stack – Evaluation of Postfix expression, Balancing of Parenthesis, Recursion, Polish Notation		
<b>6</b>		<b>Queue</b>	<b>1,2</b>	<b>7</b>
	<b>6.1</b>	The Queue as an ADT, Queue operations		
	<b>6.2</b>	Array Representation of Queue, Linked Representation of Queue		
	<b>6.3</b>	Circular Queue		
	<b>6.4</b>	Priority Queue		
	<b>6.5</b>	Doubly Ended Queue		
	<b>6.6</b>	Application of Queues – Johnson’s Algorithm , Round Robin CPU Scheduling Algorithm		
<b>7</b>		<b>Tree</b>	<b>1,3</b>	<b>7</b>
	<b>7.1</b>	Tree Definition and Terminologies		
	<b>7.2</b>	Binary Tree, Representation and traversal techniques		
	<b>7.3</b>	Binary Search Tree- Definition, Operations		
	<b>7.4</b>	Threaded Binary tree, Expression tree and Huffman tree		
	<b>7.5</b>	AVL tree- Definition, AVL tree rotation with examples		
	<b>7.6</b>	M way Tree- Introduction, B tree-definition and examples		
	<b>7.7</b>	Heaps-Definition, Operations		
	<b>7.8</b>	Application of Trees: Manipulation of Arithmetic expressions, Syntax Analysis		
<b>8</b>		<b>Graph</b>	<b>1,2,3</b>	<b>2</b>
	<b>8.1</b>	Graph Definition, Terminologies and Operations		
	<b>8.2</b>	Graph Representation		
	<b>8.3</b>	Applications of Graph -- DFS and BFS		
			<b>Total</b>	<b>42</b>

### References:

- [1] Richard F Gilberg, Behrouz A Forouzan, “Data Structure A Pseudocode Approach with C”, Brooks/Cole Publishing Company, Second edition.
- [2] Moshe, Tenenbaum, “Data Structures Using C and C, Pearson Education Asia Pvt. Ltd.”, Second edition.
- [3] Tremblay, Jean-Paul & Sorenson, “An Introduction to Data Structures with Applications”, Tata McGraw-Hill, Second edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA24	Software Project Management	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		MCA12
Course Outcomes	CO1	Make use of knowledge of Project Life Cycle to successfully implement the projects in the corporate world.
	CO2	Identify the Inputs, Tools and techniques to get the required Project deliverables and Product deliverables using 10 Knowledge areas of Project Management.
	CO3	Understand 47 Project Management Processes defined by PMBOK
	CO4	Implement the project management processes needs to successfully complete project in IT industry.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to Project Management</b>	1,3	3
	1.1	What is project? What is project Management, The role of project Manager		
	1.2	The project Management Profession Understanding organizations		
	1.3	Stakeholder management, Project phases		
2		<b>Conceptualizing and Initializing IT project</b>	1,2	3
	2.1	Information Technology Project Methodology,		
	2.2	Business case, Project selection and Approval,		
	2.3	Project management processes, Project charter, Project Planning Framework		
3		<b>Project Scope management</b>	1,3	4
	3.1	Scope Planning -Statement of work , scope statement		
	3.2	Scope definition -project oriented scope , product oriented scope		
	3.3	Scope verification Scope change Control procedures		
	3.4	Creating workbreakdown structure		
4		<b>Scheduling and Budgeting</b>	1,2,3	8
	4.1	Developing the Project Schedule, Schedule Control		
	4.2	Basic Principles of Cost Management		
	4.3	Cost Estimating: Types of cost estimates		
	4.4	Cost estimation tools and techniques		
	4.5	Cost Control: Earned Value Management, Project Portfolio		
5		<b>Project Quality and Communication management</b>	1,2	7

	5.1	Tools and Techniques for Quality Control, Pareto Analysis		
	5.2	Statistical Sampling, Six Sigma, Quality		
	5.3	Modern Quality management: Juran and the importance of Top management commitment to Quality		
	5.4	Crosby and Striving for Zero defects		
	5.5	Ishikawa and the Fishbone Diagram		
	5.6	The Project Communication Plan Reporting Performance		
<b>6</b>		<b>The Importance of Project Procurement Management</b>	<b>1</b>	<b>6</b>
	6.1	Planning Purchases and Acquisitions, Planning Contracting,		
	6.2	Requesting Seller Responses, Selecting Sellers, Administering the Contract		
	6.3	Closing the Contract Using Software to Assist in project		
	6.4	Procurement Management, Out Sourcing: The Beginning of the outsourcing phenomenon,		
	6.5	Types of outsourcing relationship, The		
	6.6	Realities of outsourcing, Managing the outsourcing relationship		
<b>7</b>		<b>Human Resource Management</b>	<b>1</b>	<b>5</b>
	7.1	Human Resource Planning, Acquiring the Project Team: Resource		
	7.2	Assignment, Resource Loading, Resource Leveling		
	7.3	Developing the Project Team, Managing the Project Team,		
	7.4	Change management : Dealing with Conflict & Resistance Leadership & Ethics		
<b>8</b>		<b>The Project Implementation Plan and Closure</b>	<b>3</b>	<b>6</b>
	8.1	Project Implementation		
	8.2	Administrative Closure, Project Evaluation		
	8.3	Leadership & Ethics in Projects: Project Leadership,		
	8.4	Ethics in Projects,		
	8.5	Multicultural Projects		
			<b>Total</b>	<b>42</b>

### References :

- [1] Kathy Schwalbe ,”Managing Information Technology Projects”, Cengage Learning ,sixth edition.
- [2] Kathy Schwalbe ,”Information Technology Project Management “Thomson Publication, sixth edition
- [3] Jack T. Marchewka ,”Information Technology Project Management”, Wiley Publication, fourth editon



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA 25	Probability and Statistics	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

<b>Pre-requisite Course Codes</b>	Discrete Mathematics (MCA13)	
<b>Course Outcomes</b>	<b>CO1</b>	Distinguish between quantitative and categorical data
	<b>CO2</b>	Apply different statistical measures on various types of data
	<b>CO3</b>	Identify, formulate and test hypothesis problems
	<b>CO4</b>	Analyze different types of Probability and their fundamental applications

Module	Unit	Topics	Ref.	Hrs.
<b>1</b>		<b>Measures of central tendency &amp; Measures of Dispersion</b>	<b>1</b>	<b>4</b>
	<b>1.1</b>	Continuous Frequency Distribution		
	<b>1.2</b>	Histogram, Frequency Polygon, Stem and leaf diagram,		
	<b>1.3</b>	Arithmetic Mean, Geometric mean, Harmonic mean,		
	<b>1.4</b>	Range, Quartile Deviation, Mean Deviation,		
	<b>1.5</b>	Box whisker plot, Standard Deviation, Coefficient of		
<b>2</b>		<b>Skewness, Correlation and regression</b>	<b>1,3</b>	<b>6</b>
	<b>2.1</b>	Karl Pearson's coefficient of Skewness, Bowley's coefficient of Skewness, Scatter Diagram		
	<b>2.2</b>	Karl Pearson's coefficient of correlation, Spearman's rank		
	<b>2.3</b>	Linear Regression and Estimation		
	<b>2.4</b>	Coefficients of regression		
<b>3</b>		<b>Skewness and Kurtosis</b>	<b>2,7,8</b>	<b>8</b>
	<b>3.1</b>	Hypothesis, Type I and Type II errors,		
	<b>3.2</b>	Tests of significance– Student's t-test:Single Mean,		
	<b>3.3</b>	Paired t-test		
	<b>3.4</b>	Chi-Square test:Test of Goodness of Fit, Independence Test		
<b>4</b>		<b>Axiomatic Approach to Probability</b>	<b>4</b>	<b>6</b>
	<b>4.1</b>	Random experiment, sample space, events		
	<b>4.2</b>	axiomatic Probability		
	<b>4.3</b>	Algebra of events		
	<b>4.4</b>	Conditional Probability, Multiplication theorem of		
	<b>4.5</b>	Independent events		
	<b>4.6</b>	System reliability, Baye's Theorem		
<b>5</b>		<b>Random variables and Distribution Functions</b>	<b>4,5</b>	<b>6</b>
	<b>5.1</b>	Discrete random variable		
	<b>5.2</b>	Continuous random variable, Two-dimensional random		

	<b>5.3</b>	Joint probability distribution		
	<b>5.4</b>	Stochastic independence		
<b>6</b>		<b>Mathematical Expectation</b>	<b>6</b>	<b>3</b>
	<b>6.1</b>	Properties of expectation		
	<b>6.2</b>	Properties of variance		
	<b>6.3</b>	Covariance		
<b>7</b>		<b>Special Discrete probability Distributions</b>	<b>4,6</b>	<b>4</b>
	<b>7.1</b>	Bernoulli		
	<b>7.2</b>	Binomial		
	<b>7.3</b>	Poisson		
	<b>7.4</b>	Geometric		
<b>8</b>		<b>Special Continuous probability Distributions</b>	<b>4,5,6</b>	<b>5</b>
	<b>8.1</b>	Normal		
	<b>8.2</b>	Uniform		
	<b>8.3</b>	Exponential		
	<b>8.4</b>	Gamma		
	<b>8.5</b>	Beta		
			<b>Total</b>	<b>42</b>

### Reference Books

- [1] S.C.Gupta, V.K.Kapoor , S Chand, “Fundamentals of Mathematical Statistics” ,1 st Edition
- [2] J.Susan Milton, Jesse C. Arnold, “Introduction to Probability & Statistics”, Tata McGraw Hill, 4<sup>th</sup> Edition
- [3] S C Gupta, “Fundamentals of Statistics”, Himalaya Publishing house, 7th edition.
- [4] Kishore Trivedi, “Probability and Statistics with Reliability, Queuing, And Computer Science Applications”, PHI (English) 1st Edition
- [5] Schaum’s, “Outlines Probability, Random Variables & Random Process”, Tata McGraw Hill, 3rd Edition
- [6] Dr J Ravichandran , “Probability & Statistics for Engineers”, Wiley
- [7] Dr Seema Sharma, “Statistics for Business and Economics”, Wiley
- [8] Ken Black, “Applied Business Statistics”, Wiley, 7th Edition

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL22	Computer Networks Lab	--	--	4	--	--	2	2
		Examination Scheme						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes		MCA22
Course Outcomes	CO1	Implement error correction and detection techniques
	CO2	Configuring various networking protocols
	CO3	Use and demonstrate networking tools

Exp No.	Experiment details	Ref.	Marks
1	<b>Data Link Layer-Error detection &amp; correction</b> Write a program to implement VRC and LRC, CRC ,checksum and Hamming code method	1	10
2	<b>DataLink Layer Communication</b> Write a program to implement Stop and wait ARQ, sliding window protocol.	1	10
3	<b>IP addressing</b> Write a program to find out class of IP addresses, Subnet mask, first address and last address.	1	10
4	<b>Routing Techniques</b> Write a program for shortest path routing algorithm , distance vector routing algorithm	1	10
5	<b>VLAN</b> Configure VLANs on the router, Inter VLAN, Router on stick, multilayer VLAN, Spanning tree.	2	10
6	<b>Networking Protocols</b> Configuration of RIP,EIGRP,OSPF, DCHP , Access List	2	10
7	<b>Address Translation</b> Configuration of NAT, Static, Dynamic and PAT	2	
8	<b>Application layer</b> Configure Telnet, DNS, HTTP, SMTP , FTP Servers, SNMP	2	10
<b>Total Marks</b>			<b>80</b>

### References:

- [1] Addison-Wesley Professional, "C++ Network Programming", Addison-Wesley Professional, 2<sup>nd</sup> edition
- [2] A.Jesen, "Packet Tracer Network Simulator", PACKT publisher, 3<sup>rd</sup> edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL23	Data Structures Lab	--	--	4	--	--	2	2
		Examination Scheme						
		TermWork		Practical		Oral		Total
		80		10		10		100

<b>Pre-requisite Course Codes</b>	Object Oriented Programming Lab (MCAL11)	
<b>Course Outcomes</b>	<b>CO1</b>	Demonstrate various sorting techniques.
	<b>CO2</b>	Apply searching and hashing techniques for efficient data retrieval and data mapping.
	<b>CO3</b>	Demonstrate various operations of linear data structures i.e. stack, queue and linked list
	<b>CO4</b>	Create binary tree and its variants.
	<b>CO5</b>	Apply graph traversal techniques.

Exp. No.	Experiment details	Ref	Marks
1	<b>Sorting Techniques:</b> Bubble , Insertion , Selection , Shell , Quick , Radix	1,2,3	10
2	<b>Searching Techniques:</b> Sequential search, Binary Search <b>Hashing Techniques:</b> Modulo division, Digit Extraction, Folding, Mid square <b>Collision Resolution technique:</b> Linear probe	1,2,3	10
3	<b>Stack implementation</b> Implementation of Stack(using Array & Linked list).	1,2,3	10
4	<b>Queue implementation</b> Implement all the different types of queues(eg: Simple Queue, Doubly Ended Queue, Circular Queue)	1,2	10
5	<b>Singly linked list implementation</b> A menu driven program that implements singly linked list for the following operations: create , display , count , insert , delete , search, sort, reverse <b>Doubly linked list implementation</b> A menu driven program that implements doubly linked list for the following operations: create , display , count , insert , delete , search ,sort, reverse <b>Singly circular linked list implementation</b> A menu driven program that implements Singly circular linked list for the following operations: create , display , count , insert , delete , search ,sort, reverse	1,2,3	10
6	<b>Binary Search Tree implementation</b> A menu driven program a. Create a Binary search tree	1,3	10

	b. Traverse the tree in In order, Preorder and Post order c. Search the tree for a given node and delete the node		
<b>7</b>	<b>Heap Tree implementation</b> A menu driven program that implements Heap tree (Maximum and Minimum Heap tree) for the following operations: ( Using Array ) Insert, Delete	<b>1,3</b>	<b>10</b>
<b>8</b>	<b>Graph Implementation</b> Implementation of insert and delete nodes in a graph using adjacency matrix along with Graph Traversal(DFS and BFS)	<b>1,2,3</b>	<b>10</b>
<b>TOTAL</b>			<b>80</b>

### References:

- [1] Richard F Gilberg, Behrouz A Forouzan, “Data Structure A Pseudocode Approach with C” Brooks/Cole Publishing Company, Second edition.
- [2] Moshe, Tenenbaum, “Data Structures Using C and C++”, Pearson Education Asia Pvt. Ltd, Second edition.
- [3] Tremblay, Jean-Paul & Sorenson, “An Introduction to Data Structures with Applications”, Tata McGraw-Hill , Second edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL26	Python Programming Lab	--	--	4	--	--	2	2
		Examination Scheme						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	-	
Course Outcomes	CO1	Make use of datatypes in Python programs.
	CO2	Create functions, modules.
	CO3	Apply Object oriented features in Python program.
	CO4	Design GUI application with database connectivity.
	CO5	Understand advanced Python concepts.

Exp. No.	Experiment Details	Ref.	Marks
1	Introduction to Python	1,2,3	10
2	Conditional statements, Looping statements and Control statements	1,2,3	10
3	String, List, Tuple and Dictionary	1,2	10
4	Functions and Modules	1,2,3	10
5	Exception handling	1,3,4	10
6	Python with OOP concepts	1,2,3	10
7	GUI programming and Database connectivity and File	2,3,4	10
8	Flavors of Python	3,4	10
<b>Total Marks</b>			<b>80</b>

### References:

- [1] John Paul Mueller, "Beginning Programming with Python for Dummies", Wiley.
- [2] Allen Downey, "Think Python : How to think like a computer scientist", Green tea press.
- [3] Wesley J. Chun, "Core Python Programming", Prentice Hall PTR.
- [4] Laura Cassell and Alan Gauld, "Python Projects", Wrox A Wiley brand.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA P21	Mini Project	--	-	--	--	--	--	<b>02</b>
		<b>Examination Scheme</b>						
		<b>Presentation Internal Assessment</b>			<b>External Assessment</b>			<b>Total</b>
		<b>25</b>			<b>25</b>			<b>50</b>

<b>Pre-requisite Course Codes :</b>	Programming language	
<b>Course Outcomes</b>	Student will be able to	
	<b>CO1</b>	Formulate a real world problem and develop its requirements.
	<b>CO2</b>	Develop a design solution for the identified requirements.
	<b>CO3</b>	Test the prototype against identified requirements.
	<b>CO4</b>	Develop effective communication skills for presentation of project related activities.

<b>Evaluation Scheme</b>
<ol style="list-style-type: none"> <li>1. Project assessment is done by internal and external examiner. The project carries weightage of 50 marks.</li> <li>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).</li> <li>3. The external examiner will be evaluating the students for 25 marks at the end of the semester.</li> <li>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.</li> </ol>

S.Y.M.C.A



# SEM III

SEM III						
Course Code	Course Name	Group	Teaching Scheme (Hrs/week)			Credits
MCA31	Core and Advanced JAVA	ICT	4	-	-	4
MCA32	Database Management System	ICT	3	1	-	4
MCA33	Operations Research	M	3	1	-	4
MCA34	Soft Skills Development	BM	4	-	-	4
MCAE35 <sup>^</sup>	<b>Elective-I</b> 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	JAVA Lab	ICT	-	-	4	2
MCAL32	Database Management System lab	ICT			4	2
MCAL36	Unified Modelling Language Lab	ICT			4	2
MCAP31	Mini Project-III	PR			2	1
<b>MCASP2 Summer Project</b>		SP	-	-	-	2
<b>Total</b>			<b>17</b>	<b>2</b>	<b>14</b>	<b>28</b>
SEM IV						
Course Code	Course Name	Group	Teaching Scheme (Hrs/week)			Credits
MCA41	Data warehousing and Mining & Business Intelligence	ICT	3	1		4
MCA42	Software Testing Quality Assurance	ICT	3	1		4
MCA43	Design and Analysis of Algorithm	ICT	3	1	-	4
MCA44	User Experience Design	ICT	3	1	-	4
MCAE45 <sup>^</sup>	<b>Elective-II</b> MCAE45 A Information Security MCAE45 B Soft Computing MCAE45 C Enterprise Resource Planning MCAE45 D Multimedia MCAE45 E Semantic Web	PE	3	-	-	3
MCAL41	Data warehousing and Mining & Business Intelligence Lab	ICT	-	-	4	2
MCAL42	Software Testing Quality Assurance	ICT	-	-	2	1
MCAL43	Design and Analysis of Algorithm	ICT	-	-	2	1
MCAL46	Mobile programming Lab	ICT	-	-	4	2
MCAP41	Mini Project-IV	PR	-	-	2	1
<b>Total</b>			<b>15</b>	<b>4</b>	<b>14</b>	<b>26</b>

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA31	Core and Advanced Java	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Prerequisite Course codes	MCA11	
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		<b>Fundamentals of Java Programming</b>	1,2	3
	1.1	Features of Object-oriented Programming, History of Java, Features of Java,		
	1.2	Java environment and tools, Data types, variable, expressions, operators, control structures, arrays.		
2		<b>Object and Classes</b>	1,2	4
	2.1	Classes, Instance variables, Methods, Constructors, Access Specifiers, Abstract Classes and Wrapper Classes,		
	2.2	Autoboxing and Unboxing, Inheritance, Polymorphism		
	2.3	Method Overriding, Use of Static, final, super and this keyword		
	2.4	Garbage collection and finalize method, string and mutable string, Inner Classes		
3		<b>Packages and Interfaces</b>	1,2	2
	3.1	Package concept, Creating user defined package, Access control protection		
	3.2	Defining interface, Implementing interface.		
4		<b>Generics and Collections</b>	1,2	5
	4.1	Generics - Generic Class, Creating Generic Classes		
	4.2	Generic Methods, Bounded Type, Collections- Collections and Generics		
	4.3	Collection Classes-Links, Vector, Linked Lists, Maps, HashMap, WildCards		
	4.4	LambdaExpressions - Lambda Type Inference, Lambda		

		Parameters		
	4.5	Lambda Function Body, Returning a Value From a Lambda Expression, Lambdas as Objects		
5		<b>Exception Handling</b>	<b>1,2</b>	<b>4</b>
	5.1	Exception handling fundamentals, Exception types		
	5.2	Exception as objects, Exception hierarch		
	5.3	Exception Keywords - Try, catch,finally, throw, throws		
	5.4	Creating User defined Exceptions, Assertion, Annotations		
6		<b>Multithreading</b>	<b>1,2</b>	<b>4</b>
	6.1	Java thread model, Life Cycle of Thread		
	6.2	Working with Thread class and the Runnable interface, Thread priorities		
	6.3	ThreadGroup class, Inter thread communication, Synchronization.		
7		<b>File handling</b>	<b>1,2</b>	<b>4</b>
	7.1	Input streams and Output streams		
	7.2	FileInputStream and FileOutputStream, Binary and Character streams		
	7.3	Buffered Reader/ Writer, Object serialization and Deserialization		
8		<b>Event handling and GUI programming</b>	<b>1</b>	<b>5</b>
	8.1	Comparison of AWT and SWING		
	8.2	Applet class, Applet API hierarchy , Life cycle of Applet		
	8.3	Delegation EventModel, Event handling mechanisms, Swing components		
	8.4	Swing Component Hierarchy- Basic and Advanced Components, JApplet		
	8.5	Layout managers, Adapter class, Inner class.		
9		<b>Database Programming</b>	<b>2</b>	<b>4</b>
	9.1	JDBC architecture, Types of drivers, Java.sql package		
	9.2	Establishing connectivity and working with connection interface		
	9.3	Working with statement interface, Working with PreparedStatement interface		
	9.4	Working with ResultSet interface, Working with ResultSetMetaData interface.		
10		<b>Web development using Servlets</b>	<b>7</b>	<b>4</b>
	10.1	Introduction to servlets, Servlet vs CGI, Servlet API overview		
	10.2	Servlet Life cycle, Generic servlet, HTTPServlet, ServletConfig, ServletContext		
	10.3	Handling HTTP Request and response –GET /POST method, request dispatching, Using cookies, Session tracking.		
11		<b>Web development using JSP</b>	<b>7</b>	<b>5</b>

	11.1	Introduction to JSP, JSP Architecture, JSP Directives, JSP scripting elements		
	11.2	Default objects in JSP, JSP Actions, JSP with beans and JSP with Database		
	11.3	Error handling in JSP, Session tracking techniques in JSP		
	11.4	Introduction to custom tags, JSTL tags in detail		
12		<b>Enterprise Java Beans</b>	<b>7</b>	<b>4</b>
	12.1	Introduction to Enterprise java beans, Types of EJB		
	12.2	Session bean , entity beans, Message driven beans		
13		<b>Introduction to Spring Frameworks</b>	<b>10</b>	<b>4</b>
	13.1	Introduction to Spring Framework, Spring Architecture,		
	13.2	Spring Aspect of Object Oriented Concepts – Join Point and Point Cuts.		
			<b>Total</b>	<b>52</b>

### 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] Wigglesworth, “ Java Programming Advanced Topics w/2CDs” ,Third Edition, Cengage Learning.
- [6] Ivan Byaross, “Commercial web development using java 2.0” , BPB, Revised Edition.
- [7] Marty Hall and Larry Brown , “ Core Servlets and Java Server Pages :Vol I: Core Technologies”, Pearson, Second Edition.
- [8] Sharnam Shah and vaishali shah, “Java EE 6 for Server Programming for professionals”, SPD ,Second Edition .
- [9] E.Balaguruswamy, “Programming with Java A Primer”, Tata McGraw Hill, Fourth Edition.
- [10] Craig Walls, “Spring in Action”, 3rd Edition, Manning.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA32	Database Management System	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	--	
Course Outcomes	CO1	Design an ER diagram and relational database.
	CO2	Apply normalization on the given database.
	CO3	Solve SQL and PL/SQL queries
	CO4	Analyze transaction and concurrency control mechanism.
	CO5	Understand storage, security and emerging trends in database systems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to DBMS</b>	3	5
	1.1	File system organization		
	1.2	Purpose of Database system		
	1.3	Data models types		
	1.4	Codd's rules		
	1.5	DBMS architecture		
	1.6	Database types		
2		<b>ER and Relational model</b>	1	5
	2.1	Entity set & Relationship set		
	2.2	Mapping cardinalities		
	2.3	EER features Designing of ER diagram		
	2.4	ER to Relational Model Designing		
3		<b>Structured Query Language (SQL)</b>	1	6
	3.1	Basic SQL (DDL,DML,DCL)		
	3.2	Intermediate SQL(Joins, Views, Transaction, Integrity constraints)		
	3.3	Advanced SQL (Functions, Triggers, Procedures, Packages)		
4		<b>Query optimization, Normalization and Functional Dependencies</b>	1	6
	4.1	Query processing steps		
	4.2	Evaluation of Query		
	4.3	Relational Optimization		
	4.4	Functional dependency and its types		
	4.5	Normal forms : 1NF, 2NF, 3NF, BCNF		
5		<b>Transaction Management and Concurrency control</b>	2	7
	5.1	ACID properties		
	5.2	Transaction states		
	5.3	Serializability and its types		

	<b>5.4</b>	Recoverability		
	<b>5.5</b>	Concurrency control mechanism		
	<b>5.6</b>	Lock based protocol		
	<b>5.7</b>	Timestamp based protocol		
<b>6</b>		<b>Data storage and security</b>	<b>2</b>	<b>5</b>
	<b>6.1</b>	Primary and Secondary storage devices		
	<b>6.2</b>	RAID levels		
	<b>6.3</b>	Introduction to database security		
	<b>6.4</b>	Discretionary and mandatory access control		
<b>7</b>		<b>Emerging Systems</b>	<b>1,2</b>	<b>5</b>
	<b>7.1</b>	Client/Server Model		
	<b>7.2</b>	Data Warehousing and Data Mining		
	<b>7.3</b>	Web Databases		
	<b>7.4</b>	Mobile Databases		
<b>8</b>		<b>Database Tools : Case study</b>	<b>3</b>	<b>3</b>
	<b>8.1</b>	Case studies based on different database tools like graph database tools (Neo4j, OrientDB, Titan), NoSQL, PostgreSQL		
			<b>Total</b>	<b>42</b>

#### 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

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		
		10		30		100 (60% Weightage)		

<b>Pre-requisite Course Codes</b>	Basic knowledge of Mathematics and Statistics	
<b>Course Outcomes</b>	<b>CO1</b>	Apply Operations research methodology to a broad range of problems in business and industry.
	<b>CO2</b>	Use mathematics and mathematical modelling using computers to forecast the implications of various choices.
	<b>CO3</b>	Solve optimization problems.
	<b>CO4</b>	Think of new methods for solving optimization problems.

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



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

#### 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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA34	Soft Skill Development	4	-	--	4		--	4
		Examination Scheme						
		ISE		MSE		Continuous Evaluation		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	--	
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		<b>Soft-Skills Introduction</b>	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		<b>Communication</b>	1,2,5	06
	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		<b>Written Communication:</b>	1,2,3	06
	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		<b>Presentation techniques</b>	6,7	10
	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.		
	<b>4.2</b>	Topics have to cover – 1. Personality: Meaning, Personality Determinants, Traits, Personality types and its, impact on career growth, 2. Personality and Values, Perception and Individual Decision Making. 3. Diversity in Organizations		
	<b>4.3</b>	4. Attitude: Meaning, Components of Attitude, changing attitude and its impact on career growth 5. Motivation 6. Goal setting: SMART (Specific, Measurable, Attainable, Realistic, Timely) Goals, personal and professional goals		
	<b>4.4</b>	7. Time Management. 8. Learning in a group, Understanding Work Teams, Dynamics of Group Behavior, Techniques for effective participation 9. Leadership 10. Emotional intelligence		
<b>5</b>		<b>Public Speaking</b>	<b>6,7</b>	<b>06</b>
	<b>5.1</b>	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)		
<b>6</b>		<b>Group Discussion Skills</b>	<b>6,7</b>	<b>07</b>
	<b>6.1</b>	Evaluation components, Do's and Don'ts. Practical (Group Discussions)		
<b>7</b>		<b>Interview Techniques</b>	<b>6,7</b>	<b>07</b>
	<b>7.1</b>	Pre-Interview Preparation, Conduct during, interview, Verbal and non-verbal communication, common mistakes. Practical (Role plays, mock interviews)		
			<b>Total</b>	<b>42</b>

#### 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 India publications, 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, sixth edition
- [7] Pareek, Udai, "Understanding Organizational Behaviour", Oxford University Press, New Delhi, fourth edition

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		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	Computer Networks	
Course Outcomes	CO1	To understand basics of security and Cryptography
	CO2	To analyze secret and public key cryptography
	CO3	To analyze hash function and message digest
	CO4	To explain authentication and its standards
	CO5	To analyze internet security protocols.
	CO6	To understand IDS, VPN and firewall.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction</b>	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		<b>Basic of Cryptography</b>	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		<b>Secret key Cryptography</b>	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		<b>Public key Cryptography</b>	2,1,4	5
	4.1	RSA		
	4.2	Diffie-Hellmen Key Exchange		
	4.3	Digital Signature		
5		<b>Hash Functions and Message Digest</b>	2,5	6
	5.1	MD2		

	<b>5.2</b>	MD4 & MD5 Comparison		
	<b>5.3</b>	SHA		
	<b>5.4</b>	HMAC		
<b>6</b>		<b>Authentication and Standards</b>	<b>1,2,4</b>	<b>6</b>
	<b>6.1</b>	Types of Authentication (Password, address, cryptographic, smart cards, biometrics, mutual)		
	<b>6.2</b>	KDC working and Multi domain KDC		
	<b>6.3</b>	Kerberos V5: names, delegation of rights, ticket lifetime, key version, Kerberos V4 vs Kerberos V5		
	<b>6.4</b>	PKI: introduction, PKI trust models, PKI & X.509		
<b>7</b>		<b>Internet Security Protocols</b>	<b>5,1</b>	<b>6</b>
	<b>7.1</b>	SSL		
	<b>7.2</b>	SET		
	<b>7.3</b>	Email Security- PGP, S/MIME		
	<b>7.4</b>	IPSec- AH, ESP		
<b>8</b>		<b>VPN, IDS and Firewall</b>	<b>5,2</b>	<b>5</b>
	<b>8.1</b>	IDS-types and detection models, IDS features, Honeypot		
	<b>8.2</b>	Firewall-Introduction, Types		
	<b>8.3</b>	Virtual Private Network: Introduction, VPN Protocols		
			<b>Total</b>	<b>42</b>

#### 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.

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		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	--		
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.
<b>1</b>		<b>Introduction to AI</b>	<b>1</b>	<b>6</b>
	<b>1.1</b>	Artificial Intelligence : Role of AI in engineering, AI in daily life		
	<b>1.2</b>	Intelligence and Artificial Intelligence		
	<b>1.3</b>	Different task domains of AI		
	<b>1.4</b>	Programming methods, Limitations of AI		
	<b>1.5</b>	<b>Intelligent Agent:</b> Agent, Performance Evaluation		
	<b>1.6</b>	Task environment of agent		
	<b>1.7</b>	Agent classification		
	<b>1.8</b>	Agent architecture		
<b>2</b>		<b>Problem Solving</b>	<b>1,2</b>	<b>11</b>
	<b>2.1</b>	Problems, problem spaces and search: Define the problem as a state space search, Production systems		
	<b>2.2</b>	Problem characteristics, Production system characteristic		
	<b>2.3</b>	Issues in design of search program		
	<b>2.4</b>	<b>Uninformed Search Methods:</b> Breadth First Search (BFS), Depth First Search (DFS) , Depth Limited Search, Depth First Iterative Deepening(DFID),		
	<b>2.5</b>	<b>Informed Search Methods:</b> Greedy best first Search , A* Search , Memory bounded heuristic Search.		
	<b>2.6</b>	<b>Local Search Algorithms and Optimization Problems:</b> Hill climbing search Simulated annealing, Local beam search, Genetic algorithms.		
	<b>2.7</b>	<b>Adversarial Search:</b> Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning.		

<b>3</b>		<b>Knowledge Representation</b>	<b>1,3</b>	<b>9</b>
	<b>3.1</b>	Knowledge Representation: Need to represent knowledge		
	<b>3.2</b>	Knowledge representation with mapping scheme		
	<b>3.3</b>	Properties of good knowledge-based system		
	<b>3.4</b>	Knowledge representation issues		
	<b>3.5</b>	AND-OR graph		
	<b>3.6</b>	Types of knowledge		
	<b>3.7</b>	The Wumpus World, The Propositional logic,		
	<b>3.8</b>	First Order Logic: Syntax and Semantic, Inference in FOL,		
	<b>3.9</b>	Forward chaining, backward Chaining.		
<b>4</b>		<b>Uncertain Knowledge and Reasoning</b>	<b>1,3</b>	<b>3</b>
	<b>4.1</b>	Uncertainty, Representing knowledge in an uncertain domain,		
	<b>4.2</b>	The semantics of belief network,		
	<b>4.3</b>	Inference in belief network.		
<b>5</b>		<b>Planning and Learning</b>	<b>1,2</b>	<b>8</b>
	<b>5.1</b>	The planning problem, Planning with state space search		
	<b>5.2</b>	Partial order planning, Hierarchical planning, Conditional Planning.		
	<b>5.3</b>	Learning: Forms of Learning, Inductive Learning, Learning Decision Tree.		
	<b>5.4</b>	Expert System: Introduction, Phases in building Expert Systems, ES Architecture		
	<b>5.5</b>	ES vs Traditional System.		
<b>6</b>		<b>Applications</b>	<b>2,4</b>	<b>5</b>
	<b>6.1</b>	Natural Language Processing(NLP)		
	<b>6.2</b>	Expert Systems		
	<b>6.3</b>	Neural Network.		
			<b>Total</b>	<b>42</b>

### 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.

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		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	---	
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.
<b>1</b>		<b>Management Information Systems</b>	<b>1,3</b>	<b>8</b>
	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		
<b>2</b>		<b>Strategic Design and Development of MIS</b>	<b>1,2</b>	<b>9</b>
	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.		
<b>3</b>		<b>Decision Making</b>	<b>2</b>	<b>10</b>
	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		
<b>4</b>		<b>Information, knowledge, Business Intelligence</b>	<b>2,4</b>	<b>10</b>
	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		
<b>5</b>		<b>E-Commerce: Applications and Issues</b>	<b>1,2,4</b>	<b>7</b>
	5.1	Introduction to E-Commerce, Scope of E-commerce,		
	5.2	ECommerce Applications and Issues, case study		
<b>6</b>		<b>Securing Information Systems</b>	<b>1,3,4</b>	<b>8</b>
	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		
			<b>Total</b>	<b>52</b>

**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

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		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	--	
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		<b>Introduction to Computer Graphics</b>	1,2	2
	1.1	Introduction to Computer Graphics		
	1.2	Elements of Computer Graphics, Graphics display systems.		
2		<b>Output primitives &amp; its Algorithms</b>	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		<b>2D Geometric Transformations &amp; Clipping</b>	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		<b>Basic 3D Concepts &amp; Fractals</b>	1,2	6
	4.1	3D object representation methods: B-REP Fractals		

	<b>4.2</b>	Sweep representations, CSG, Basic transformations, Reflection, shear.		
	<b>4.3</b>	Projections – Parallel and Perspective Halftone and Dithering technique.		
	<b>4.4</b>	Self-similarity: Koch Curves/snowflake, Sierpinski Triangle		
<b>5</b>		<b>Introduction to Image Processing</b>	<b>5,3</b>	<b>4</b>
	<b>5.1</b>	Fundamental Steps in Digital Image Processing ,Components of an Image Processing System		
	<b>5.2</b>	Basic Concepts in Sampling and Quantization, Representing Digital Images		
	<b>5.3</b>	Spatial and Gray Level Resolution		
<b>6</b>		<b>Image Enhancement Technique</b>	<b>3,4,5</b>	<b>10</b>
	<b>6.1</b>	Image Enhancement in the Spatial Domain		
	<b>6.2</b>	Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, and Power Law Transformations		
	<b>6.3</b>	Piecewise Linear Transformation Functions: Contrast stretching, Gray-level slicing, Bit plane slicing.		
	<b>6.4</b>	Introduction to Histogram, Image Histogram and Histogram Equalization, Image Subtraction, and Image Averaging		
			<b>Total</b>	<b>42</b>

### 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

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		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	
Course Outcomes	CO1 An ability to comprehend the abilities of middleware and understand its 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		<b>Introduction to Middleware</b>	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		<b>Introduction to Service oriented architecture</b>	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		
3		<b>Getting started with SOA</b>	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	<b>Starting with the Business :</b> 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		
	3.10	Influencers, Alignment and Traceability, Business Process Management and Modeling		
	3.11	Basic Business Process Model Components, Executable Models, Business Process Models in an SOA World		
		<b>Service Oriented Enterprise Application</b>	<b>1,2,3</b>	<b>10</b>
4	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.		
		<b>Service Oriented Analysis and Design</b>	<b>1,2</b>	<b>6</b>
5	5.1	Need for models, Principles of service Design –Reuse, Integration, Agility		
	5.2	Design of Activity Services ( or Business Services) - Illustration		
	5.3	Data Services, Design of Client Services, Design of Business Process Services, Illustration – Loan Approval Business Process, Explanation of Loan Approval Process		
		<b>SOA Governance, Security and Implementation</b>	<b>1,2,3</b>	<b>8</b>
6	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)		

	<b>6.4</b>	Approaches for Enterprise-wide SOA Implementation-Strategy (Due Diligence, AS IS Assessment), TO BE Strategy		
	<b>6.5</b>	SOA Development (Transition Planning, Validation, Proof of Concept, Business Process Model), Service Deployment and Monitoring		
			<b>Total</b>	<b>42</b>

**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.

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						
		Term Work			Practical	Oral	Total	
		80			10	10	100	

Prerequisite Course codes	MCA11	
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 JAVA
	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	10
2	Objects and Classes	1,2	10
3	Generics, Collections and Lambda Expression	1,2	10
4	Program based on Exception Handling and Multi-threading	1,2	10
5	File Handling	1,2	10
6	Event handling and GUI programming Database Programming	2	10
7	Web development using Servlets and JSP	5	10
8	Introduction to Spring Frameworks	13	10
<b>Total Marks</b>			<b>80</b>

### 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] Wigglesworth, “ Java Programming Advanced Topics w/2CDs” ,Third Edition, Cengage Learning.
- [6] Ivan Byaross, “Commercial web development using java 2.0” , BPB, Revised Edition.
- [7] Marty Hall and Larry Brown , “ Core Servlets and Java Server Pages :Vol I: Core Technologies”, Pearson, Second Edition.
- [8] Sharnam Shah and vaishali shah, “Java EE 6 for Server Programming for professionals”, SPD ,Second Edition .
- [9] E.Balaguruswamy, “Programming with Java A Primer”, Tata McGraw Hill, Fourth Edition.
- [10] Craig Walls, “Spring in Action”, 3rd Edition, Manning.

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						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	-	
Course Outcomes	CO1	Design database schema using SQL.
	CO2	Write various queries using SQL.
	CO3	Demonstrate cursor, trigger and constraint using PL/SQL.
	CO4	Demonstrate functions, procedures and packages using PL/SQL.

Exp. No.	Experiment details	Ref	Marks
1	<b>SQL Practical</b> <b>Data Definition Language:</b> Create, Alter, Drop, Rename, Truncate <b>Data Manipulation Language:</b> Insert, Update, Delete, Select <b>Data Control Language:</b> Grant, Revoke, Roles <b>Transaction Control Language:</b> Commit, Rollback, Save point	1,2,3	10
2	<b>SQL SELECT Statements:</b> Selecting All Columns, Selecting Specific Columns, Column Alias, Concatenation Operator, Arithmetic Operators, Comparison Conditions, Logical Conditions, ORDER BY Clause	1,2,3	10
3	<b>Functions:</b> Single Row Functions, Character Functions, Number Functions, Date, Functions, Conversion Functions, General Functions, Multiple Row Functions, Group Function <b>Subquery:</b> Subquery, Types of Subquery, Group Function, Having Clause	1,2,3	10
4	<b>Joins:</b> 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, Synonyms <b>Constraints:</b> Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint, Enabling & Disabling	1,2,3	10
5	<b>PL/SQL Practical</b> 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	1,2,3	10
6	<b>Cursor:</b> Types of Cursor, Explicit Cursor Life Cycle, Explicit Cursor Attributes <b>Trigger:</b> Trigger, Statement Trigger, Row Trigger, Using Conditional Operations,	1,2,3	10
7	<b>Exceptions:</b> Block Structure, Exception Handlers, Types of	1,2,3	10



	Exceptions Records: Table-Based, Cursor-Based, Programmer-Defined		
<b>8</b>	<b>Functions:</b> Create Function, Function with Arguments, Executing Function, Dropping Function <b>Procedures:</b> Block Structure of Subprogram, Types of Subprograms, Procedure with Parameters, Executing Procedures, Dropping Procedures. <b>Packages:</b> Package Specification, Package Body, Creating Package, Execution, Dropping Package	<b>1,2,3</b>	<b>10</b>
<b>Total Marks</b>			<b>80</b>

**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.

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						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	MCA11	
Course Outcomes	CO1	Illustrate the use of UML using industrial CASE tool
	CO2	Model of the Problem Space to construct Behavioral diagrams of UML
	CO3	Construct object oriented diagram to model the design of software system.
	CO4	Designing Business Case scenarios with the help of Structural Diagrams of using UML

Exp. No.	Experiment Details	Ref.	Marks
1	<b>Study of UML Overview-</b> The Nature and purpose of Models	1,2	10
2	<b>Implementing Use Case</b> -Capturing a System Requirement, Use Case Relationships, Use Case Overview Diagrams	1,2	10
3	<b>Implementing Activity Diagram</b> - 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	10
4	<b>Implementing Class and Objects-</b> 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	10
5	<b>Implementing Sequence Diagram</b> - Participants, Time, Events, Signals, and Messages, Activation Bars, Nested Messages, Message Arrows	1,2	10
6	<b>Implementing Communication Diagram</b> 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	10
7	<b>Implementing Component</b> 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-	1,2	10

	Box Component Views		
<b>8</b>	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	<b>1,2</b>	<b>10</b>
<b>Total Marks</b>			<b>80</b>

**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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA P31	Mini Project-III	--	--	--	--	--	--	02
		<b>Examination Scheme</b>						
		<b>Presentation Internal Assessment</b>			<b>External Assessment</b>			<b>Total</b>
		<b>25</b>			<b>25</b>			<b>50</b>

<b>Pre-requisite Course Codes :</b>	Programming language, DBMS, UML	
<b>Course Outcomes</b>	<b>CO1</b>	Formulate a real world problem and develop its requirements.
	<b>CO2</b>	Develop a design solution for the identified requirements.
	<b>CO3</b>	Test the prototype against identified requirements.
	<b>CO4</b>	Develop effective communication skills for presentation of project related activities.

<b>Evaluation Scheme</b>	
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.

# SEM IV

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA41	Data warehousing and Mining & Business Intelligence	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	DBMS(MCA33), mathematics	
Course Outcomes	Student Will be able to	
	CO1	Understand Data warehouse characteristics with its different models
	CO2	To design project structure of the data warehouse
	CO3	Apply data warehouse concepts for data analysis and report generation
	CO4	Use conceptualization of BI techniques to make use of relevant theories, concepts and techniques to solve real-world BI problems

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Basic Concepts of Data Warehousing</b>	3	6
	1.1	Introduction, Meaning and characteristics of Data Warehousing,		
	1.2	KDD, Online Transaction Processing (OLTP), Data Warehousing Models.		
	1.3	Data warehouse architecture & Principles of Data Warehousing Data Mining		
2		<b>Data preprocessing</b>	3	6
	2.1	Preprocess the data. Data cleaning Data integration and transformation		
	2.2	Data reduction Dimensionality reduction		
	2.3	Data compression Feature extraction Discretization and concept hierarchy generation		
	2.4	Dimensional Modeling Design		
3		<b>Building a Data Warehouse</b>	3	10
	3.1	Project Structure of the Data warehouse, Data warehousing and Operational Systems, Organizing for building data warehousing,		
	3.2	Important considerations – Tighter integration, Empowerment,		
	3.3	Willingness Business Considerations: Return on Investment Design		
	3.4	Considerations, Technical Consideration, Implementation Consideration, Benefits of Data warehousing.		
4		<b>Business Intelligence-</b>	1,2	6
	4.1	Introduction and overview of BI-Effective and timely decisions,		
	4.2	Data Information and knowledge, BI Architecture, Ethics and BI.		

	<b>4.3</b>	BI Applications- Balanced score card, Fraud detection, Telecommunication Industry, Banking and finance, Market segmentation		
<b>5</b>		<b>Prediction methods and models for BI</b>	<b>2,3</b>	<b>6</b>
	<b>5.1</b>	Data preparation, Prediction methods-Mathematical method		
	<b>5.2</b>	Distance methods, Logic method		
	<b>5.3</b>	heuristic method-local optimization technique, stochastic hill climber, evaluation of models		
<b>6</b>		<b>BI using Data Warehousing</b>	<b>3,4</b>	<b>8</b>
	<b>6.1</b>	Introduction to DW, DW architecture,		
	<b>6.2</b>	ETL Process, Top-down and bottom-up approaches, characteristics and benefits of data mart,		
	<b>6.3</b>	Difference between OLAP and OLTP. Dimensional analysis- Define cubes. Drill- down and roll- up – slice and dice or rotation,		
	<b>6.4</b>	OLAP models- ROLAP and MOLAP.		
	<b>6.5</b>	Define Schemas- Star, snowflake and fact constellations		
			<b>Total</b>	<b>42</b>

#### References:

- [1] Carlo Vercellis, “Business Intelligence data mining and optimization for decision making”, wiley publication.
- [2] Zbigniew Michlewicz, martin Schmidt, matthew michalewicz, constantin Chiriac, “Adaptive business Intelligence”, Springer-Verlag Berlin Heidelberg, First edition
- [3] Ralph Kimball and Margy Ross, “The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling”, John Wiley and Sons, 2013 , Third Edition
- [4] Chaudhuri and Dayal, “An Overview of Data Warehousing and OLAP Technology”, Sections 1-7 (available on Blackboard)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA42	Software Testing and Quality Assurance	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	MCA12	
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 Automation
	CO4	Apply various Software Quality Assurance Techniques to ensure the quality in software.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Basics of Software Testing</b>	1,2	3
	1.1	Humans, Errors & Testing, Correctness Vs Reliability,		
	1.2	Testing & Debugging, Principles of Testing, Test Metrics		
2		<b>Testing in the Software Life Cycle &amp; Test Levels</b>	1,2	6
	2.1	The General V-Model, W-Model, Component Test, Integration Test, System Test,		
	2.2	Acceptance Test, Generic types of Testing-Functional, Non Functional		
	2.3	Testing software structure, Regression Testing		
3		<b>Static Testing</b>	1,2	5
	3.1	Structured Group Examinations - Reviews,		
	3.2	Static Analysis -- Control Flow Analysis & Data Flow Analysis		
	3.3	Tools for Static Testing		
4		<b>Dynamic Testing</b>	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, User Documentation Testing, Domain Testing,		
	4.3	White Box-Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage		
5		<b>Test Management</b>	1,2	6
	5.1	Test Planning, Test Management,		
	5.2	Test Process, Test Reporting		
	5.3	Incident Management – Test Log, Incident Reporting,		



		Classification, Status		
<b>6</b>		<b>Test automation</b>	<b>1,2</b>	
	<b>6.1</b>	Design and Architecture for Automation,		<b>6</b>
	<b>6.2</b>	Test Automation-Design and Architecture for Automation,		
	<b>6.3</b>	Generic Requirements for test Tool/Framework,		
	<b>6.4</b>	Criteria for selecting test tools, Testing of Object Oriented Systems		
<b>7</b>		<b>Software Quality</b>	<b>3,4</b>	<b>2</b>
	<b>7.1</b>	Software Quality Standards, SQA Planning: SQA plan, Organizational Level Initiatives		
<b>8</b>		<b>Software Measurement &amp; Metrics</b>	<b>3,4</b>	<b>6</b>
	<b>8.1</b>	Measurement during Software Life Cycle Context		
	<b>8.2</b>	Defect Metrics, Metrics for software Maintenance & Requirements		
	<b>8.3</b>	Measurement Principles		
	<b>8.4</b>	Case study for Identifying Appropriate Measures & Metrics for Projects		
		<b>Total</b>		<b>42</b>

#### References:

- [1] Andreas Spillner ,”Software Testing Foundations”, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors, fourth edition
- [2] Aditya P. Mathur ,”Foundations of Software Testing”, Pearson Education, second edition
- [3] KshirasagarNaik&PriyadarshiTripathi,“Software Testing & Quality Assurance Theory & Practice”, Wiley Student Edition.
- [4] Nina S. Godbole , “Software Quality Assurance Principles & Practice”, Alpha Science Publication, third edition

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA43	Design and Analysis of Algorithms	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Data Structure and C++	
Course Outcomes	CO1	Analyze basic, approximation and divide & conquer algorithms.
	CO2	Apply greedy and dynamic method to given problem.
	CO3	Evaluate backtracking and branch and bound techniques.
	CO4	Apply graph and string matching algorithms to a given problem.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to analysis of algorithm</b>	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	Master method		
2		<b>Approximation Algorithm</b>	3	4
	2.1	P and NP complete problem. P and NP hard problem.		
	2.2	The Vertex-Cover Problem		
	2.3	The set-covering Problem		
3		<b>Divide and Conquer</b>	1	4
	3.1	Binary Search		
	3.2	Merge sort analysis		
	3.3	Quick sort analysis		
4		<b>Greedy Method &amp; Dynamic Programming</b>	3,2	7
	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 Multiplication		
	4.7	Longest Common Subsequence		
	4.8	Optimal Binary Search Tree		
5		<b>Backtracking</b>	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		

<b>6</b>		<b>Branch and Bound</b>	<b>1</b>	<b>4</b>
	<b>6.1</b>	Introduction to Branch and bound technique.		
	<b>6.2</b>	Bounding and FIFO branch and bound		
	<b>6.3</b>	Least Cost search branch and bound .		
	<b>6.4</b>	15 puzzle problem		
	<b>6.5</b>	Travelling salesman problem		
<b>7</b>		<b>Graph algorithm</b>	<b>1,2</b>	<b>8</b>
	<b>7.1</b>	Single source shortest path- Dijkstra's algorithm, Bellman Ford Algorithm		
	<b>7.2</b>	All pair shortest path-Floyd Warshall algorithm, Johnson's Algorithm		
	<b>7.3</b>	Max Flow Algorithm: Ford-Fulkerson method, Maximum Bipartite Matching, Push-relabel algorithm		
<b>8</b>		<b>String Matching Algorithm</b>	<b>3</b>	<b>6</b>
	<b>8.1</b>	Brute Force String matching		
	<b>8.2</b>	Rabin Carp string matching		
	<b>8.3</b>	Knuth-Morris-Pratt algorithm		
	<b>8.4</b>	String Matching with Finite Automata		
			<b>Total</b>	<b>42</b>

#### 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 Tamassia, "Algorithm design foundation, analysis and internet examples", Second edition , wiley student edition.

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		
		10	30	100 (60% Weightage)				

<b>Pre-requisite Course Codes</b>	System Analysis & Design, Software Engineering and Project Management,UML
<b>Course Outcomes</b>	<b>CO1</b> To understand HMI and UX design
	<b>CO2</b> To explain UX design life cycle
	<b>CO3</b> To analyze UX design process for users
	<b>CO4</b> To analyze various parameters for design process.
	<b>CO5</b> To evaluate UX design process
	<b>CO6</b> To understand UX design for Agile development

Module No.	Unit No.	Topics	Ref.	Hrs.
<b>1</b>		<b>Introduction to Human Machine Interaction</b>	<b>6,8</b>	<b>3</b>
	<b>1.1</b>	Introduction		
	<b>1.2</b>	History of User interface designing		
	<b>1.3</b>	Usability		
	<b>1.4</b>	GUI & Web		
	<b>1.5</b>	User interface Design Goals		
<b>2</b>		<b>Introduction to UX Design</b>	<b>1,2</b>	<b>6</b>
	<b>2.1</b>	What is UX, Ubiquitous interaction		
	<b>2.2</b>	Emerging desire for usability.		
	<b>2.3</b>	From usability to user experience		
	<b>2.4</b>	Emotional impact as part of the user experience		
	<b>2.5</b>	User experience needs a business case		
	<b>2.6</b>	Roots of usability		
<b>3</b>		<b>The UX Design- life cycle</b>	<b>1</b>	<b>6</b>
	<b>3.1</b>	Introduction		
	<b>3.2</b>	A UX process lifecycle template		
	<b>3.3</b>	Choosing a process instance for your project		
	<b>3.4</b>	The system complexity space		
	<b>3.5</b>	Meet the user interface team		
	<b>3.6</b>	Scope of UX presence within the team		
<b>4</b>		<b>The UX Design Process – Understand Users</b>	<b>1,3</b>	<b>7</b>
	<b>4.1</b>	Introduction		
	<b>4.2</b>	The system concept statement		
	<b>4.3</b>	User work activity gathering		
	<b>4.4</b>	Abridged contextual inquiry process		

	4.5	Data-driven vs. model driven inquiry		
	4.6	History , Contextual Analysis		
	4.7	Extracting Interaction Design Requirements,		
	4.8	Constructing Design- Information Models.		
<b>5</b>		<b>The UX Design Process-thinking, ideation and sketching</b>	<b>1,3</b>	<b>7</b>
	5.1	Information		
	5.2	Architecture and Interaction Design and Prototyping Introduction		
	5.3	Design paradigms		
	5.4	Design thinking		
	5.5	Design perspective		
	5.6	User personas, Ideation, Sketching, More about phenomenology		
	5.7	Mental Models and Conceptual Design, Wireframes		
<b>6</b>		<b>The UX Design Process-Evaluation</b>	<b>1,2</b>	<b>8</b>
	6.1	UX Evaluation and Improve UX Goals, Metrics and Targets		
	6.2	UX Evaluation Techniques.- Formative vs Summative		
	6.3	types of formative and informal summative evaluation methods		
	6.4	types of evaluation data, some data collection technics		
	6.5	variations in formative evaluation results		
	6.6	informal summative data analysis		
	6.7	formative data analysis		
	6.8	feedback to process		
	6.9	evaluation report		
<b>7</b>		<b>UX methods for Agile Development</b>	<b>4</b>	<b>5</b>
	7.1	Introduction		
	7.2	Basics of agile SE method		
	7.3	drawbacks of agile SE method from the UX perspective		
	7.4	A synthesized approach to integrate UX		
			<b>Total</b>	<b>42</b>

#### References:

- [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 Editor
- [4] Lindsay Ratcliffe and Marc McNeill , “Agile Experience Design”, Pearson.
- [5] William Lidwell, Kritina Holden and Jill Butler , “Universal Principles of Design”, Rosenfeild Media
- [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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45A	Information Security	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	Network security	
Course Outcomes	CO1	To understand the basics of security principles and practices.
	CO2	To explain data and program security
	CO3	To analyze database and operating system security
	CO4	To analyze security of wireless network and web services
	CO5	To understand laws for information security.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Security Principles and Practices</b>	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		<b>Data and Program Security</b>	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		<b>Operating System Security</b>	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		

	<b>3.6</b>	Control of Access to General Objects		
	<b>3.7</b>	File Protection Mechanism		
<b>4</b>		<b>Database Security</b>	<b>3,2</b>	<b>6</b>
	<b>4.1</b>	Database Security Requirements and Challenges		
	<b>4.2</b>	Database Integrity, Data Security Policies		
	<b>4.3</b>	Sensitive data		
	<b>4.4</b>	Interface		
	<b>4.5</b>	Multilevel database Application Software Controls :Concurrency Control		
	<b>4.6</b>	Cryptograph control		
	<b>4.7</b>	Audit train control		
<b>5</b>		<b>Software Web Services Security</b>	<b>4</b>	<b>6</b>
	<b>5.1</b>	Technologies for web services (XML, SOAP, WSDL & UDDI)		
	<b>5.2</b>	Web Services Security – Token types		
	<b>5.3</b>	XML encryption		
	<b>5.4</b>	XML segment		
<b>6</b>		<b>Security of Wireless Networks</b>		<b>4</b>
	<b>6.1</b>	An overview of wireless technology		
	<b>6.2</b>	Wired world versus wireless world: putting Wireless Networks in Information Security Context		
	<b>6.3</b>	Attacks on Wireless Networks		
<b>7</b>		<b>Laws &amp; Legal Framework for Information Security</b>	<b>1</b>	<b>7</b>
	<b>7.1</b>	Introduction, Information Security and Law		
	<b>7.2</b>	Understanding the Laws of Information Security		
	<b>7.3</b>	Indian IT Act, Laws of IPR		
	<b>7.4</b>	Patent laws		
	<b>7.5</b>	Copyright Law		
	<b>7.7</b>	Ethical Issues in Information Security: Introduction		
	<b>7.8</b>	Issues in Network enterprises		
	<b>7.9</b>	Computer Ethics and Security and Privacy Policies		
			<b>Total</b>	<b>42</b>

**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 .

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45 B	Soft Computing	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	Artificial Intelligence
Course Outcomes	Student will be able to
	<b>CO1</b> To distinguish different architectures of artificial Neural Network based on learning methods.
	<b>CO2</b> To apply fuzzy logic to design control system
	<b>CO3</b> To understand and apply genetic algorithm for various application
	<b>CO4</b> To analyze real time application by using hybrid method

Module No.	Unit No.	Topics	Ref.	Hrs.
<b>1</b>		<b>Soft Computing</b>	<b>1</b>	<b>2</b>
	<b>1.1</b>	Hard computing Vs Soft Computing,		
	<b>1.2</b>	Soft computing constituents – ANN, Fuzzy Logic, GA Applications of Soft Computing		
<b>2</b>		<b>Artificial Neural Network</b>	<b>1,2</b>	<b>6</b>
	2.1	Introduction, Fundamental Concept, Artificial Neural Network, Brain vs. Computer - Comparison Between Biological Neuron and Artificial Neuron, Basic Models of Artificial Neural Network		
	2.2	Supervised Learning Network-Linear Separability, Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons, Back-Propagation Network.		
	2.3	Unsupervised Learning Networks- MaxNet		
<b>3</b>		<b>Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets</b>	<b>1,2,3</b>	<b>22</b>
	<b>3.1</b>	Introduction to Fuzzy Logic,		
	<b>3.2</b>	Classical Sets (Crisp Sets),Fuzzy Sets		
	<b>3.3</b>	Classical Relations and Fuzzy Relations		
		Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relations		
	<b>3.4</b>	Membership Functions		
		Introduction, Features of the Membership Functions,		
		Fuzzification, Methods of Membership Value Assignments		
	<b>3.5</b>	Defuzzification		
		Introduction, Lambda-Cuts for Fuzzy Sets (Alpha-Cuts),		



		Lambda-Cuts for Fuzzy Relations, Defuzzification Methods		
	<b>3.6</b>	Fuzzy Inference System: Truth Values and Tables in Fuzzy Logic, Fuzzy Propositions, Formation of Rules, Decomposition of Rules (Compound Rules), Aggregation of Fuzzy Rules, Fuzzy Inference Systems (FIS)- Construction and Working Principle of FIS, Methods of FIS, Overview of Fuzzy Expert System Case study based on Fuzzy expert System		
<b>4</b>		<b>Genetic Algorithm</b>	<b>1,2</b>	<b>5</b>
	<b>4.1</b>	Basic concepts, Difference between genetic algorithm and traditional methods,		
	<b>4.2</b>	Simple genetic algorithm, Working principle,.		
	<b>4.3</b>	Procedures of GA, Genetic operators- reproduction, Mutation, crossover		
<b>5</b>		<b>Hybrid Soft computing Techniques</b>	<b>1,2</b>	<b>4</b>
	<b>5.1</b>	Neuro fuzzy hybrid system		
	<b>5.2</b>	Genetic neuro hybrid system		
<b>6</b>		<b>Application of Soft computing</b>	<b>1,2</b>	<b>3</b>
	<b>6.1</b>	Soft computing based hybrid fuzzy controller		
	<b>6.2</b>	Soft computing based rocket engine control		
			<b>Total</b>	<b>42</b>

### References:

- [1] Anandita Das, "Artificial Intelligence and Soft Computing for Beginners", Shroff Publication.
- [2] Dr. S. N. Sivanandam and Dr. S. N. Deepa, "Principles of Soft Computing", John Wiley
- [3] S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India.
- [4] Kumar Satish, "Neural Networks", Tata McGraw Hill
- [5] Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley India.
- [6] David E. Goldberg, "Search, Optimization & Machine Learning", TBS (1989), First edition

Course Code	Course Name	Teaching Scheme (Hrs/ week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45C	Enterprise Resource Planning	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	MCA14	
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.
<b>1.</b>		<b>Introduction to Enterprise Resource Planning (ERP)</b>	<b>1,9</b>	<b>07</b>
	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		
<b>2.</b>		<b>ERP Implementation Life cycle</b>	<b>1, 9</b>	<b>06</b>
	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		
<b>3.</b>		<b>ERP and Related Technologies</b>	<b>1,9</b>	<b>08</b>
	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)		
<b>4.</b>		<b>ERP Manufacturing Perspective</b>	<b>3,4,5</b>	<b>05</b>
	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		
<b>5.</b>		<b>ERP Modules</b>	<b>3,4,5</b>	<b>05</b>
	5.1	Finance		
	5.2	Plant Maintenance		
	5.3	Quality Management		
	5.4	Materials Management		
<b>6.</b>		<b>Benefits of ERP</b>	<b>3,4,5</b>	<b>06</b>
	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		
<b>7.</b>		<b>Introduction to ERP tools</b>	<b>7,8,9</b>	<b>05</b>
	7.1	OpenERP		
	7.2	JD Edwards-Enterprise One		
	7.3	Microsoft Dynamics-CRM Module		
	7.4	SAP.		
<b>TOTAL</b>				<b>42</b>

#### References:

- [1] Alexis Leon, "Enterprise Resource Planning", Tata McGraw Hill, 3<sup>rd</sup> 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] AnnettaClewto 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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE45 D	Multimedia	4	--	--	4	--	--	4S
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

<b>Pre-requisite Course Codes</b>	Computer Graphics (MCAE35 D)	
<b>Course Outcomes</b>	<b>CO1</b>	Perceive multimedia architecture and its latest applications.
	<b>CO2</b>	Implement compression, decompression techniques and different formats for image, audio and video.
	<b>CO3</b>	Plan and develop multimedia projects

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

	<b>4.4</b>	Discrete Cosine Transform, CCITT group 3 1D,3 21D and 4 2D compression		
<b>5</b>		<b>Audio and Video Compression</b>	<b>1,3,4</b>	<b>7</b>
	<b>5.1</b>	Audio Compression-Audio/Sound Basic concepts Computer representation of sound		
	<b>5.2</b>	ADPCM in speech coding, MPEG audio		
	<b>5.3</b>	Introduction to digital video: Types – Chromasub sampling, CCIR , HDTV Computer Video format		
	<b>5.4</b>	Motion Compression, Motion Vector Search Technique		
	<b>5.5</b>	Sequential, 2D logarithmic, Hierarchal search		
	<b>5.6</b>	Standards used – H.261, Comparison of MPEG and H.264 , MPEG 1,2,4,7 and File formats – DVI		
<b>6</b>		<b>Multimedia presentation and Authoring</b>	<b>1,2,4</b>	<b>4</b>
	<b>6.1</b>	Multimedia system design & its Issues, Types		
	<b>6.2</b>	Authoring Systems, Design Issues Approaches		
	<b>6.3</b>	User Interface Issues, Architecture		
	<b>6.4</b>	Information characteristics for presentation, Presentation design knowledge		
	<b>6.5</b>	Effective HCI		
			<b>Total</b>	<b>42</b>

#### 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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAE35 E	Semantic web	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Background in HTML and XML	
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		<b>Introduction to the Semantic Web</b>	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		<b>Introduction to Ontologies</b>	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		<b>Ontology Languages for the Semantic Web</b>	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		<b>Web Ontology Language: OWL</b>	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		<b>Ontology Engineering</b>	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		<b>Logic and Inference: Rules</b>	<b>2</b>	<b>4</b>
	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		<b>Semantic web and Web 2.0</b>	<b>2</b>	<b>6</b>
	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		<b>Applications of Semantic Web</b>	<b>2,3</b>	<b>6</b>
	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		
			<b>Total</b>	<b>42</b>

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).

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCAL41	Data warehousing and Mining & Business Intelligence Lab	--	--	4	--	--	2	2
		Examination Scheme						
		Term Work		Practical		Oral		Total
		80		10		10		100

<b>Pre-requisite Course Codes</b>	DBMS(MCA33), Mathematics, DW	
	Student will be able to	
<b>Course Outcomes</b>	<b>CO1</b>	Learn how to build a data warehouse and query it (using open source tools).
	<b>CO2</b>	Learn to perform data mining tasks using a data mining toolkit (using open source tool).
	<b>CO3</b>	Understand the data sets and data preprocessing.
	<b>CO4</b>	Learn dimension modelling tool for BI
	<b>CO5</b>	Design ETL project using open source tool

Exp. No.	Experiment Details	Ref.	Marks
1	Unit-I Build Data Warehouse <ul style="list-style-type: none"> <li>Setting Up and Starting Warehouse Builder</li> <li>Introducing OWB Architecture and Configuration</li> <li>Defining Source Metadata</li> <li>Ensuring Data Quality Using Data Profiling</li> <li>Defining Staging Metadata and Mapping Tables</li> </ul>	1,3	10
2	<ul style="list-style-type: none"> <li>Deriving Data Rules and Running Correction Mappings</li> <li>Defining a Relational Dimensional Model</li> <li>Handling Slowly Changing Dimensions</li> </ul>	1,2	10
3	<b>Study of OLAP</b> <ul style="list-style-type: none"> <li>Analytical Queries</li> <li>Grouping Functions</li> <li>Windowing Functions</li> <li>RollUp and Cube</li> </ul>	1,4	10
4	Open source tool for study of <ul style="list-style-type: none"> <li>Using Classification Models</li> <li>Using Regression Models</li> <li>Using Clustering Models</li> </ul>	2,3	10
5	<b>Study of Open Source BI Tools</b> <ul style="list-style-type: none"> <li>Preparing Reports</li> <li>Preparing Dashboards</li> <li>Preparing Balanced Score Cards and Analysis of Reports</li> </ul>	2,3	10
6	ETL working with open source tool	3	10
7	Dimensional modelling tool working	3	10
8	Beyond the Syllabus -Simple Project on Data Preprocessing	1,2	10
<b>Total Marks</b>			<b>80</b>



**References:**

- [1] Carlo Verzellis, “Business Intelligence data mining and optimization for decision making”, wiley publication.
- [2] Zbigniew Michlewicz, martin Schmidt, matthew michalewicz, constantin Chiriac, “Adaptive business Intelligence”, Springer-Verlag Berlin Heidelberg, First edition
- [3] Ralph Kimball and Margy Ross, “The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling”, John Wiley and Sons, 2013 , Third Edition
- [4] Chaudhuri and Dayal, “An Overview of Data Warehousing and OLAP Technology”, Sections 1-7 (available on Blackboard)

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						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	MCA42	
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	10
2	Construction of CFG & Deriving Test Cases	1,2	10
3	Implementation of Test Cases using Unit Testing, Integration & System Testing	1,2	10
4	State Transition Test, Cause Effect Graphing and Decision Table Technique	1,2	10
5	Study of Automation Tools, Building Test Cases.	3	10
6	Using Base URL to Run Test Cases in Different Domains	3	10
7	Selenium commands-selenese, Matching Text Patterns, Performance Testing Concepts :Load Testing, Stress Testing	3	10
8	Web Driver Implicit & Explicit Wait, Cross Browser Testing, API Testing	3	10
<b>Total Marks</b>			<b>80</b>

#### 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.

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
		<b>Examination Scheme</b>						
		Term Work		Practical		Oral		Total
		80		10		10		100

<b>Pre-requisite Course Codes</b>	<b>C++ and Data structures</b>	
<b>Course Outcomes</b>	<b>CO1</b>	To implement greedy and dynamic method
	<b>CO2</b>	To implement backtracking and branch and bound techniques.
	<b>CO3</b>	To demonstrate graph algorithms to a given problem.
	<b>CO4</b>	To demonstrate string matching algorithms.

Sr. no	Experiment details	Ref	Marks
1	To implement Greedy algorithms ( prims, kruskal, knapsack)	1,2	10
2	To implement dynamic algorithms (Matrix multiplication, 0/1 knapsack, OBST)	1,2	10
3	To implement Backtracking algorithm (graph coloring, n-Queen , Sum of subset)	1,2	10
4	To implement branch and bound algorithm( Travelling salesman problem, 15 puzzle problem)	1,2	10
5	To implement Single source shortest path( Dijkstra's algorithm, Bellman Ford Algorithm)	1,2	10
6	To implement All pair shortest path (Floyd Warshall algorithm, Johnson's Algorithm)	1,2	10
7	To implement Max Flow Algorithm ( Ford-Fulkerson method, Maximum Barpitarte Matching, Push -relabel algorithm)	1,2	10
8	To implement String matching algorithm (Brute Force String matching, Rabin Carp string matching, Knuth- Moris-Pratt algorithm, String matching with Finite Automata )	1,2	10
<b>Total marks</b>			<b>80</b>

#### 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.

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						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	
Course Outcomes	CO1 Understand basics of Mobile application.
	CO2 Design and Develop User Interface using Mobile Programming Platform.
	CO3 Develop Mobile Applications with database connectivity.

Exp. No.	Experiment Details	Ref.	Marks
1	Introduction and installation of Android.	1,2,3	10
2	Working with view, intents, fragments and asynchronous calling.	1,3	10
3	Design User Interface Widgets (Text, Button, Toggle, Images, Notification, Toast).	1,2,3	10
4	Design Menus, Dialogues, List and Tabs.	1,2,3	10
5	Develop Multimedia components in Android application.	1	10
6	Application development with Database connectivity.	1,2	10
7	Android web development.	1	10
8	Publishing Android application on Play store.	2,3	10
<b>Total Marks</b>			<b>80</b>

#### References:

- [1] Robi Sen and Chris King, "Android in Action", Dreamtech press, Third Edition.
- [2] Michael Burton and Donn Felker, "Android Application Development for Dummies", Wiley.
- [3] Wei-Meng Lee, "Beginning Android 4 Application Development", Wrox A Wiley Brand.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA P41	Mini Project-IV	--	--	--	--	--	--	02
		<b>Examination Scheme</b>						
		<b>Presentation Internal Assessment</b>			<b>External Assessment</b>			<b>Total</b>
		<b>25</b>			<b>25</b>			<b>50</b>

<b>Pre-requisite Course Codes :</b>	Programming language, DBMS, UML	
	Student will be able to	
<b>Course Outcomes</b>	<b>CO1</b>	Formulate a real world problem and develop its requirements.
	<b>CO2</b>	Develop a design solution for the identified requirements.
	<b>CO3</b>	Test the prototype against identified requirements.
	<b>CO4</b>	Develop effective communication skills for presentation of project related activities.

<b>Evaluation Scheme</b>
<ol style="list-style-type: none"> <li>1. Project assessment is done by internal and external examiner. The project carries weightage of 50 marks.</li> <li>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).</li> <li>3. The external examiner will be evaluating the students for 25 marks at the end of the semester.</li> <li>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.</li> </ol>

**T.Y.MCA**

<b>SEM V</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>GR</b>	<b>(L)</b>	<b>(T)</b>	<b>(P)</b>	<b>C</b>
MCA501	Advanced Web Technology & Dot Net	ICT	4	--	--	4
MCA502	Wireless & Mobile Technology	ICT	4	--	--	4
MCA503	Soft Computing	ICT	4	--	--	4
MCA504	Distributed computing and Cloud Computing	ICT	4	--	--	4
<b>Elective II ( SELECT ANY ONE)</b>						
MCA5051	Cyber Security	ICT	4	--	--	4
MCA5052	Multimedia Technology	ICT	4	--	--	4
MCA5053	Information System security and Audit	ICT	4	--	--	4
MCA5054	Bioinformatics	ICT	4	--	--	4
MCA5055	Software Quality Assurance	ICT	4	--	--	4
L501	Lab I-AWT + Dot Net	ICT	--	--	6	3
L502	Lab II- Wireless & Mobile Technology + Mini project	ICT	--	--	6	3
PR501	Mini Project	SP	--	--	--	2
		Total	<b>20</b>	-	<b>12</b>	<b>28</b>
<b>SEM VI</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>GR</b>	<b>(L)</b>	<b>(T)</b>	<b>(P)</b>	<b>C</b>
MCA SP 6.1	INTERNSHIP – Project	SP	--	--	30	15
MCA SP 6.2	INTERNSHIP -Seminar	SP	--	--	--	01
					Total	16

SEM V



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA501	Advanced web Technology & Dot Net	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

<b>Pre-requisite Course Codes</b>	Programming languages like C++, JAVA
<b>Course Outcomes</b>	Students will be able to
	<b>CO1</b> Learn latest technologies, tools and frameworks
	<b>CO2</b> Develop well designed standalone as well as dynamic Web applications
	<b>CO3</b> To develop project using technologies like C# , ASP .NET , Ajax, JQuery
	<b>CO4</b> To design project based on Semantic web, Web Services, Silverlight

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction :</b>	5	4
	1.1	The World Wide Web: WWW Architecture		
	1.2	Web Search Engines, Web crawling, Web indexing		
	1.3	Web Searching, Search engines optimization and limitations		
	1.4	Introduction to the semantic web( RDF, OWL)		
2		<b>Introduction to .NET framework :</b>	6	5
	2.1	Evolution of .NET , Comparison of Java and .NET, Architecture of .NET framework		
	2.2	Common Language Runtime		
	2.3	Common Type System		
	2.4	Metadata, Assemblies, Application Domains, CFL Features of .NET , Advantages and Application		
3		<b>C# :</b>	1,4, 10	8
	3.1	Basic principles of object oriented programming, Basic Data Types		
	3.2	Building Blocks- Control Structures,		
	3.3	operators, expressions, variables		
	3.4	Reference Data Types- Strings, Data time objects,		
	3.5	Arrays, Classes and object		
	3.6	Exception Handling, Generics		
	3.7	File Handling, Inheritance and Polymorphism		
	3.8	Database programming		
4		<b>Web Applications in ASP.NET</b>	7	8
	4.1	ASP.Net Coding Modules,		
	4.2	ASP.NET Page Directives, Page events and Page Life		

		Cycle ,		
	4.3	Post Back and Cross Page Posting	3	
	4.4	ASP.Net Application Compilation models ASP.NET server Controls		
	4.5	HTML Controls, Validation Controls,		
	4.6	Building Databases		
	4.7	Introduction to JQuery: What is jQuery? JavaScript vsjQuery		
	4.8	How to use jQuery in ASP.NET?		
5		<b>Managing State</b>	7	5
	5.1	Preserving State in Web Applications , Page-Level State, Using Cookies to Preserve State		
	5.2	ASP.NET Session State , Storing Objects in Session State ,		
	5.3	Configuring Session State , Setting Up an Out-of-Process State Server		
	5.4	Storing Session State in SQL Server		
	5.5	Using Cookie less Session IDs, Application State		
6		<b>Introduction to web services:</b>	12, 13	5
	6.1	What is a Web Service? Software as a service , Web Service Architectures		
	6.2	SOA , Creating and consuming Web		
	6.3	XML Web Services, Designing XML Web Services		
	6.4	Creating an XML Web Service with Visual Studio		
	6.5	Creating Web Service Consumers ,Discovering Web Services Using UDDI		
7		<b>Advance .NET Concepts :</b>	11, 13	10
	7.1	Introducing WPF , WPF Class Hierarchy		
	7.2	Introducing WCF The WCF Architecture , WCF Endpoints		
	7.3	Introducing WF, Describing Components of WF , Exploring Activities, Describing Types of Workflows		
	7.4	Exploring Built-in Activities , Understanding Bookmark Activities		
	7.5	Handling Runtime Errors ,Hosting Workflows ,Creating a Simple WF Application		
	7.6	<b>Exploring Silverlight</b> , Architecture of Silverlight , Silverlight Controls in Silverlight Applications		
	7.7	Creating a Simple Silverlight Application Integrating Silverlight with ASP.NET Applications		
	7.8	<b>Introducing AJAX Controls</b> The Script Manager Control, The Script Manager Proxy Control, The Timer Control		
	7.9	The Update Panel Control, The Update Progress Control		
<b>Total</b>			<b>45</b>	

## References:

- [1] "Beginning C#" - Wrox Publication
- [2] Chirag Patel "Advance .NET Technology" second edition DreamTech Press
- [3] Jonathan Chaffer and Karl Swedberg "Learning jQuery" Third Edition, SPD Publication
- [4] "Professional C# 2012 and .NET 4.5" - Wrox Publication
- [5] RAJ KAMAL "Internet and Web Technologies" Tata McGraw Hill
- [6] ".NET programming" Black Book
- [7] Murach's "ASP. Net 4. 0 Web Programming with C# 2010"
- [8] Andrew Trolsen "Pro C# 5.0 and the .NET 4.5 Framework", APress
- [9] Vijay Mukhi "C# with Visual Studio", BPB
- [10] "Heard First C#" Second Edition, O'Reilly
- [11] Murach's "ADO. Net 4 Database Programming with C#" 2010 4th Edition
- [12] "Web Technologies Black book", DreamTech Press
- [13] Ralph Moseley & M. T. Savaliya "Developing Web Application" Second Edition, Wiley

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA502	Wireless & Mobile Technology	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Networking, Computer Networks	
Course Outcomes	Students will be able to	
	CO1	To describe the fundamental components of wireless communication.
	CO2	To compare various techniques used for medium access in wireless communication.
	CO3	To Classify Mobile Network Layer and Mobile Transport Layer.
	CO4	To Evaluate various wireless LAN standards and telecommunication system procedures

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction To Wireless Technology :</b>	1	5
	1.1	Mobile and wireless communications		
	1.2	Applications, history, market vision, overview Frequency of Radio Transmission		
	1.3	Signal Antennas, Signal Propagation		
	1.4	Multiplexing, Modulation, SpreadSpectrum		
	1.5	Coding and Error Control (Convolution Codes)		
2		<b>Wireless Communication :</b>	2	6
	2.1	Cellular systems- Frequency Management and Channel Assignment		
	2.2	Dropped call rates & their evaluation		
	2.3	CDMA – FDMA – TDMA – CSDMA		
	2.4	Generations of Cellular Networks 1G,2G		
	2.5	2.5G,3G and 4G		
3		<b>Wireless Lan :</b>	2	8
	3.1	IEEE 802.11,		
	3.2	WiFi,		
	3.3	IEEE 802.16		
	3.4	Bluetooth, WIMAX		
	3.5	Standards– Architecture – Services		
4		<b>Mobile Communication Systems :</b>	1	8
	4.1	GSM-architecture-Location tracking and call setup-		
	4.2	Mobility management- Handover-Security-GSM SMS		
	4.3	International roaming for GSM- call recording functions-		

		subscriber and service data mgt -		
	4.4	Mobile Number portability - VoIP service for Mobile Networks		
	4.5	GPRS – Architecture-GPRS procedures-attach and detach procedures-		
	4.6	PDP context procedure-		
	4.7	combined RA/LA update procedures-Billing		
5		<b>Mobile Network Layer</b>	1	6
	5.1	Mobile IP		
	5.2	Dynamic Host Configuration Protocol		
	5.3	Mobile Ad Hoc Routing Protocols–		
	5.4	Multicast routing		
6		<b>Mobile Transport Layer :</b>	1	6
	6.1	TCP over Wireless Networks		
	6.2	Indirect TCP ,Snooping TCP		
	6.3	Mobile TCP , Fast Retransmit / Fast Recovery Transmission Timeout Freezing		
	6.4	Selective Retransmission		
	6.5	Transaction OrientedTCP		
	6.6	TCP over 2.5 / 3G wireless Networks		
7		<b>Application Layer :</b>	1,2,8	6
	7.1	WAP Model		
	7.2	Mobile Location based services		
	7.3	WAPGateway , WAP protocols		
	7.4	WAP user agent profile		
	7.5	Caching model-wireless bearers for WAP, WML		
	7.6	WMLScripts – WTA - iMode- SyncML		
<b>Total</b>			<b>45</b>	

### References:

- [1] Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education
- [2] William Stallings, “Wireless Communications and Networks”, Pearson Education
- [3] Vijay Garg, “Wireless network evolution: 2G to 3G”, Prentice Hall, 2002.
- [4] MISRA “Wireless Communication and Networks: 3G and Beyond”, McGraw Hill
- [5] Melizza Othman “Principles of mobile computing and mobile communications”, CRCpress
- [6] Matthew Gast “802.11 Wireless Networks: The Definitive Guide”, 2nd Edition, O’Reilly
- [7] Ivan Stojmenovic “Handbook of Wireless Networks and Mobile Computing”, Wiley India
- [8] Yi-Bing Lin “Wireless and Mobile Network Architectures”, ImrichChlamtac
- [9] Dr. Sunilkumar S. Manvi S. Kakkasageri “Wireless and Mobile Networks: Concepts and Protocols”

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA503	Soft Computing	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	Discrete Mathematics, Probabilities and Statics
Course Outcomes	Students will be able to
	<b>CO1</b> Classify the fundamental components of wireless communication.
	<b>CO2</b> Interpret techniques used for medium access in wireless communication.
	<b>CO3</b> Classify technical details of telecommunication and aspects of Wireless LAN.
	<b>CO4</b> Analyze the concept of Mobile Network Layer and Mobile Transport Layer.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to Soft Computing: —</b>	1	2
	1.1	Evolution of Computing - Soft Computing Constituents		
	1.2	From Conventional AI to Computational Intelligence		
	1.3	Machine Learning Basics		
2		<b>Artificial Neural Network</b>	1	6
	2.1	<b>Introduction</b> , Fundamental Concept, Artificial Neural Network Biological Neural Network, Brain vs. Computer - Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer), Evolution of Neural Networks		
	2.2	Basic Models of Artificial Neural Network, <b>Supervised Learning Network</b> - Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons,		
	2.3	Back-Propagation Networks, backpropagation learning methods effect of learning rule co-efficient, back propagation algorithm factors affecting back propagation training		
	2.4	Associative Memory Networks, Unsupervised Learning Networks, Special Networks		
3		<b>Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets</b>	1	3
	3.1	Introduction to Fuzzy Logic		
	3.2	Classical Sets (Crisp Sets)		
	3.3	Fuzzy Sets		
4		<b>Classical Relations and Fuzzy Relations</b>	1	4
	4.1	Introduction		
	4.2	Cartesian Product of Relation		

	4.3	Classical Relation, Fuzzy Relations		
5		<b>Membership Functions:</b>	1, 2	3
	5.1	Introduction, Features of the Membership Functions		
	5.2	Fuzzification		
	5.3	Methods of Membership Value Assignments		
6		<b>Defuzzification:</b>	1, 2	3
	6.1	Introduction		
	6.2	Lambda-Cuts for Fuzzy Sets (Alpha-Cuts) LambdaCuts for Fuzzy Relations		
	6.3	Defuzzification Methods		
7		<b>Fuzzy Arithmetic and Fuzzy Measures:</b>	1	4
	7.1	Introduction, Fuzzy Arithmetic- Interval Analysis of Uncertain Values Fuzzy Numbers		
	7.2	Fuzzy Ordering, Fuzzy Vectors Extension Principle		
	7.3	Fuzzy Measures- Belief and Plausibility Measures, Probability Measures Possibility and Necessity Measures		
	7.4	Measures of Fuzziness, FuzzyIntegrals		
8		<b>Fuzzy Rule Base and Approximate Reasoning:</b> , ,	1, 2	4
	8.1	Introduction, Truth Values and Tables in Fuzzy Logic Fuzzy Propositions		
	8.2	Formation of Rules, Decomposition ofRules (Compound Rules) Aggregation of Fuzzy Rules		
	8.3	Fuzzy Reasoning (Approximate Reasoning)- Categorical Reasoning, Qualitative Reasoning, Syllogistic Reasoning Dispositional Reasoning		
	8.4	Fuzzy Inference Systems (FIS)- Constructionand Working Principle of FIS, Methods of FIS, Overview of Fuzzy Expert System		
9		<b>Fuzzy Decision Making:</b>	1	3
	9.1	Introduction, Individual Decision Making Multi-person Decision Making, Multi-objective Decision Making Multi-attribute Decision Making, Fuzzy Bayesian Decision Making		
	9.2	<b>Fuzzy Logic Control Systems:</b> - Introduction, Control System Design		
	9.3	Architecture and Operation of FLC System, FLC System Models Application of FLC Systems		
10		<b>Genetic Algorithm</b>	1	4
	10.1	Basic concepts, :, Difference between genetic algorithm and traditional methods, Simple genetic algorithm		
	10.2	Similarity templates, Workingprinciple, Procedures of GA		
	10.3	Genetic operators- reproduction, Mutation, crossover, basic building block hypothesis		
	10.4	the two-armed and k-armed bandit problem, Minimal deceptive problem, Applications		
11		<b>Applications of Soft Computing</b>	1, 2,3	9

11.1	Introduction, A Fusion Approach of Multispectral Images with SAR (Synthetic Aperture Radar) Image for Flood Area- Image Fusion		
11.2	Neural Network Classification, Methodology and Result		
11.3	Optimization of Traveling Salesman Problem using Genetic Algorithm Approach- Genetic Algorithms, Schemata, Problem Representation, Reproductive Algorithms, Mutation Methods, Results		
11.4	Genetic Algorithm-Based Internet Search Technique- Genetic Algorithms and Internet,		
11.5	First Issue: Representation of Genomes, Second Issue: Definition of the Crossover Operator, Third Issue: Selection of the Degree of Crossover		
11.6	Fourth Issue: Definition of the Mutation Operator, Fifth Issue: Definition of the Fitness Function, Sixth Issue: Generation of the Output Set		
11.7	Soft Computing Based Hybrid Fuzzy Controllers- Neuro-Fuzzy System		
11.8	Real-Time Adaptive Control of a Direct Drive Motor, GA-Fuzzy Systems for Control of Flexible Robots GP-Fuzzy Hierarchical Behavior Control, GP-Fuzzy Approach, Soft Computing Based Rocket Engine Control- Bayesian Belief Networks		
11.9	Fuzzy Logic Control, Software Engineering in Marshall's Flight Software Group, Experimental Apparatus and Facility Turbine Technologies SR-30 Engine, System Modifications Fuel-Flow Rate Measurement System, Exit Conditions Monitoring		
<b>Total</b>			<b>45</b>

### References:

- [1] Dr. S. N. Sivanandam and Dr. S. N. Deepa, "Principles of soft computing" John Wiley
- [2] S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.
- [3] N.P. Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press.
- [4] Siman Haykin, "Neural Networks" Prentice Hall of India
- [5] Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
- [6] Kumar Satish, "Neural Networks" Tata McGraw Hill



Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA504	Distributed computing and Cloud Computing	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Networking
Course Outcomes	Student will be able to
	<b>CO1</b> Apply various process communication protocols to Distributed Systems.
	<b>CO2</b> Compare different algorithms of Distributed Systems.
	<b>CO3</b> Solve the different issues of Distributed System Management.
	<b>CO4</b> Analyze the latest trends Service oriented architecture, Cloud Services.
	<b>CO5</b> Analyze different Cloud models for its implementation.
	<b>CO6</b> Demonstrate various Cloud Technologies.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to Distributed Computing Concepts</b>	1,3	3
	1.1	Basic concepts of distributed systems		
	1.2	Distributed computing models		
	1.3	Software concepts, issues in designing distributed systems		
	1.4	Client server model and current case studies of the World Wide Web 1.0 and World Wide Web 2.0.		
2		<b>Inter Process Communication Fundamental concepts</b>	1,3	5
	2.1	Related to inter process communication including message-passing mechanism		
	2.2	Case study on IPC in MACH		
	2.3	Concepts of group communication and case study of group communication CBCAST in ISIS,		
	2.4	API for Internet Protocol		
3		<b>Formal Model Specifications and Remote Communication</b>	1,3	5
	3.1	Basic concepts of formal model definitions		
	3.2	Different types of communication systems		
	3.3	algorithms for message passing systems		
	3.4	Basic concept of middleware		
	3.5	Remote Procedural Call (RPC)		
	3.6	Case study on Sun RPC, Remote Method Invocation (RMI) along with a case study on Java RMI.		
4		<b>Clock synchronization</b>	1,3	3
	4.1	clock synchronization		

	4.2	physical and logical clocks,		
	4.3	global state mutual Exclusion algorithms election algorithms		
5	5.1	Distributed System Management Resource management	1,3	5
	5.2	process management		
	5.3	threads, and fault tolerance		
6	6.1	Distributed Shared Memory Fundamental concepts of DSM	1,3	5
	6.2	types of DSM		
	6.3	various hardware DSM systems		
	6.4	Consistency models		
	6.5	issues in designing and implementing DSM systems		
7	7.1	Distributed File System Concepts of a Distributed File System (DFS)	1,3	4
	7.2	file models		
	7.3	issues in file system design		
	7.4	naming transparency and semantics of file sharing		
	7.5	techniques of DFS implementation		
8	8.1	Advances in Distributed Computing (SOA & Cloud Computing) Service-Oriented Architecture	6,7	4
	8.2	Elements of Service-Oriented Architectures, RPC versus Document Orientation		
	8.3	Major Benefits of Service- Oriented Computing, Composing Services, Goals of Composition		
	8.4	Challenges for Composition, Spirit of the Approach		
9	9.1	Fundamentals of Cloud computing	6,7	2
	9.2	Evolution of Cloud Computing, cluster computing Grid computing		
	9.3	Grid computing versus Cloud Computing, Key Characteristics of cloud computing		
10	10.1	Cloud models Benefits of Cloud models,Public Cloud	6,7	4
	10.2	Private Cloud, Hybrid Cloud, Community Cloud, Shared Private Cloud		
	10.3	Dedicated Private Cloud, Dynamic Private Cloud, Savings and cost impact Web services delivered from cloud		
	10.4	Platform as a service,Software as a service, Infrastructure as a service		
11	11.1	Cloud Security Fundamentals Privacy and security in cloud	7,8	5
	11.2	Security architecture		
	11.3	Data security		
	11.4	Identity and access management		
	11.5	security challenges		
12	12.1	Implementation of Cloud Technologies, Introduction to Cloud Technologies	7,8	
	12.2	Hypervisor, Web services, AJAX		
	12.3	MASHUP, Hadoop, Map reduce		
	12.4	Virtualization Technologies, Virtual Machine Technology		
	12.5	Cloud data center, Case studies : Google, Microsoft, Amazon		
			<b>Total</b>	<b>45</b>

## References:

- [1] Dr. Sunita Mahajan , Seema Shah “Distributed Computing” Oxford University Press
- [2] Tanenbaum S “Distributed Operating Systems”, Pearson Education
- [3] Pradeep K. Sinha “Distributed OS”, PHI
- [4] George Coulouris, Jean Dollimore, Tim Kindberg, Addison-Wesley “Distributed Systems concepts and design”
- [5] Anthony T. Velte, Robert Elsenpeter “Cloud Computing a Practical Approach”, TMH
- [6] Dr. Kumar Saurabh “Cloud Computing insights into new-era infrastructure”, Wiley India
- [7] John W. Rittinghouse “Cloud Computing implementation, management and security” James F. Ransome, CRC Press, Taylor & Francis group, 2010.
- [8] Shivanandan “Distributed Computing Architecture”
- [9] George Reese “Cloud Application Architecture”, O’reilly and associates

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA5051	Cyber Security	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		
Course Outcomes	CO1	To understand the basics of Cybercrime and Cyber security
	CO2	To analyze the issues and challenges faced due to cyber crime
	CO3	To evaluate various tools and methods used in cybercrime
	CO4	To analyse the laws for cyber crime
	CO5	To analyze the effect of cybercrime in an organization

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to Cybercrime</b>		4
	1.1	Cybercrime definition and origins of the world,		
	1.2	Cybercrime and information security		
	1.3	Classifications of cybercrime		
2		<b>ITA 2000</b>		4
	2.1	Cybercrime and the Indian ITA 2000,		
	2.2	A global Perspective on cybercrimes		
3		<b>Cyber offenses&amp; Cybercrime: Issues and challenges</b>		12
	3.1	How criminal plan the attacks, Social Engineering		
	3.2	Cyber stalking, Cyber cafe and Cybercrimes Botnets,		
	3.3	Attack vector, Cloud computing		
	3.4	Proliferation of Mobile and Wireless Devices		
	3.5	Trends in Mobility		
	3.6	Credit Card Frauds in Mobile and Wireless Computing Era		
	3.7	Security Challenges Posed by Mobile Devices,		
	3.8	Registry Settings for Mobile Devices		
	3.9	Authentication Service Security		
	3.10	Attacks on Mobile/Cell Phones,		
	3.11	Mobile Devices: Security Implications for Organizations,		
	3.12	Organizational Measures for Handling Mobile		
	3.13	Devices-Related Security Issues		
	3.14	Organizational Security Policies and Measures in Mobile Computing Era, Laptops		
	3.15	Internet Filtering Encryption issues		
	3.16	Internet Gambling, Spam - Unsolicited Junk Email		
	3.17	Digital Signatures		
	3.18	Anti-Spam Laws, Anti-Spam Suits		
	3.19	What is Cyber squatting? Ant cyber squatting		
	3.20	Software Piracy		

	3.21	Domain Name Disputes,		
	3.22	File Sharing		
4		<b>Tools and Methods Used in Cyberline</b>		6
	4.1	Proxy Servers and Anonymizers		
	4.2	Phishing, Password Cracking		
	4.3	Keyloggers and Spywares		
	4.4	Virus and Worms		
	4.5	Steganography,		
	4.6	DoS, DDoS Attacks		
	4.7	SQL Injection		
	4.8	Buffer Over Flow		
	4.9	Attacks on Wireless Networks		
	4.10	Phishing, Identity Theft (ID Theft)		
5		<b>Cybercrimes and Cybersecurity:</b>		6
	5.1	The Legal Perspectives Why do we need Cyberlaw: The Indian Context, The Indian IT Act,		
	5.2	Digital Signature and the Indian IT Act, Amendments to the Indian IT Act,		
	5.3	Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario		
6		<b>Cybersecurity: Organizational Implications</b>		8
	6.1	Cost of Cybercrimes and IPR Issues: Lesson for Organizations		
	6.2	Web Treats for Organizations: The Evils and Perils		
	6.3	Security and Privacy Implications from Cloud Computing		
	6.4	Social Media Marketing: Security Risk and Perils for Organization		
	6.5	Social Computing and the Associated Challenges for Organizations		
	6.6	Protecting People's Privacy in the Organization		
	6.7	Organizational Guidelines for Internet Usage		
	6.8	Safe Computing Guidelines and Computer Usage Policy		
	6.9	Incident Handling: An Essential Component		
	6.10	Intellectual Property in the Cyberspace of Cybersecurity		
	6.11	Importance of Endpoint Security in Organizations		
7		<b>Cyber Acts and related issues</b>		5
	7.1	Children's Online Privacy Protection Act (COPPA)		
	7.2	The Children's Internet Protection Act (CIPA Sexual Predator Laws)		
	7.3	The Child Online Protection Act (COPA)		
	7.4	The Communications Decency Act (CDA)		
	7.5	Electronic Signatures in Global & National Commerce Act (E-Sign)		
			<b>Total</b>	<b>45</b>

## References:

- [1] Nina Godbole, SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India, New Delhi
- [2] KAHATE , "Cryptography and Network Security", TMH
- [3] Nina Godbole "Information Systems Security", Wiley India, New Delhi
- [4] Dan Shoemaker, William Arthur Conklin, Wm Arthur Conklin "Cybersecurity: The Essential Body of Knowledge", Cengage Learning.
- [5] Edward Amoroso "Cyber Security", Silicon Press, First Edition
- [6] Kenneth J. Knapp "Cyber Security & Global Information Assurance", Information Science Publishing.
- [7] William Stallings, "Cryptography and Network Security", Pearson Publication

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA5052	Multimedia Technology	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Computer Graphics	
	CO1	Classify components of multimedia System usage with real time application.
	CO2	Analyze elements of multimedia.
	CO3	Evaluate coding techniques.
	CO4	Elaborate multimedia project using tool in planned cost & timeline.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Introduction to Multimedia:</b>	1,2	6
	1.1	Definition and Scope of Multimedia, its Components & applications		
	1.2	Interactive Multimedia, Multimedia Growth, Multimedia Advantages & disadvantages		
	1.3	Major categories of Multimedia titles.		
	1.4	Multimedia Products, Kiosk		
	1.5	Multimedia in Public place, Multimedia on Web, Multimedia in business, Multimedia in mobile phones		
	1.6	iPod, Hypermedia and Hypertext, Hypermedia Applications		
2		<b>Graphics &amp; Text</b>	2	7
	2.1	Graphics: Bitmap Graphics, Vector Graphics, Image file format GIF vs. JPEG		
	2.2	Graphics image sources, Graphics on internet, Graphic programs feature		
	2.3	Animation: Principals of animations, Animation types & technique, Applications of Animation		
	2.4	Morphing , Warping, Animation file and formats		
	2.5	Text: Text in multimedia Applications, General guidelines		
	2.6	Designing and use of text, working with text		
	2.7	Text fonts, Menus and Navigation, Font editing drawing tools		
3		<b>Sound , Audio and Video :</b>	2,3	7
	3.1	Multimedia system sounds, Sound, Sound file formats		
	3.2	MIDI, MIDI Messages, MIDI Vs Digital Audio		
	3.3	sound on Internet		

	3.4	Adding sound & video to your multimedia project, Analog display standards		
	3.5	Digital display standards, Digital video Basics		
	3.6	Video recording and tap formats, Video on internet,		
	3.7	Difference between computer, TV and Video, Optimizing video files for CD-ROM.		
4		<b>Multimedia Authoring Tools</b>	2, 5	5
	4.1	Making instance multimedia, Types of Authoring tools		
	4.2	Time based authoring tools, card and page based authoring tools Icon and object based authoring tools		
	4.3	Authoring Vs Presentation, Story boarding, Graphic design principle for PowerPoint		
	4.4	Development process for Multimedia Applications		
	4.5	Contents analysis for different applications.		
5		<b>Designing and Producing:</b>	2,5	6
	5.1	Designing, designing the structure of multimedia,		
	5.2	Different types of Multimedia structure, Hot spots, Buttons		
	5.3	User interface analysis & Design: Rules of user interface design		
	5.4	models of user interface design		
	5.5	User interface Analysis & Elements of user interface, User interface design, User interface evaluation & examples		
	5.6	Delivering: Testing, Preparing of delivery.		
6		<b>Planning and costing</b>	5	7
	6.1	The process of making multimedia & multimedia skills		
	6.2	multimedia skills team		
	6.3	Planning & costing: Project planning, scheduling & costing		
	6.4	Idea analysis, Idea management software		
	6.5	Pre testing, Task planning		
	6.6	Building a Team		
	6.7	Prototype, Multimedia project team roles		
	6.8	Development: Alpha Development, Beta Development		
7		<b>Coding and Compression.</b>	6	7
	7.1	Introduction to coding and compression techniques,		
	7.2	7 Hrs 66 Entropy encoding,		
	7.3	run length, Arithmetic encoding		
	7.4	Huffman, LempelZiv encoding		
	7.5	JPEG compression process, MPEG audio and video compression		
	7.6	Various CD Formats ,MPEG Standards		
			<b>Total</b>	<b>45</b>



**References:**

- [1] Ron Wodaski "Multimedia Madness", SAMS pub.
- [2] Tay Vaughan "Multimedia: Making it works", TMH pub
- [3] Rao "Multimedia Communication", Wiley -Dreamtech
- [4] S.K. Tripathi, S. V. Raghvan "Multimedia System"
- [5] P.K. AndleighKthakar "Mutimedia System Design", Prentice hail of India
- [6] J.E.K Budford "Multimedia System", Addision Wesley

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA5053	Information System Security and Audit	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes	Network Security	
Course Outcomes	CO1	To understand the basics of security principles and practices.
	CO2	To analyze data and program security
	CO3	To analyze database and operating system security
	CO4	To understand laws and digital forensic for information security.
	CO5	To analyze security of wireless network and web services
	CO6	To understand security audit.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Security Principles and Practices</b>		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		
	1.8	Guidelines and Procedures		
2		<b>Data and Program Security</b>		6
	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		
3		<b>Operating System Security</b>		5
	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		<b>Database Security</b>		5

	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		
<b>5</b>		<b>Steganography and Digital Forensics</b>		<b>4</b>
	5.1	Steganography- Overview and Principles		
	5.2	need of steganography		
	5.3	pros and cons		
	6.4	Steganography vs Cryptography		
	5.5	Types of Steganography Digital Forensics- Introduction,		
	5.6	Forensic life cycle		
	5.7	Water marking		
<b>6</b>		<b>Laws, &amp; Legal Framework for Information Security</b>		<b>4</b>
	6.1	Introduction, Information Security and Law		
	6.2	Understanding the Laws of Information Security		
	6.3	Indian IT Act, Laws of IPR		
	6.4	Patent laws		
	6.5	Copyright Law		
	6.6	Ethical Issues in Information Security: Introduction		
	6.7	Issues in Network enterprises,		
	6.8	Computer Ethics and Security and Privacy Policies		
<b>7</b>		<b>Software Web Services Security</b>		<b>4</b>
	7.1	Technologies for web services (XML, SOAP, WSDL & UDDI)		
	7.2	Web Services Security – Token types,		
	7.3	XML encryption		
<b>8</b>		<b>Security of Wireless Networks</b>		<b>4</b>
	8.1	An overview of wireless technology		
	8.2	Wired world versus wireless world: putting Wireless Networks in Information Security Context,		
	8.3	Attacks on Wireless Networks		
<b>9</b>		<b>Auditing for Security</b>		<b>8</b>
	9.1	Introduction		
	9.2	Organizations Roles and Responsibilities for Security Audits		
	9.3	Auditors Responsibilities for Security Audits,		
	9.4	Types of Security Audits		
	9.5	Technology Based Audits		
	9.6	Phases in Security Audits		
	9.7	Budgeting for Security Audits		
			<b>Total</b>	<b>45</b>

**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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA5054	Bioinformatics	3	1	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	Mathematics
Course Outcomes	Student will be able to
	<b>CO1</b> To impart knowledge on introduction and historical and academic perspective to the field of bioinformatics
	<b>CO2</b> To learn the key methods and tools used in bioinformatics
	<b>CO3</b> To influence of biological science on computing science
	<b>CO4</b> To Understand the theoretical basis behind bioinformatic
	<b>CO5</b> To relates Informatics and explore the tools and techniques used in Bioinformatics

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Bioinformatics</b>	1	4
	1.1	Bioinformatics as multidisciplinary domain		
	1.2	Goal and scope of bioinformatics		
	1.3	Future prospectus of bioinformatics		
	1.4	Use of computers to biologists		
2		<b>Biological research on the web</b>	1, 2, 3	6
	2.1	Public biological databases : Primary sequence database		
	2.2	Protein sequence databases		
	2.3	Secondary databases		
	2.4	Protein pattern databases		
	2.5	Searching biological databases- depositing data into public Databases		
	2.6	Finding software , Judging the quality of information		
3		<b>Introduction to Protein structure</b>	2,3,4	9
	3.1	Chemistry of proteins : 1D to 3D		
	3.2	Peptide bond		
	3.3	Amino Acid		
	3.4	Web based protein structure tools : Structure visualization		
	3.5	Cn3D, RasMol		
	3.6	Structure modeling, MolMol, JMol		
	3.7	Structure classification : Types of classification, Databases (SCOP,CATH)		
	3.8	Structure alignment : Comparing two structures (ProFit) Structure analysis : ProCheck		
4	4.1	Composition of DNA and RNA	2, 3	6
	4.2	Watson and Crick Solve the Structure of DNA		

	4.3	Importance and features of DNA sequence analysis ,		
	4.4	Development of DNA Sequencing Methods,		
	4.5	Gene finders and Feature Detection in DNA		
5	5.1	Pairwise Sequence Comparison,	3, 4	9
	5.2	Pairwise Sequence alignment methods : Dot plot		
	5.3	Dynamic programming, Local and Global similarities, Word and K-tuple		
	5.4	BLAST, FASTA		
	5.5	Multiple sequence alignment methods : Progressive		
	5.6	ClustalW, Iterative, DiAlign		
6	6.1	Phylogenetic Analysis : Phylogenetic Trees Based on Pairwise Distances	5	6
	6.2	Phylogenetic Trees Based on Neighbor Joining		
	6.3	Phylogenetic Trees Based on Maximum Parsimony		
	6.4	Phylogenetic Trees Based on Maximum Likelihood Estimation Introduction to motif		
7	7.1	Automating data analysis using Perl	4	5
	7.2	Perl basics		
	7.3	Pattern matching and regular expressions		
	7.4	Parsing BLAST output using Perl		
<b>Total</b>			<b>45</b>	

### References:

- [1] Cynthia Gibas, Per Jambeck “Developing Bioinformatics Computer Skills”, O'Reilly.
- [2] T Kattwood & D J Parry-Smith “Introduction to Bioinformatics” Addison Wesley Longman
- [3] Machael “Bioinformatics A beginners Guide” Wiley-Dreamtech
- [4] Rehm and Reed “Biotechnology: a multi-volume comprehensive treatise” Volume 5b
- [5] Neil C. Jones, Pavel A. Pevzner “An Introduction to Bioinformatics Algorithms”

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA5055	Software Quality Assurance	3	1	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	Software project management
Course Outcomes	Student will be able to
	<b>CO1</b> To give a focus on concept of quality its models and improvements,
	<b>CO2</b> To measure quality and metrics and quality management system through its element
	<b>CO3</b> focuses on principles and practices in quality management system and gives guidance on measure and metrics in process and product domain of quality
	<b>CO4</b> To get knowledge on software quality, its model and improvements, in-depth knowledge on measuring quality,
	<b>CO5</b> To understand quality management system and on principles and practices of QMS

Module No.	Unit No.	Topics	Ref.	Hrs.
1		<b>Fundamentals Of Software Quality Engineering</b>	1	9
	1.1	Concepts of Quality		
	1.2	Hierarchical Modeling		
	1.3	Quality Models		
	1.4	Quality Criteria And its Interrelation		
	1.5	Fundamentals of Software Quality Improvement		
	1.6	Concepts of Process Maturity		
	1.7	Improving Process Maturity		
2		<b>Development In Measuring Quality</b>	1,2	9
	2.1	Selecting Quality Goals And Measures		
	2.2	Principles Of Measurement		
	2.3	Measures And Metrics		
	2.4	Quality Functional Deployment-Goal/Question/Measures		
	2.5	Paradigm		
	2.6	Quality Characteristics Tree		
	2.7	The FURPS Model And FURPS		
	2.8	Gilb Approach		
	2.9	Quality Prompts		
3		<b>Quality Management System</b>	1	9
	3.1	Element Of A Quality Engineering Program Quality Control		
	3.2	Assurance And Engineering- Reliability		
	3.3	Maintainability, Verifiability, Testability		

	3.4	Safety And Supportability		
	3.5	Historical Perspective Element Of QMS, Human Factors, Time Management		
	3.6	QMS For Software		
	3.7	Quality Assurance-ISO9000 Series		
	3.8	A Generic Quality Management standard		
	3.9	Tools For Quality		
4	4.1	Principles And Practices In Qms	3, 4	9
	4.2	Process-Product-Project		
	4.3	People In Software Development And Management		
	4.4	Spectrum		
	4.5	Principle And Critical Practices In QMS		
	4.6	ISO 9001And Capability		
	4.7	Maturity Models-Six Sigma		
	4.8	Zero Defects And Statistical Quality Control.		
5	5.1	Measures And Metrics In Process And Project Domain	5	9
	5.2	Key Measures For Software Engineers		
	5.3	Defects		
	5.4	Productivity And Quality		
	5.5	Measuring And Improving The Development Process		
	5.6	Assigning Measures To Process Elements And Events		
	5.7	Isikawa Diagrams		
	5.8	Metrics For Software Quality		
	5.9	Integrating Metric Within Software Engineering Process		
	5.10	Metrics For Small Organization		
			<b>Total</b>	<b>45</b>

### References:

- [1] Brian Hambling“ Managing Software Quality”, Tata McGraw Hill
- [2] Juran. J.M.Franks, M.Gyrna, “Quality Planning and Analysis(from the product development through use)”,Tata McGraw Hill
- [3] Alcon Gillies“Software Quality: Theory and Management”, International Thomson, Computer Press 1997.
- [4] Naik –Tripathi “Software Testing Quality Assurance”, Wiley Dreamtech
- [5] Stephan H.Kan, “Metric and Model in Software Quality Engineering”, Addison Wesley,1995.
- [6] Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Fifth Edition McGraw Hill,
- [7] 2001 Humphrey Watts, “Managing the Software Process”, Addison Wesley,1986

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
L501	Laboratory I – AWT + Dot Net	--	--	4	--	--	2	2
		Examination Scheme						
		TermWork		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes	Students will be able to
Course Outcomes	<b>CO1</b> Understand the concepts of the advanced web technologies
	<b>CO2</b> Implement web services and develop well designed, dynamic Web applications.
	<b>CO3</b> Develop well designed, effective standalone applications using .NET technology.

Exp. No.	Experiment Details	Ref.	Marks
1	<b>Introduction to C#</b> <ul style="list-style-type: none"> <li>• Program to demonstrate reference data types i.e. string, date time</li> <li>• Program using array, using object and class , using array list, collection</li> </ul>	11,3	8
2	<b>Program based on Exception Handling ,Generic, Inheritance and polymorphism</b> <ul style="list-style-type: none"> <li>• Program to demonstrate getter and setter method</li> <li>• Program to On Exception Handling Mechanism covering (Try,Catch,Throw,Throws,Finally)</li> <li>• Program to demonstrate generic, to demonstrate inheritance and polymorphism</li> </ul>	11,3	9
3	<b>Program based on File handling</b> <ul style="list-style-type: none"> <li>• Program to demonstrate use of directories, sequential access file ,random access file</li> <li>• Program on serialization and deserialization</li> <li>• Program to demonstrate LINQ</li> </ul>	7	9
4	<b>ASP.NET :</b> <ul style="list-style-type: none"> <li>• Program based onPostBack and CrossPage posting</li> <li>• Program based on validation controls</li> <li>• Program using Master Pages and Themes and Skins</li> <li>• Program to demonstrate PageLife Cycle</li> </ul>	10	8
5	<b>ADO.Net and jQuery:</b> <ul style="list-style-type: none"> <li>• Program to demonstrate binding of different Controls using ADO.NET</li> <li>• Program to demonstrate the use of jQuery</li> </ul>	8, 4	8
6	<b>Managing State:</b> <ul style="list-style-type: none"> <li>• Program to demonstrate Managing State with ViewState and Session</li> <li>• Program based on Cookies for maintaining state.</li> <li>• Program using Cache Object to store Data, Program on a Shopping Cart</li> </ul>	8, 13	9
7	<b>Web services :</b>	7, 5,	9



<ul style="list-style-type: none"> <li>• Program to create web service</li> <li>• Program to create web service which returns DataSet.</li> <li>• Program to call web service asynchronously</li> <li>• Program for securing a Service using Windows Authentication</li> <li>• Program for securing a Service using SOAP header</li> </ul>	13	
<b>Total Marks</b>		<b>60</b>

**References:**

- [1] B.M. Harwani, "Practical ASP.NET Projects", SPD Publication
- [2] NET programming Black Book, DreamTech Press
- [3] Jack Purdum, "Beginning C# 3.0: An Introduction to Object Oriented Programming", Wrox Publication, 2008
- [4] Jonathan Chaffer and Karl Swedberg "Learning jQuery", 3rd Edition, SPD Publication, 2012
- [5] Chirag Patel, "Advance .NET Technology" 2nd Edition, DreamTech Press, 2012
- [6] Cristian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 and .NET 4.5", Wrox Publication
- [7] Anne Boehm, Joel Murach, "murach's ASP. NET 4 Web Programming with C# 2010", 4th Edition, SPD Publication, 2011
- [8] Anne Boehm, Ged Mead, "murach's ADO. NET 4 database Programming with C# 2010", 4th Edition, SPD Publication, 2011
- [9] Andrew Trolsen, "Pro C# 5.0 and the .NET 4.5 Framework" 6th Edition, APress, 2013
- [10] Vijay Mukhi and Sonal Mukhi, "Visual Studio .NET with C#", BPB Publication
- [11] Andrew Stellman and Jennifer Greene, "Head First C#", 2nd Edition, O'Reilly, SPD Publication
- [12] Web Technologies Black book, DreamTech Press, 2013
- [13] Ralph Moseley & M. T. Savaliya, "Developing Web Application", 2nd Edition, Wiley, 2012

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
L502	Laboratory II – Wireless & Mobile Technology + Mini project	--	--	4	--	--	2	2
		Examination Scheme						
		Term Work		Practical		Oral		Total
		80		10		10		100

Pre-requisite Course Codes		
Course Outcomes	CO1	Install and configure PhoneGap software.
	CO2	Analyze the working of latest interactive environment i.e. PhoneGap for mobile application development.
	CO3	Design Application for mobile devices using JavaScript, HTML5, CSS by accessing features of PhoneGap.
	CO4	Adapt the features of Android's Communication APIs for Accelerometer, Camera, Contact, Event and File System.

Exp. No.	Experiment Details	Ref.	Marks
1	<b>Introduction To Phonegap</b> o A Little PhoneGap History o Why Use PhoneGap? o How PhoneGap Works o Designing for the Container o Writing PhoneGap Applications o Building PhoneGap Applications o PhoneGap Limitations o PhoneGap Plug-Ins o Getting Support for PhoneGap o PhoneGap Resources o Hybrid Application Frameworks	1,2	4
2	<b>Phonegap Development, Testing, And Debugging</b> o Hello, World! o PhoneGap Initialization o Leveraging PhoneGap APIs o Enhancing the User Interface of a PhoneGap Application o Testing and Debugging PhoneGap Applications o Dealing with Cross-Platform Development Issues o API Consistency	1,2	8
3	<b>Configuring An Android Development Environment For Phonegap</b> o Installing the Android SDK o Eclipse Development Environment Configuration o Creating an Android PhoneGap Project o Testing Android PhoneGap Applications	1,2	8
4	<b>API</b> Accelerometer Querying Device Orientation Watching a Device's Orientation o Capture	1,3	20

	Using the Capture API Configuring Capture Options Capture at Work o Contacts Introduction Listing all available contacts Displaying contact information for a specific individual Creating and saving a new contact o Events Creating an Event Listener Device ready Event Application Status Events Network Status Events Button Events o File System, Storage, Connection and Local Databases Introduction, Saving a file to device storage, Opening a local file from device storage Displaying the contents of a directory Creating a local SQLite database, Uploading a file to a remote server Caching content using the web storage local storage API o Notification Visual Alerts (Alert and Confirm), Beep, Vibrate Notification in Action		
<b>5</b>	Mini Project will be made with mobile technology with android as the platform or Advanced Web Technologies like ASP.NET, C#	1,3	<b>20</b>
<b>Total Marks</b>			<b>60</b>

**References:**

- [1] PhoneGap Essentials – John M. Wargo
- [2] Beginning PhoneGap – RohitGhatol , Yogesh Patel
- [3] Hello, android ED brunette pragmatic bookshelf

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
PR 501	Mini Project	--	--	--	--	--	--	02
		Examination Scheme						
		Presentation Internal Assessment			External Assessment			Total
		25			25			50

Pre-requisite Course Codes : Programming language, DBMS, UML		
	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.

Evaluation Scheme				
<ol style="list-style-type: none"> <li>Project assessment is done by internal and external examiner. The project carries weightage of 50 marks.</li> <li>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).</li> <li>The external examiner will be evaluating the students for 25 marks at the end of the semester.</li> <li>ESE for project shall carry maximum 50 marks in each semester. These 50 marks shall be given by the internal and external examiner together.</li> </ol> <p>The evaluation of a student shall be based on his/her performance in ESE. During evaluation faculty must follow the rubrics prepared for respective evaluation. Performance shall be continuously monitored and record of assessment shall be maintained in the prescribed pro-forma by course faculty and monitored by department Head. The marks and weightage is shown in the following Table.</p>				
<b>Table: Marks and Weightage of Evaluation</b>				
Evaluation	Paper writing	Presentation		
	Marks	% weightage	Marks	% weightage
ISE	--	--	--	--
MSE	--	--	--	--
ESE	25	100	25	100

SEM VI

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA SP 6.1	INTERNSHIP – Project	--	--	30	--	--	15	15
		Examination Scheme						
		Presentation		Oral		Report		Total
		25		25		50		100

**Pre-requisite Course Codes :** Programming language, DBMS, UML

Course Outcomes	Student will be able to	
	<b>CO1</b>	Apply programming concepts to develop software solutions
	<b>CO2</b>	Apply the software engineering principles to solve real life problems using modern tools, used in the organization
	<b>CO3</b>	Apply the software project management processes to carry out the successful completion of project
	<b>CO4</b>	Apply technical communication effectively in the organization
	<b>CO5</b>	Use professional ethics in application development
	<b>CO6</b>	Develop skills for working in the team and for life-long learning

#### Evaluation Scheme

1. Student need to select a company for internship, or can work under the guidance the internal mentor. If student is not selected to work in industry for internship project, internal mentor need to organize project in the college itself which may be in accordance with Academic rules of institute. Max. 3 students shall be allotted to one internal mentor in case of student not getting industry internship.
2. Every student should submit joining letter along with their project proposal within 4 weeks of joining internship in company. Project proposal should include company information, External mentor information, project abstract and tool (tentatively) working.
3. After submission of project proposals, ISE shall be conducted.
4. MSE shall be conducted as per academic time table.
5. Student need to arrange for meeting between internal and external mentor for feedback and improving the industry interaction before ESE.
6. Every student shall make draft of project report and get it accessed by internal mentor. The Project report should contain an Introduction to Project, which should clearly explain the project scope in detail. Also, Data Dictionary, ERDs, File designs and a list of output reports should be included if required as per the project title and scope. The project Work should be of such a nature that it could prove useful or be relevant from the commercial/management angle. Every student should submit duly signed Project Report.
7. ESE shall be conducted after submission of Project Report

The evaluation of a student shall be based on his/her performance in ISE, MSE and ESE. The mode of evaluation for ISE and MSE is Orals and Presentation. During evaluation faculty must follow the rubrics prepared for respective evaluation. Performance shall be continuously monitored and record of assessment shall be maintained in the prescribed pro-forma by course faculty and monitored by department Head. The marks and weightage is shown in the following Table.

**Table: Marks and Weightage of Evaluation**

Evaluation	Oral		Presentation		Report	
	Marks	% weightage	Marks	% weightage	Marks	% weightage
ISE	15	100	10	100	--	--
MSE	15	100	10	100	--	--
ESE	25	100	25	100	50	100

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
MCA SP 6.2	Internship-Seminar	--	--	--	--	--	01	01
		Examination Scheme						
		Presentation		Paper writing			Total	
		25		25			50	

**Pre-requisite Course Codes :** Programming language, DBMS, UML

Course Outcomes	Student will be able to	
	CO1	Apply programming concepts to develop software solutions
	CO2	Apply the software engineering principles to solve real life problems using modern tools, used in the organization
	CO3	Apply the software project management processes to carry out the successful completion of project
	CO4	Apply technical communication effectively in the organization
	CO5	Use professional ethics in application development
	CO6	Develop skills for working in the team and for life-long learning

Evaluation Scheme

**Step 1: Review Process**

1. Student should submit list of papers and patents selected for review
2. Students should submit review of literature which include content based on survey, comparison etc

**Step 2 : Define problem and state proposed solution**

1. Based on the literature review, students should define problem he identified and wants to work on it.
2. Students should be able to define solution for the problems identified

**Step 3: Submission of the INTRODUCTION AND BODY of the technical paper**

1. Based on the above content students should be able to write introduction and body of technical paper

**Step 4: Submission of conclusion**

1. Students should submit conclusion on the above analysis

**Step 5: Submission of complete paper**

1. Students should conclude all the information in IEEE format
2. Students should submit the technical paper

**Step 6: Submission of Final Drafted Paper**

1. Students should include list of the conferences where the paper can be submitted
2. Final paper should be submitted in hard copy

The evaluation of a student shall be based on his/her performance in ESE. During evaluation faculty



must follow the rubrics prepared for respective evaluation. Performance shall be continuously monitored and record of assessment shall be maintained in the prescribed pro-forma by course faculty and monitored by department Head. The marks and weightage is shown in the following Table.

**Table: Marks and Weightage of Evaluation**

Evaluation	Paper writing		Presentation	
	Marks	% weightage	Marks	% weightage
ISE	--	--	--	--
MSE	--	--	--	--
ESE	25	100	25	100