REGULATIONS SPECIFIC TO M.C.A. PROGRAM

IN

UNIVERSITY DEPARTMENT OF MANAGEMENT

SCIENCE

Dr. BabasahebAmbedkarMarathwada University, Aurangabad.

(With Effect from Academic Year 2016-17)

Master of Computer Applications
(Choice Based Credit & Grade System)
OBJECTIVE OF MCA COURSE

M.C.A program prepares students to take up positions as systems analysts, system designers, programmers and managers in any field related to information technology. The program, therefore, aims at imparting comprehensive knowledge with equal emphasis on theory and practice. The M.C.A. students are encouraged to spend a full semester working in the industry in the institute giving them insight into the workings of the IT world.

Rules and Regulations

1. Eligibility and Selection Criteria

a) "A candidate seeking admission to Master of Computer Application (MCA) should have passed Bachelor's Degree examination of any faculty with atleast 50% of marks, of Dr. BabasahebAmbedkarMarathwada University or any other degree equivalent thereto and have Mathematics/Statistics as one of the subject at Degree level or HSC level. However in case of students belonging to Backward Classes, a relaxation of 5% shall be available for admission."

OR

Appeared at the final year examination of a post 10+2 course of minimum three years duration leading to an award of Bachelor's Degree, in any discipline by the Association of Indian Universities or has passed with minimum 50% of marks in the aggregate (45% in case of candidate who is domiciled in Maharashtra and belongs to the reserved categories) or appeared at an examination considered equivalent there to would be treated as eligible. Also the candidate must have passed mathematics/Business Mathematics & Statistics paper for 10+2 or graduation Level.

AND

Passed the CET conducted by Director of Technical Education Maharashtra State with nonzero score for that year.

b) The Department reserves the right to cancel the admissions of any student and ask him to discontinue his studies at any stage of his/her carrier on the grounds of unsatisfactory academic performance, indiscipline or any misconduct.

2. Duration

Duration of the MCA programme shall be a minimum of 3 years/6 semesters and maximum of 6 years from date of admission. The entire period of the sixth semester shall be devoted for the Major Project work.

3. Admission/Promotion Criteria

If candidate getsselected for UDMS MCA course through DTE admission process, he/she have to apply on the application form of the University provided with the prospectus. Once the candidate is admitted to the MCA course, he/she will be promoted to next semester with full carryon; subject to the registration of candidate in every consecutive semester. Dropout candidate will be allowed to register for respective semester in which he/she has failed, subject to the condition that his/her tenure should not exceed more than twice the duration of MCA course from the date of first registration at UDMS. The admission of concern candidate will automatically get cancelled if he/she fails to complete the course in maximum period. (Six years)

4. Credits and Degrees

i. A candidate who has successfully completed all the Foundation, Core, Elective courses and Project Workas prescribed for the MCA Courseand Service courses as approved by the University with prescribed CGPA shall be eligible to receive the degree.

ii. One Credit shall mean one teaching period of one hour per week for one semester (of 15 weeks) for theory courses and two hours/week of practical for one semester.

5. Courses

The MCA programme comprises of

i. Foundation Course: It may be of two kinds Compulsory Foundation Course for Knowledge Enhancement and Elective Foundation Course for value based education.

ii. Core Course: A core course is course that a candidate admitted to particular P.G. programme must successfully complete to receive the degree.Elective Course: Elective courses identified by the DepartmentalCommittee of the department offering the programme. Means these courses given to the candidate as optional from which he/she has to opt for specialization. Whereas no elective course shall be offered unless a minimum of 10 students are registered.

iii. Service Course: There shall be one/two service courses, one amongst the department of the School of Professional Studies and one amongst all university departments. The service courses will be offered in third and fourth semesters only.

iv. Each course shall include lectures/tutorials/laboratory of field work/ seminar/practical training/assignments /mid-term and term end examinations/paper/report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

v. Each course shall have a unique alphanumerical code.

For eg.

MANC401 Computer Organization

Here, **MAN** means Management Science
C means MCA course
401 means Subject Code

vi. The departmental committee shall design the course structure including the detailed syllabus for this MCA programme offered by the department. The department committee shall have the freedom to introduce new courses and / or to modify / redesign existing courses and replace any existing course with a new course to facilitate better exposure and training for the candidates.

vii. **Attendance:** A student must have 75% of mandatory attendance in each Course for appearing in the examination. In the event of Non-Compliance of Attendance criteria(75%), students will have to seek admission next year so as to complete the course. However Student having 65% attendances with medical certificate can apply to the H.O.D. for condonation of attendance.

6. Registration for Service Course

i. The Student has to complete at least one service course of four credits in either Semester – III or Semester – IV and at a time student will be allowed to appear for only one service course.

ii. The student will register the service course of his interest after the start of semester in the concerned department on official registration form. The teacher incharge of the respective course will keep the record of the students registered. Maximum 15 days period will be given from the date of admission for completion of registration procedure. The departmental committee shall follow a selection procedure to avoid overcrowding to particular course(s)

iii. No student shall be permitted to register for more than one service course in semester.

iv. University shall prescribe the maximum number of students in each course taking into account the teachers and physical facilities available in the department.

v. The University may make available to all students a listing of all the courses offered in every semester specifying the credits, the prerequisites, a brief description or list of topics the course intends to cover, the instructor who is giving the courses, the time and place of the classes for the course. This information shall be made available on the University Website.

vi. Normally no service course shall be offered unless a minimum of 10 students are registered.

vii. The Student shall have to pay the prescribed fee per course per semester/year for the registration as decided by the University.

7. Departmental Committee

As an autonomous department, MCA course is monitored by Departmental Committee. The Committee consists of H.O.D. (Director) as Chairman and some/all Respective Faculty of the Department as its members.

8. Grievance Redressal Scheme

The University shall form a Grievance Redressal Committee for this course in UDMS with the course teacher and HOD, which shall solve all grievances relating to the Assessment of the student.

9. GradeAwards

i. In order to pass the examination following choice based credit and grading system (CBC&GS) will be followed. Ten point rating scale shall be used for evaluation of performance of the student to provide Letter Grade for each course and overall grade for this course. Grade points are based on the total number of marks obtained by him / her in all the heads of the examination of the course. These grade points and their equivalent range of the marks are shown separately in following:

Table – I: Ten Point grades and grade description

Sr.No.	Equivalent Percentage	Grade points for SGPA and CGPA	Grade	Grade Description
1.	90 – 100	9.00 – 10	O	Outstanding
2.	80 – 89.99	8.00 – 8.99	A++	Excellent
3.	70 – 79.99	7.00 – 7.99	A+	Exceptional
4.	60 – 69.99	6.00 – 6.99	A	Very Good
5.	55 – 59.99	5.50 – 5.99	B+	Good
6.	50 – 54.99	5.00 – 5.49	B	Fair
7.	45 – 49.99	4.50 – 4.99	C+	Average
8.	**40.01 – 44.99**	**4.01 – 4.49**	C	Below Average
9.	40	4.00	D	Pass
10.	Below 40	0.00	F	Fail

ii. **Table – II: Classification for the degree is given as follows**

Classification	Overall letter grade
First Class with distinction	*A+ and above*
First Class	*A*
Higher Second Class	*B+*
Second Class	*B*
Pass	*C+ to D*
Fail	*F*

iii. In the event of student registered for the examination (i.e. Internal Tests/End Semester Examination/Practical/Seminar/Project Viva-voce), non-appearance shall be treated as the student deemed to be absent in the respective course.

iv. Minimum D grade shall be the limit to clear /pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations. There will be no revaluation or recounting scheme under this system.

v. Using table – I, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and Cumulative Grade Card with CGPA will be given on completion of the course.

10. Computation of SGPA (Semester Grade Point Average) & CGPA (Cumulative Grade Point Average)

The computation of SGPA and CGPA will be as below:

i. Semester Grade Point Average (**SGPA**) is the weighted average of points obtained by a student in a semester and will be computed as follows:

$$SGPA = \frac{\textit{Sum(Course Credit * Number of Points in concern course gained by the student)}}{\textit{Sum (Course Credit)}}$$

The SGPA for all the six semesters will be mentioned at the end of every semester.

ii. The Cumulative Grade Point Average (**CGPA**) will be used to describe the overall performance of a student in all semesters of the course and will be computed as follows:

$$CGPA = \frac{\textit{Sum(All Six semester SGPA)}}{\textit{Total number of semesters}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

11. EvaluationScheme

Each theory course will be of 100 Marks and be divided in to Internal Examination (Sessional) of 20 Marks and Semester End Examination of 80 Marks. (20+80=100)
Each Practical Course will be of 50 Marks (Internal + External) = (10 + 40=50).
Project Work from Sem – I, II, and IV will be 100 marks (Internal + External) = (20+80=100).
Project Work from Sem – III and V will be 50 marks (Internal + External) = (10+40=50).
As well as In-plant Training Project from Sem – III and V will be 50 marks (Internal).
Major Project in the Sem –VI will be of 350 marks (Internal + External) = (70+280=350).

a) For Theory Course

i. Internal Evaluation Scheme

There shall be weekly assessment in the form of Test/Assignment/Tutorials/seminars/Presentations/laboratory work/Field work/Project Work throughout the semester. Aggregation of these marks will be considered for the internal evaluation of 20 marks.

ii. Semester End Examination Evaluation Scheme

- English shall be the medium of instruction and examination.
- Examination shall be conducted at the end of each semester as per the academic calendar notified by department itself.
- The Semester End Examination theory question paper will have two parts **(20 + 60 = 80)**Marks

PART Awill carry short question (fill in the blanks/multiple choice questions/match the columns/state true or false/answer in one sentence) as compulsory questions and it should cover entire syllabus (20 Marks).
PART Bwill carry 7 questions out of which there shall be at least one question from each unit, student will have to answer any 5 questions out of 7.

b) For Practical Course

i. Internal Evaluation Scheme

A student should complete lab assignments practically given by course teacher. However, in addition teacher can allot a mini project to students for better evaluation but assignments are compulsory. Internal evaluation for the practical will be considered for 10 Marks.

ii. External Evaluation Scheme

Under this roof, a student has to face practical examinations in which he/she has to complete the task on computer system (It may computer program or testing) given by External Examiner. Also student has to present seminar or viva-voce in front of External Examiner. External evaluation for the practical will be considered for 40 Marks.

c) For In-plant Training Project–

a) At the end of second& Fourth semester, all students will have to undergo Summer Training (MANC554 & MANC756) of 6-8 weeks with an industrial, business, service organization or department. The condition of successfully completing the programme shall not be deemed to have been satisfied unless a student undergoes summer training under the supervision of the department in organization as approved by the Departmental/Faculty from time to time. Each student will be required to submit the implant training report to the Department/faculty for the work undertaken during this period within three weeks of the commencement of the third& Fifth semester respectively for the purpose of evaluation in the third&Fifth semester respectively.

b) A candidate shall not be allowed to appear for III semester & V semester Examination of Full Time 3 years Course unless he/she completes the Inplant Training and submit the reports to the concerned teacher.

c) Internal Evaluation –

Internal Evaluation for the Inplant Training Project will be of 50 marks that will be evaluated by the respective faculty/ guide depending upon presentation/review/performance during project/ report writing/field work/seminars etc

d) For Project –

i. **Internal Evaluation** –

All the students are divided among different teams & work under the guidance of the Faculty/guide. Internal Evaluation for the project will be of 20% marks that will be evaluated by the respective faculty/ guide depending upon presentation/review/performance during project/ report writing/field work/seminars etc.

ii. External Evaluation Scheme

Student has to present seminar/viva-voce/ demonstration of project in front of External Examiner. External evaluation for the project will be considered for 80% Marks.

e) At the end of each semester the Committee of Department shall assign grades to the students and will prepare the result. Also, the Department will display the grade points and grades for the notice of students.

f) Every student shall have the right to scrutinize answer sheets of mid semester/semester end examinations and seek clarifications from the teacher regarding evaluation of the sheets as per Grievance Schedule.

g) Sixth Semester Project Evaluation Scheme

The Major project work should be carried out over the entire period of the final semester in an Industry. If the project is carried out in an Industry organization outside the campus, then a co-guide shall be there from Industry. Every student should do the Major Project individually. However students can opt for project in groups based on merits/requirements of the project and in consultation with the project guide. A guide will review the projectperiodically.At the end of the semester the candidate shall submit the Project report (two bound copies) duly approved by the guide and H.O.D. of the department. The department will appoint external examiner for assessment of the project. Theproject will be assessed by the external examiner and the guide separately onthe basis of the following criteria tentatively.

- Innovative Idea 15%
- Content 15%
- Preparation of Project Report 30%
- Presentation/Viva- voce 40%

If student failed to complete the project within scheduled time then he/she has to reappear and register freshly with new project topic after paying required fees for that semester.

12. Grade Card

The university under its seal shall issue to the students a grade card on completion of each semester. Grade card shall contain the following:

a. Title of the courses along with code taken by the student.
b. The credits associated with and grades awarded for each course.
c. The number of grade and grade pointsecured by the student.
d. The total credits earned by the student in that semester.
e. The SGPA of the student.
f. The total credits earned by the student till that semester.
g. The CGPA of the student (At the end of the VIthsemester).

Cumulative Grade Card

The grade card issued on completion of the programme shall contain the name of the programme, the department /school offered the programme, the titles of the courses taken, the credits associated with each course, gradesawarded, the total credits earned by the student, the CGPA and the class in which thestudent is placed.

13. General Clause

It may be noted that beside the above specified rules and regulations all the other rules and regulations in force and applicable to semester system in Post-Graduate courses in Dr. BabasahebAmbedkarMarathwada University will be applicable as amended from time to time by the University. The students shall abide by all such Rules and Regulations.

MCA Course Structure

Sem	Course	Ref. No	Subject Title	Credit	No. of Hrs. per Sem/Minm Assessment/ Tutorial	Exam Hrs.	Marks		Total
							Internal	End Sem Exam	
I	Generic Foundation Course	MANC401	Computer Organization & Architecture	4	60 - 05	3	20	80	100
		MANC402	Information System Analysis & Design Methodology	4	60 - 05	3	20	80	100
		MANC403	Mathematics – I	4	60 - 05	3	20	80	100
		MANC404	Basic of Web technology	4	60 – 05	3	20	80	100
		MANC405	Constitution of India	2	30	1.5	10	40	50
		MANC406	Research Methodology	2	30	1.5	10	40	50
	Skill Based Foundation Course	MANC451	Practical Based on MANC404	2	30	1.5	10	40	50
	Core Course	MANC407	Object Oriented Programming using C++	4	60 – 05	3	20	80	100
		MANC452	Practical Based on MANC407	2	30	1.5	10	40	50
		MANC453	Project	4	60	--	20	80	100
			Total	**32**	**480**		**160**	**640**	**800**

Sem	Course	Ref. No	Subject Title	Credit	No. of Hrs. per Sem/Minm Assessment/ Tutorial	Exam Hrs.	Marks		Total
							Internal	End Sem Exam	
II	Generic Foundation Course	MANC408	Operating System	4	60 – 05	3	20	80	100
		MANC409	Database Management System	4	60 – 05	3	20	80	100
		MANC410	Mathematics – II	4	60 – 05	3	20	80	100
	Skill Based Foundation Course	MANC454	Practical Based on MANC409	2	30	1.5	10	40	50
	Core Course	MANC411	Software Engineering	4	60 – 05	3	20	80	100
		MANC412	Data Structure Using C++	4	60 – 05	3	20	80	100
		MANC413	ASP.NET	4	60 - 05	3	20	80	100
		MANC455	Practical Based on MANC412	2	30	1.5	10	40	50
		MANC456	Practical Based on MANC413	2	30	1.5	10	40	50
		MANC457	Project	4	60	--	20	80	100
			Total	**34**	**510**		**170**	**680**	**850**

Sem	Course	Ref. No	Subject Title	Credit	No. of Hrs. per Sem/Minm Assessment/ Tutorial	Exam Hrs.	Marks		Total
							Internal	End Sem Exam	
III	Core Course	MANC501	Entrepreneurship Development	4	60 – 05	3	20	80	100
		MANC502	Artificial Intelligence	4	60 – 05	3	20	80	100
		MANC503	Java Programming	4	60 – 05	3	20	80	100
		MANC504	Design and Analysis of Algorithms	4	60 – 05	3	20	80	100
		MANC505	Advance Database Management System	4	60 – 05	3	20	80	100
		MANC551	Practical Based on MANC503	2	30	1.5	10	40	50
		MANC552	Practical Based on MANC504	2	30	1.5	10	40	50
		MANC553	Practical Based on MANC505	2	30	1.5	10	40	50
		MANC554	In-plant Training Project	2	30	--	50	-	50
		MANC555	Project	2	30	--	10	40	50
	Open Elective Course	MANC52X	Group A	4	60 – 05	3	20	80	100
			Total	**34**	**510**		**210**	**640**	**850**

Open Elective Course: Group A

Elective Course	MANC521	Cloud Computing	4	60 – 05	3	20	80	100
	MANC522	Emerging Trends in Information Technology						
	MANC523	Cyber Laws						

Sem	Course	Ref. No	Subject Title	Credit	No. of Hrs. per Sem/Minm Assessment/ Tutorial	Exam Hrs.	Marks		Total
							Internal	End Sem Exam	
IV	Skill Based Foundation Course	MANC506	Verbal & Non- Verbal Aptitude	4	60 – 05	3	20	80	100
	Core Course	MANC507	Software Testing and Quality Assurance	4	60 – 05	3	20	80	100
		MANC508	Advanced Data Communication and Networks	4	60 – 05	3	20	80	100
		MANC509	Object Oriented Analysis and Design	4	60 – 05	3	20	80	100
		MANC510	Linux Administration and Server Configuration	4	60 – 05	3	20	80	100
		MANC556	Practical Based on MANC509	2	30	1.5	10	40	50
		MANC557	Practical Based on MANC510	2	30	1.5	10	40	50
		MANC561	Project	4	60	--	20	80	100
	Open Elective Course	MANC52X	Group B	4	60 – 05	3	20	80	100
		MANC55X	Practical Based on Group B	2	30	1.5	10	40	50
			Total	**34**	**510**		**170**	**680**	**850**

Open Elective Course: Group B

Elective Course	MANC524	Advanced JAVA	4	60 – 05	3	20	80	100
	MANC558	Practical Based on MANC524	2	30	1.5	10	40	50
	MANC525	C Sharp	4	60 – 05	3	20	80	100
	MANC559	Practical Based on MANC525	2	30	1.5	10	40	50
	MANC526	Data Mining	4	60 – 05	3	20	80	100
	MANC560	Practical Based on MANC526	2	30	1.5	10	40	50

Sem	Course	Ref. No	Subject Title	Credit	No. of Hrs. per Sem/Minm Assessment/ Tutorial	Exam Hrs.	Marks		Total
							Internal	End Sem Exam	
V	Generic Foundation Course	MANC701	Software Project Management	4	60 - 05	3	20	80	100
	Skill Based Foundation Course	MANC702	Quantitative Aptitude	4	60 - 05	3	20	80	100
	Core Course	MANC703	Ethical Hacking	4	60 - 05	3	20	80	100
		MANC704	Web Development using PHP	4	60 - 05	3	20	80	100
		MANC751	Practical Based on MANC704	2	30	1.5	10	40	50
		MANC705	JSP	4	60 - 05	3	20	80	100
		MANC752	Practical Based on MANC705	2	30	1.5	10	40	50
		MANC756	In-plant Training project	2	30	--	50	-	50
		MANC757	Project	2	30	--	10	40	50
	Open Elective Course	MANC72X	Group C	4	60 – 05	3	20	80	100
		MANC75X	Practical Based on Group C	2	30	1.5	10	40	50
			Total	**34**	**510**		**210**	**640**	**850**

Open Elective Course: Group C

Elective Course	MANC721	Android Development	4	60 – 05	3	20	80	100
	MANC753	Practical Based on MANC721	2	30	1.5	10	40	50
	MANC722	Image Processing	4	60 – 05	3	20	80	100
	MANC754	Practical Based on MANC722	2	30	1.5	10	40	50
	MANC723	Hadoop	4	60 – 05	3	20	80	100
	MANC755	Practical Based on MANC723	2	30	1.5	10	40	50

Sem	Course	Ref. No	Subject Title	Credit	No. of Hrs. per Sem/Minm Assessment/ Tutorial	Exam Hrs.	Marks		Total
							Internal	End Sem Exam	
VI	Core Course	MANC758	**Major Project**	14	210	--	70	280	350

			Course Total	**182**	**2730**	**--**	**990**	**3560**	**4550**
			Service Course	**4**	**60**	**--**	**20**	**80**	**100**
			Grand Total	**186**	**2790**	**--**	**1010**	**3640**	**4650**

PROGRAM OUTCOMES (POs)

MCA graduates will be able to:

PO -1	**Domain Knowledge:** Apply the knowledge of software design & development, Testing and IT specialization for the solution of applications, IT and societal problems.
PO -2	**Problem Analysis:** Identify, formulate, research literature and analyze complex technological problems reaching substantiated conclusions using computer science, networking, and mathematics.
PO -3	**Conduct investigations of Complex Problems :** Design and conduct scientific & technological research and to analyze and interpret the resulting data.
PO -4	**Modern Tool Usage :** Use the techniques, skills & modern IT tools for technological practice.
PO -5	**The engineer and Society:** Understand ethical & professional engineering in the context of global, economic, environmental & societal realities as well as other contemporary issues
PO -6	**Environment and Sustainability:** Understand the impact of technological solution in societal & environmental contexts & demonstrate the knowledge of, and need for sustainable development.
PO -7	**Ethics:** Develop practical solution for technological problems under professional and ethical constraints.
PO -8	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO -9	**Communication:** Communicate effectively on complex technical activities with the engineering community and with the society at large, such as, being able to comprehend & write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO -10	**Life-Long Learning:** Recognize the need for and have the ability to engage in, perpetual learning by working on projects for which they have no prior experience.

Program Educational Objectives (PEOs)

The objectives of MCA program are to produce graduate who:

PEO - 1	Have a strong foundation in software design & development with an ability to solve important problems in a modern technological society as valuable, productive software engineer, Tester, consultant.
PEO - 2	Have a broad background to practice computer application in the areas of software engineering, networking, s/w Testing, Artificial intelligence, data mining in industry and government settings meeting the growing expectations of stake holders.
PEO - 3	Have an ability to pursue higher studies and succeed in academic and research careers.
PEO - 4	Have the ability to function and communicate effectively, both individually and within multidisciplinary teams using modern tools.
PEO - 5	Recognize the need for and possess the ability to engage in life-long learning.
PEO - 6	Will be sensitive to the consequences of their work, both ethically and professionally, for productive professional careers.

Program Articulation Matrix -

Only for core courses

Sr. no	Sem	Course	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
1.	I	MANC401	X		X	X						
2.		MANC402	X			X	X			X		
3.		MANC403	X									
4.		MANC404	X			X				X		X
5.		MANC451	X			X				X		X
6.		MANC405	Will be given by university									
7.		MANC406	X	X	X	X	X	X	X	X	X	X
8.		MANC407	X			X				X		
9.		MANC452	X			X				X		
10.		MANC453	X			X			X	X	X	
11.	II	MANC408	X	X		X						
12.		MANC409	X			X				X		X
13.		MANC454	X			X				X		X
14.		MANC410	X	X	X	X	X		X	X		
15.		MANC411	X			X						
16.		MANC412	X			X						
17.		MANC455	X			X						
18.		MANC413	X			X				X		X
19.		MANC456	X			X				X		X
20.		MANC457	X			X			X	X	X	
21.	III	MANC501		X	X							X
22.		MANC502	X									
23.		MANC503	X			X						
24.		MANC551	X			X						
25.		MANC504	X	X	X	X						
26.		MANC552	X	X	X	X						
27.		MANC505	X			X				X		X

28.		MANC553	X			X				X		X
29.		MANC554	X			X			X	X	X	
30.		MANC555	X			X			X	X	X	
31.	IV	MANC506	X									
32.		MANC507	X			X				X		X
33.		MANC508		X		X					X	
34.		MANC509	X			X				X		
35.		MANC556	X			X				X		
36.		MANC510	X			X						X
37.		MANC557	X			X						X
38.		MANC561	X			X			X	X	X	
39.	V	MANC701	X			X	X			X		X
40.		MANC702	X									
41.		MANC703	X									
42.		MANC704	X			X	X		X	X	X	X
43.		MANC751	X			X	X		X	X	X	X
44.		MANC705	X			X				X		
45.		MANC752	X			X				X		
46.		MANC756	X			X			X	X	X	
47.		MANC757	X			X			X	X	X	
48.	VI	MANC758	X			X			X	X	X	X

Subject Title		**Computer Organization And Architecture**			
Subject Ref. No.		**MANC401**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	understand basic structure of computer
CO-2	perform computer arithmetic operations
CO-3	understand control unit operations
CO-4	design memory organization that uses banks for different word size operations

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X									
CO-2			X							
CO-3			X	X						
CO-4			X	X						
AVG	X		X	X						

Pre Requisite		Internal Components of the CPU, Logic design and Boolean algebra
Unit – I		**Introduction to Digital Computer** Functions and Block Diagram of Computer Types of Software – System software / Application software / Utility Software. Compilers, Interpreters, Assemblers, Linker, Loader **Number System and Boolean Algebra** Binary, Octal, HEX and their inter-conversion 1's and 2's complement, Logic Gates, Binary Arithmetic, Number Systems – BCD, EBCDIC, ASCII, De-Morgan's Theorem, Duality Theorem, Algebra Rules, Logic Circuits.
Unit – II		**Combinational Circuits** Karnaugh Map Techniques, Half / Full Adder – Subtractor, Multiplexer /

		Demultiplexer, Digital Comparator, ALU
Unit – III		**Sequential Circuits** Flip Flops - SR, D, JK, Master – Slave, Shift Register, Introduction to Counter
Unit – IV		**Memory System** Memory Hierarchy, Primary Memory – DRAM, SDRAM, DDR, RDRAM. ROM, PROM, EPROM, EEPROM, Concepts of Auxiliary, Associative, Cache and Virtual Memory, DMA
Unit – V		**CPU Organization** CPU Building Blocks, CPU Registers and BUS Characteristics, Addressing Modes, Interrupts, Instruction sets and Execution cycle, Assembly Programming, Pipelining – Data Path, Time Space Diagram.
		Processor Architecture Components of Microprocessor, I/O Ports, 16-Bit (80286) Architecture, 32-Bit (80486) Architecture, Super scalar Architecture in Pentium Processors, 64-Bit (Pentium Dual-Core) Architecture
Text Books		1. R P Jain, "Modern Digital Electronics", Tata McGraw Hill 3rd Edition 2. Mano Morris, "Computer System and Architecture", Pearson, 3rd Edition 3.Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications", Prentice Hall 5th Edition
Additional Reference Books		1. JP Hayes, "**Computer Architecture and Organization**, McGraw Hill 2nd Ed 2. Govindarajalu, B, " IBM PC AND CLONES: Hardware, Troubleshooting and Maintenance", McGraw-Hill 2 Edition

Subject Title		**Information System Analysis And Design Methodologies**		
Subject Ref. No.		**MANC - 402**	**No. of Credits**	4
			No. of Periods / Week	4
			Assignments / Sessional	20
			Semester Examination	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe basics of system analysis and design concepts.
CO-2	Demonstrate effective project execution and control techniques that result in successful projects.
CO-3	Design system profile and user interface effectively.
CO-4	Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
CO-5	Map security issues to contemporary project to achieve information security.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**				**X**		**X**
CO-5	**X**			**X**	**X**			**X**		
AVG	**X**			**X**	**X**			**X**		**X**

Prerequisites	NA
Unit I	**Overview of systems Analysis and design System concepts :**

	1) Types of systems: Information System 2) System Development Life cycle 3) Role & Skills of system Analyst Models: 1) Waterfall 2) Prototyping 3) Spiral (including WIN-WIN Spiral) 4) RAD 5) Group Based Approach: JAD 6) Object Oriented methodology
Unit II	**Activities in Requirements Determination** a) Requirements Anticipation b) Requirements Investigation c) Requirements Specifications Software requirement Specification (SRS) 1] Structure and contents of the requirements specification analysis modeling, types of requirements - functional and non-functional , Quality criteria, requirements definition ,SRS format, Fundamental problems in defining requirements 2] Structure and standards followed for SRS 3] characteristics of good SRS – Unambiguous , complete , verifiable , consistent , modifiable , traceable , usable during maintenance
Unit III	**Evaluation :** 1) Feasibility Study : economical,operational,social,technical 2) Evaluating Proposed Solution 3) Developing a System proposal 4) Software Acquisition
Unit IV	**Systems Design:** Elements of Design 1) Design of input & Control, Objectives of Input Design Data Capture Guidelines ,Design of Source Document ,Input Validations 2) Design of output, Objectives of Output Design, Types Of Output 3) Design of File , Basic File Terminology , Data Structure Diagrams Types of Files ,Methods of File Organizations 4) Design of Procedure 5) Design of program Specification **User Interface design:** Elements of good design , design issues ,features of modern GUI , Menus , Scroll bars, windows , buttons, icons ,panels , error messages etc. Case studies should be covered on the topic
Unit V	**Introduction to Information Security :** Definition of Information Security ,Computer Crimes and virus, Internal Control , Need for IS , Types of Security –

	1) Physical Security 2) Logical Security
Text Books	1. Analysis & Design of Information System – V. Rajaraman 2. Software Engineering by Pressman
Reference books	1. Analysis & Design of Information System – James Senn 2. Software Engineering – Pressman 3. System Analysis & Design – Hawryszkiewycz 4. Software Engineering - Jawadekar 5. System Analysis & Design methods – Whiten, Bentley 6. System Analysis & Design – Elias Awad 7. Computer Security for Dummies 8. Internet Security by Derek Atkins et al. 9. Computer Viruses – From an Annoyance to a Serious Threat White Paper September 2001
Web References	1. http://en.wikipedia.org 2. http://www.tutorialspoint.com 3.http://www.chris-kimble.com/Courses/World_Med_MBA/Types-of-Information-System.html 4.http://www.freetutes.com/systemanalysis/sa2-object-oriented-methodology.html 5. http://www.biometricsinstitute.org/pages/types-of-biometrics.html

Subject Title		**Math-I**		
Subject Ref. No.		**MANC403**	**No. of Credits**	4
			No. of Periods / Week	4
			Assignments / Sessional	20
			Semester Examination	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	express a logic sentence in terms of predicates, quantifiers, and logical connectives
CO-2	Demonstrate an understanding of relations and functions and be able to determine their properties.
CO-3	Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples
CO-4	Use the properties of real numbers in algebraic problems
CO-5	Perform and model basic operations on real numbers.
CO-6	Demonstrate a variety of problem-solving techniques.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3	**X**									
CO-4	**X**									
CO-5	**X**									
CO-6	**X**									
AVG	**X**									

Prerequisites	Basic knowledge of mathematics like set theory
Unit I	**Mathematical logic**: Propositions (Statements) Logical connectivities, N, A ,V, Compound statements form, truth tables, tantology , implications and equivalence of statements forms logical identities Normalforms : disjunctive normal form and simplification. Conjunctive normal form, logical implications, validarguments, methods of proof. Theory of inference of statement calculus, predicate calculus, qualifiers freeand bound variables, theory of inference of predicate calculus.
Unit II	**Relations and Functions**: Relation defined as ordered n-tuple Unary, binary, ternary, n-ary Restrict to binary relations Complement of a relation, converse relation, compositions, matrix representation and its properties Graphical representation of relation – Digraphs Properties of binary relation – reflexive, irreflexive, symmetric, asymmetric , transitive equivalence, equivalence classes, partitions covering, compatible relation maximal compatibility block, transitive closure – Warshall's algorithm. Partial ordering relation – Hesse diagram, Chains and antichains. Lattice, maximal and minimal elements , upper bound, lower bound, definitions Functions – definitions : Partial function, hashing functions, characteristic functions, floor functions ceiling functions, subjective control, injenctive (one-to-one) Inverse functions, left reverse, right inverse Bijection and cardinality of finite set Infinite sets and compatibility, Properties of countable sets Non-denumerable sets.
Unit III	**Algebraic Structures**: Operations on sets -unary , binary , ternary definitions of algebraic systems (restrict to binary operations) Properties – closure , idempotent , associative , communicative , associative, commutative, identity , inverse, Semigroup , subsemigroupMonoid , submonoid group , abelian group , permutation group,multiplicatibeabelian group , cyclic group Subgroups : Cosets , right cosets , left cosets normal subgroups , quotient groups , isomorphism , homomorphism , automorphismGroup codes: Weight and Hamming distance , minimum distance of code , generation of codes using parity checks – even parity , odd parity , parity check matrix – Hamming code, for detection and correction errors , formation of encoding function, decoding Application of residue –arithmetic to computers group codes
Unit IV	**Graph theory & Trees**: Basic terminology , simple and weighted graph , adjacency and incidence , handshaking lemma, underlying graph of a digraph , complete graph, regular graph, bipartrite graph, complete bipartrite Isomorphism, complement of graph , connected graphs, paths-simple, elementary, circuit – simple, elementary Edge connectivity, vertex connectivity Eulesian path and eulesian circuit, planner graph – regions Euler's formula Trees : Definition – leaf, root , branch node, internal node,

	Rooted and binary trees , regular m-ary tree
Unit V	**Permutations & Combinations**: Addition principle, multiplication principle, Bijection principle, r-permutations of n elements, r-combination of n elements, binomial coefficients, circular permutations,permutations with repetitions, Multinomial theorem, combinations with repetitions, Distribution of objects- Distinct objects in distinct cells, Indistinguishable objects in distinct cells, Distinct objects in, indistinguishable cells, Indistinguishable objects in distinguishable cells. Probability: Sample space, events, different approaches, conditional probability, Baye's rule, Random variables, univariate& bivariate Discrete Distributions Binomial, Poisson, Negative Binomial, Geometric, hyper geometric, zeta distributions Continuous Distributions Uniform, normal, Erlanggamma, exponential, Ray Leigh laplace, cauchy, marginal & conditional distributions For the above discrete distribution definition of r.v and derivation of its p.m.f. is expected. For the continuous distributions p.d.f. should be defined. 6 Special properties of the distribution (if any)should be tested. Generating Functions and Recurrence Relations: Principle of Inclusion & Exclusion,Formula Derangement- restrictions on relative positions Generating functions for discrete numeric functions, for combinations, Homogeneous, non-homogeneous,Pigeonhole principle
Text Book	1. Swapan Kumar Sarkar, "A text book of Discrete Mathematics", S. Chand Publication 2. Discrete Mathematical Structures for Computer S Science by Kolman B and Bushy R , Prentice – Hall of India 1998 3. S.C. Gupta and V K Kapoor, "Mathematical Statistics", Publication Sultan chand and sons 2002
Reference Books	4. Discrete Mathematics by C L Liu- Tata McGraw Hill Publishing house 2000 5. Discrete Mathematical Structures with applications to Computer Science by Tremblay and 6. Manohar, Prentice – Hall of India 1997 7. S P Gupta, "Statistical Methods", Publications sultan chand and sons 2008 8. Elhance D.N. , ElhanceVeena , Agrawal B.M. Fundamentals of Statistics 2012

Subject Title		**Basics of Web Technology**			
Subject Ref. No.		**MANC404**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Design WebPages using basic HTML tags & forms.
CO-2	Apply different CSS to WebPages.
CO-3	Write basic script in JavaScript to perform different functionalities.
CO-4	Validate the forms input depending upon different events.
CO-5	Write simple VBScript code to validate forms input.
CO-6	Design website using Dream Viewer tool.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**				**X**		**X**
AVG	**X**			**X**				**X**		**X**

Prerequisites	Student should know the basic programming concepts.
Unit I	**HTML & Forms** Introduction To HTML, WWW, W3C, web publishing, Common HTML, Tags Physical & Logical, Some basic tags like <body> , changing background color of page, text color etc., Text formatting tags, <p> , <hr> tags, Ordered & Unordered Lists Tags, Inserting image, Links: text, image links, image mapping , Tables , Frames, Form Introduction with text box, text area, buttons, List box, radio, checkbox etc.
Unit II	**CSS** Introduction To Style sheet, types of style sheets- Inline, External, Embedded CSS, text formatting properties, CSS Border, margin properties, Positioning Use of classes in CSS, color properties, use of &
Unit III	**JavaScript** Intro to script, types, intro of JavaScript, JavaScript identifiers, operators, control & Looping structure, Intro of Array, Array with methods, Math, String, Date Objects with methods User defined & Predefined functions, DOM objects, Window Navigator, History, Location.
Unit IV	**Event handling & Validations on Forms – JavaScript** Handling Events on Button, Textbox, radio button, checkbox, drop down box, text area etc. Form Validation – numeric, alphanumeric, alphabets and any combination of these. Disabling the keys on the keyboard, regular expression
Unit V	**VBScript** Introduction to VBScript, Variables, Data types, Control Structures & Loops, Functions in VBScript, Client side web scripting, validating forms, DOM, Handling errors

Text Books	• HTML, DHTML, JavaScript, Perl & CGI Ivan Bayross • HTML & CSS : The Complete reference, Fifth Edition By Thomas Powell
Reference books	• Html, Xhtml, And Css Bible (English) 5th Edition (paperback) by Schafer, Steven • HEAD FIRST HTML AND CSS, 2/ED (UPDATED FOR HTML) by ROBSON • Beginning HTML and CSS (English) (Paperback) by Rob Larsen • Learn to Code HTML and CSS (English) (Paperback) by Howe • Javascript Bible (English) 7th Edition by Danny Goodman Michael Morrison Paul Novitski Tia GustaffRayl • Javascript Programming: Pushing the Limits (English) 1st Edition By (2013)Jon Raasch • Head First JavaScript (2007) By michael Morrison • JavaScript: The Definitive Guide (2011) by Flanagan, David • VBScript Programmers reference wrox Press • VBScript in a Nutshell (English) (Paperback) by Petrusha, Childs, Lomax
Web References	1. www.w3school.com 2. www.tutorialpoint.com

Subject Title	**:**	**Practical Based on MANC404**			
Subject Ref. No.	**:**	**MANC451**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	10
			External	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Design WebPages using basic HTML tags & forms.
CO-2	Apply different CSS to WebPages.
CO-3	Write basic script in JavaScript to perform different functionalities.
CO-4	Validate the forms input depending upon different events.
CO-5	Write simple VBScript code to validate forms input.
CO-6	Design website using Dream Viewer tool.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**				**X**		**X**
AVG	**X**			**X**				**X**		**X**

Content	**:**	Assignment based on the HTML,JAVASCRIPT, VBSCRIPT will be covered.

Subject Title		**Constitution of India**			
Subject Ref. No.		MANC405	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40
Syllabus Will be provided by university.					

Subject Title		Research Methodology			
Subject Ref. No.		MANC406	No. of Credits		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understand the basic framework of Research Process
CO-2	Complete a literature search on a defined research topic
CO-3	Prepare a research proposal with an appropriate research design, measurement and sample
CO-4	Prepare critical appraise of a recent published research paper
CO-5	Articulate; reflect on Qualitative & Quantitative research type and their application areas.
CO-6	Design the Hypothesis & Apply various test methods

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X	X			X					X
CO-2		X	X	X		X				X
CO-3		X	X	X	X	X	X	X	X	X
CO-4										
CO-5										
CO-6		X	X	X	X		X	X	X	X
AVG	X	X	X	X	X	X	X	X	X	X

Prerequisites	-NA-
Unit I	Nature and Scope of Research Methodology; Research Problem identification; Types of Problems; Problem solving process; Problem Formulation and Statement of Research Objectives; Research Applications.
Unit II	Research process; Research designs-exploratory, descriptive & experimental research designs
Unit III	Methods of Data Collection – Observational and Survey methods; Questionnaire Design; Attitude measurement Techniques; Motivational Research Techniques; Administration of Surveys;
Unit IV	Sample Design; Selecting an Appropriate Statistical Technique; Field Work and Tabulation of Data;
Unit V	Analysis of Data-; Use of SPSS and other Statistical Software Packages; Advanced Techniques for Data Analysis – ANOVA, Discriminant Analysis, Factor Analysis, Conjoint Analysis, Multidimensional Scaling and Clustering Methods; Organization structure of research; Research Proposal; Purpose and types of Research Proposal.
Text Book	1. Research methodology methods & techniques by C.R. kothari 2. Statistical methods: Dr.S.P. Gupta-sultan Chand & sons New Delhi. 3. Research methodology by gupta 4. Research methodology in social science by Giridhari 5. Management Research Methodology by K.N. Krishnaswamy, AppaIyersivakumar and M. Mathirajan. 6. Management Research by Andrews, F.M. and S.B. WitheySocial Indicators of Well Being. Plenum Press. 7. Survey Methods by Fowler, Floyd J.Jr., 8. Exploring Research by Salkind, Neil J.,
Reference Books	

Subject Title		Object Oriented Programming using C++			
Subject Ref. No.		MANC407	No. of Credits		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understand the concept of programming
CO-2	Learn and develop logic for programming skill using C language
CO-3	Enhance the knowledge of basic flow of control within a programming concept.
CO-4	Understand the concept of Object Oriented Programming
CO-5	Implement the concept of Object Oriented Concept in real software development
CO-6	Develop the conceptual programming using C++ Language

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X				X		
CO-5	X			X				X		
CO-6	X			X				X		
AVG	X			X				X		

Prerequisites	**:** Basics of Computer Fundamentals , OS and C programming.
Unit I	A Brief History of C, C is middle-level Language, C is a Structured Language, Complier Vs Interpreters, The Form of a C Program, Library & Linking, Compilation & Execution of C. Program on, Dos & Unix, **Variables, Data Types, Operator & Expression,** Character Set, C Token, Identifier & Keyword, Constant, Integer, Floating Point, Character, String, Enumeration , Data Types in C, Data Declaration & Definition, Operator & Expression, Arithmetic, Relational, Logical, Increment &Decrement, Bitwise, Assignment, Conditional ,2.8 Precedence & Associatively of Operators.**Console I/O** Introduction, Character input & Output, String Input & Output, Formatted Input/Output (scanf/printf) sprintf&sscan. **Control Statement :**Introduction, Selection Statements If, Nested if, if-else-if, The? Alternative, The Conditional Expression, switch, Nested switch, Iteration Statements , for loop, while loop, do-while loop , Jump Statements goto& label, break & continue, exit() function **Command Line Arguments : Storage Class & Scope :** Meaning of Terms, Scope - Block scope & file scope, Storage Classes, Automatic Storage, Extern Storage, Static, Storage, Register Storage, **Bitwise Operator :** Introduction, Applications Masking, Internal Representation of Date, Bit Fields
Unit II	**Principle of OOP's:** Introduction Procedural Vs Object Oriented Programming Classes, Object, Data , Abstraction, Encapsulation, Inheritance, Polymorphism Dynamic Binding, Message Passing Object, Oriented Languages Object Based languages **Array & String :** Single Dimension Arrays , Accessing array elements, Initializing an array, Multidimensional Arrays, Initializing the arrays, Memory Representation Accessing array elements, Passing Single Dimension array to Function, Array & Pointer, Array of Pointer, String Manipulation Functions. **Pointers :** Introduction, Memory Organization, The basics of Pointer, The Pointer operator, Application of Pointer, Pointer Expression Declaration of Pointer, Initializing Pointer, De-referencing Pointer,

	void Pointer, Pointer Arithmetic, Precedence of & , * operators, Pointer to Pointer, Constant Pointer . **Function :**Introduction, Arguments & local variables, Returning Function Results by reference & Call by value, Recursion. **Structure, Union, Enumeration &typedef :**Structures Declaration and Initializing Structure, Accessing Structure members, Structure Assignments, Arrays of Structure, Passing Structure to function, Structure Pointer, Unions
Unit III	**Classes & Object:** A Sample C++ Program with class Defining Member Functions Making an Outside Function Inline Nesting of Member Functions Private Member Functions Arrays within a Class Memory Allocation for Objects Static Data Members, Static Member Functions, Arrays of Objects Object as Function Arguments Friendly Functions, Returning Objects, Const member functions Pointer to Members, Local Classes **Constructor & Destructor:** Constructor, Parameterized Constructor, Multiple Constructor in a Class Constructors with Default Arguments, Dynamic Initialization of Objects ,Copy Constructor O**perator Overloading & Type Conversion:** Defining operator Overloading ,Overloading Unary Operator, Overloading Binary Operator , Type Conversion , Rules for Overloading Operators **: C++ Preprocessor :** Introduction, Preprocessor Directive Macro Substitution, File Inclusion directive, Conditional Compilation **File handling:** Introduction, Defining & Opening a File, Closing a File, Input/Output Operations on Files, Error Handling During I/O Operation, Random Access To Files, Command Line Arguments. **Graphics In C :** Introduction, Drawing Object in C Line, Circle, Rectangle, Ellipse, Changing Foreground & Background, Filling Object by Color
Unit IV	**Inheritance:** Defining Derived Classes ,Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance ,Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes **Virtual Function;** Virtual Function, Pure Virtual Function, Early Vs Late Binding, concept of

	pointers, Pointer to Object, This pointer Introduction to exception handling and working with files.
Unit V	Exception Handling, Namespace in C++ , Template in C++
Text Book	1. C : The Complete Reference : Herbert Schildt , 2. OOPs Using C++ : Balgurusamy, 3. Graphics under C : YashwantKanetkar , 4. Let us C : YashwantKanetkar 5. Let us C++ : YashwantKanetkar **Additional** 6. Programming with C : Bryon Gottfried, 7. Graphics Under C : Y. Kanetkar **:**
Reference Books	8. Let us C Solutions : Y.P. Kanetkar, 3. Spirit Of "C" : MoolishKooper. 9. The Complete Reference C++ by Herbert Schildt 10. C++ and Active learning approach by Randal Albert, Todd Bredlove 11. Advanced C primal ++ by Stephen prata

Subject Title		**Practical Based on MANC407**			
Subject Ref. No.		**MANC452**	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write, compile , execute the programs in C++ using appropriate predefined functions in C++.
CO-2	Implement the loops and decision making statements to solve the problem.
CO-3	Implement pointers, structures and unions and implement it in real time applications using C & C++
CO-4	Implement the object oriented concepts in developing application using C++.
CO-5	Developing applications in C++ using the understanding of Inheritance and polymorphism.
CO-6	Write the I/O streams, programs using classes to handle stream objects in C++ language

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X				X		
CO-5	X			X				X		
CO-6	X			X				X		
AVG	X			X				X		

Prerequisites	**:** Basics of Computer Fundamentals, OS and C programming.	
Unit I	**Programs using C Language**	
	1.	WAP to print int, float character and string data using specifies.
	2.	WAP perform arithmetic operations on int, float data.
	3.	WAP to perform all operators i.e. arithmetic operator, relational operator, conditional operator, logical operator, ternary operator & Bit-wise operators.
	4.	WAP to find greater among three , four and five number using if-else & nested if statement.
	5.	WAP to find the grade of the students using if-else ladder
	6.	WAP to find factorial using while, do-while, for statements
	7.	WAP to print sum of first 10 numbers using while, do-while, for statements
	8.	WAP to print even & odd numbers from 1 to N using while, do-while, for statements
	9.	WAP to demonstrate application of switch statement. Arithmetic operation using operator
	10.	WAP to print different output pattern using while, do-while & for statement
	11.	WAP to demonstrate the real application of goto, break, continues & exit keywords
	12.	WAP to demonstrate application of Simple Function.
	13.	WAP to demonstrate application of Function with arguments.
	14.	WAP to demonstrate application of Function with return type and no arguments.
	15.	WAP to demonstrate application of Function with arguments and return type.
	16.	WAP to demonstrate application of call by value and call reference concept.
	17.	WAP to demonstrate application of Recursion Function - Factorial of number using recursion - Sum to 10 numbers using recursion - Generate Fibonacci Series using recursion
	18.	WAP to demonstrate the use of Pointer.

	19.	WAP to create single dimension array
	20.	WAP to create double dimension array
	21.	WAP to pass an array to function.
	22.	WAP to create a structure and access its member using object. - Normal Object - Object as an Array - Object as a pointer
	23.	WAP to create a nested structure and access its member using object
	24.	WAP to create a union and access its member using object
	25.	WAP to pass the structure to Function and manipulate it.
	26.	WAP to manipulate multiple structure in one Function.
	27.	WAP the demonstrate the application of prototype of function
	28.	WAP for Command Line Argument Concepts
	29.	WAP to manipulate numeric and string data using CMD
	30.	WAP that demonstrate all string manipulation function
	31.	WAP that demonstrate Application of Storage class in C i.e. register, automatic, external and static
Unit II	**Programs using C++ Language**	
	32.	Write a C++ program to create a class and access its member and methods. Method definition inside the class.
	33.	Write a C++ program to create a class and access its member and methods. Method definition outside the class.
	34.	Write a C++ to create a class and access its member and methods using class object as an Array.
	35.	Write a C++ program to create a class and access its member and methods using class object as a pointer.
	36.	Write a C++ program to create a class and access its member and methods by using dynamic object of a class.
	37.	Write a C++ program to create a instance and class variable and demonstrate how data is shared by class & instance variable.
	38.	WAP a C++ program for inline function & friend function.
	39.	WAP a C++ program to implement array, pointer, structure, union in class.
	40.	WAP a C++ program that demonstrate the enumeration and typedef in C++.

Unit III	**Object & Classes**	
	41.	WAP a C++ program that demonstrate the use of Static member and static method.
	42.	WAP a C++ program that demonstrate the use of const members.
	43.	WAP a C++ program that demonstrate the use of macros in C++.
	44.	WAP a C++ program that demonstrate the use constructor and destructors in C++. Default constructor, parameterized constructor and copy constructor.
	45.	WAP a C & C++ program that demonstrate how to read & write a character in file using File Handling concept.
	46.	WAP a C & C++ program that demonstrate how to read & write a number in file using File Handling concept.
	47.	WAP a C & C++ program that demonstrate how to read & write a structure in binary file using File Handling concept.
	48.	WAP a C++ program that demonstrate how to read & write a object of a class in file using File Handling concept.
Unit IV	**Inheritance**	
	49.	Write a C++ program to demonstrate the use of **this** pointer.
	50.	Write a C++ program to create a class and access its member and methods. Method definition inside the class
	51.	Write a C++ program to demonstrate the implementation of Abstraction in C++.
	52.	Write a C++ program to demonstrate the implementation of Encapsulation in C++.
	53.	Write a C++ program to demonstrate the implementation of Single Inheritance in C++.
	54.	Write a C++ program to demonstrate the implementation of Multilevel Inheritance in C++.
	55.	Write a C++ program to demonstrate the implementation of Multiple Inheritance in C++.

	56.	Write a C++ program to demonstrate the implementation of Hybrid Inheritance in C++.
	57.	Write a C++ program to demonstrate the implementation of Hierarchy Inheritance in C++.
	58.	Write a C++ program to demonstrate the application of IS-A and Has-A relation
	59.	WAP a C++ program that demonstrate the use Access Modifier i.e. private, public and protected in C++.
	60.	WAP a C++ program that demonstrate how to pass the arguments to base class
	61.	WAP a C++ program to implement the application of abstract class in C++.
	62.	WAP a C++ program that demonstrate the implementation of Nested Class.
	63.	WAP a C++ program for virtual function.
	64.	WAP a C++ program that demonstrate the application of static binding .i.e overloading
	65.	WAP a C++ program that demonstrate the application of dynamic binding .i.e overriding.
	66.	
Unit V	**Exception Handling, Namespace in C++ , Template**	
	67.	WAP a C++ program to handle arithmetic exception.
	68.	WAP a C++ program to handle ArrayIndexOutOfIndex exception.
	69.	WAP a C++ program to handle NullPointer exception.
	70.	WAP a C++ program to handle Nested Exception.
	71.	WAP a C++ program to demonstrate namespace application in C++.
	72.	WAP a C++ program to demonstrate the application of template C++.

Subject Title	**:**	**Project**			
Subject Ref. No.	**:**	**MANC453**	**No. of Credits**	**:**	4
			No. of Periods / Week	**:**	4
			Internal	**:**	20
			External	**:**	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide.

SEMESTER - II

Subject Title		**Operating System**			
Subject Ref. No.		**MANC408**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Master functions, structures and history of operating systems
CO-2	Master understanding of design issues associated with operating systems
CO-3	Master various process management concepts including scheduling, synchronization, & deadlocks
CO-4	Be familiar with multithreading
CO-5	Master concepts of memory management including virtual memory & Master system resources sharing among the users
CO-6	Master issues related to file system interface and implementation, disk management & Be familiar with protection and security mechanisms

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X									
CO-2		X								
CO-3				X						
CO-4				X						
CO-5				X						
CO-6				X						
AVG	X	X		X						

Prerequisites	Fundamentals of Computer System, Fundamentals of C programming
Unit I	**Introduction**: Logical View, User View System Calls, Concept of Virtual Machine, Interrupt Concept
Unit II	**Process Management:** Process Concept, Process Control Block, Process Schedule , Process operations, Inter-process Communication, Communication in Client-Server **CPU Scheduling:** Scheduling Concept, Scheduling Criteria, Scheduling algorithms, Scheduling Evaluation, Simulation Concept
Unit III	**Process Synchronization** & **Deadlock:** Synchronization concept, Synchronization Requirement, Critical Section Problem, Monitors, Deadlock concepts, Deadlock prevention & avoidance, Deadlock Detection, Deadlock Recovery
Unit IV	**Memory Management:** Memory Management Techniques, Contiguous & Non Contiguous allocation, Logical & Physical Memory, Conversion of Logical to Physical address, Paging, Segmentation, Segment with paging Virtual Memory Concept, Demand paging, Page Replacement algorithm, Allocation of Frames, Page fault. **File management:** File Structure, Protection, FILE system Implementation, Directory structure, Free Space Management, Allocation Methods, Efficiency & Performance, and Recovery.
Unit V	**Disk Management:** Disk Structure, Disk Scheduling algorithm, Disk management, Swap Space concept and Management, Disk performance issues **Android OS structure & IOS structure**
Text Books	1. Silberschatz , Galvin, and Gagne "Operating System Concepts", John Wiley, 8th Ed., 2009. 2. D. M. DhamdhereOperating Systems--A Concept Based Apparoach, McGraw-Hill, 2008
Reference books	1. Tannenbaum, "Operating Systems", PHI, 4th Ed., 2000. **2. William Stallings, "Operating Systems Internals & Design Principles", Pearson Education, 6th Ed., 2009.**
Web References	1. www.nptel.com

Subject Title		**Database Management System**			
Subject Ref. No.		**MANC-409**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe basic concepts of Database Systems
CO-2	Be competent to use SQL commands like DML, DCL and DCL. Apply normalization while designing databases.
CO-3	Understand storage structure of DBMS
CO-4	Map concepts of transactions, deadlock and locking techniques with examples
CO-5	Execute Commands for granting and revoking privileges.
CO-6	Create a Database design and implement it in a small project in teams.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X						
CO-5	X			X						
CO-6	X			X				X		X
AVG	X			X				X		X

Prerequisites	NA
Unit I	**Basic concepts:** Database and Need for DBMS : ,Characteristics of DBMS, Database Users, 3-tier architecture of DBMS (its advantages over 2-tier), Data Models, Views of data-schemas and instances, Data Independence,Conventional data models & systems, NDM & HDM Expressing relationships, DBTG set **Entities:** Relationships, Representation of entities, attributes, relationship attributes, relationship set , Generalization, aggregation,Structure of relational Database and different types of keys,Expressing M:N relation
Unit II	**Relational Model and Relational Database design** Codd‟s rules, Relational data model & relational algebra, Relational model concept, Relational model constraints, Relational Algebra, Relational database language Data definition in SQL, Views and Queries in SQL, Specifying constraints and Indexes in SQL, Specifying constraints management systems, Oracle , Ingres Database Design – ER to Relational Functional dependencies, Normalization Normal forms based on primary keys , (1 NF, 2 NF, 3 NF, BCNF, 4 NF, 5 NF), Loss less joins and dependency preserving decomposition
Unit III	**Storage and File Structure :** Overview of physical storage media : Magnetic disk, RAID, Tertiary storage, Storage access, File organization, Organization of records in files, Data dictionary storage
Unit IV	**Transaction And Concurrency control :** Concept of transaction, ACID properties , Serializibility, States of transaction, Concurrency control, Locking techniques , Time stamp based protocols, Granularity of data items, Deadlock
Unit V	**Crash Recovery and Backup :** Failure classifications, storage structure, Recovery & atomicity, Log base recovery, Recovery with concurrent transactions, Failure with loss of Non-Volatile storage, Database backup & recovery from catastrophic failure, Remote Backup System **Security and privacy :** Database security issues, Discretionary access control based on grant & revoking privilege, Mandatory access control and role based access control for multilevel security, Encryption & public key infrastructures

Text Books	1. Database system concept Korth 2. Fundamentals of Database SysemsElmasriNavathe 3. Database Management Systems Bipin Desai
Reference books	1. Introduction to database systems C.J.Date 2. Principles of Database Management James Martin 3. Computer Database organization James Martin 4. Database system practical Approach to design, implementation & management Connoly&Begg 5. Database Management systems Ramakrishnan&Gehrke
Web References	

Subject Title		**Practical Based on MANC409 (DBMS)**			
Subject Ref. No.		**MANC454**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Execute commands like DDL, DML etc.
CO-2	Execute PL/SQL basic commands
CO-3	Write triggers and execute them
CO-4	Write advanced queries including joins
CO-5	Create views.
CO-6	Create a Database design and implement it in a small project in teams using Sql.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X						
CO-5	X			X						
CO-6	X			X				X		X
AVG	X			X				X		X

Prerequisites	The objective of the course is to make student equipped with the latest DBMS software.
Unit I	**Assignment I** : 1 Overview of RDBMS, Oracle introduction 2 Introduction of SQL DDL, DML, DTL Basic Data Types Char, varchar/varchar2, long, number, Fixed & floating point Date, CLOB, BLOB 3 Table Constraint definition Commands to create table **Assignment II** : 1 Commands for table handling Alter table, Drop table, Insert records 2 Commands for record handling Update, Delete Select with operators like arithmetic, comparison, logical Query Expression operators Ordering the records with orderby Grouping the records 3 SQL functions : Date, Numeric, Character, conversion Group functions avg, max, min, sum, count **Assignment III** : 7 Set operations Union, Union all, intersect, minus 8 Join concept Simple, equi, non equi, self, outer join 9 Query & sub queries **Assignment IV** : 10 Synonym introduction, object type Create, synonym as alias for table & view, drop 11 Sequence : Introduction, alter sequence, drop 12 View : Intro, create, update, drop
Unit II	**Assignment V** : 13 Index : Introduction, create 14 Primary introduction to DBA User create, granting privileges (Grant, Revoke, Commit, Rollback, Savepoint) 15 Report writer using SQL Title, Btitle, skip, pause, column, SQL, Break on, computer sum **Assignment VI** : 16 Introduction of PL/SQL Advantages of PL/SQL Support of SQL Executing PL/SQL 17 PL/SQL character set & Data Types Character, row, rowed, Boolean, binary integer, number Variable, constant **Assignment VII** : 18 PL/SQL blocks Attribute % type, %rowtype, operators, function comparison numeric, character, date Control structure Condition – if Interactive- loop, for, while Sequential – goto 19 Composite data types Record- declaration, refer, record assignmentTable- Declaration, table attributes (Count, delete, exists, first, last, next, prior)
Unit III	**Assignment VIII** : 20 Database Triggers Definition, syntax, parts of triggers Types of triggers, enabling & disabling triggers **Assignment IX** : 21 Sub programs : Definition Features Cursors **Assignment X** : 22 Procedures : Definition, creating, Parameter 23 Function Definition & implementation

	Assignment XI :	Exercise1 1. Create table Salespeople with fields snum, sname, city, commission 2. Orders table with fields onum, odate, snum, amt 3. Customers table with fields cnum, cname, city, rating, snum
	Assignment XII :	Exercise 2 1. Add at least 10 records 2. Display all the records with all sales people‟s information. 3. Display the details of fields sname, commission 4. Display the odate, snum, onum, amt from orders table. 5. Display snum from orders table without duplications. 6. Display name & city of salesman where city is “Pune 7. Display all details of customer where rating is 100. 8. Display all details from customer table where salespersons number is 1001. 9. Display the numbers of sales persons, with orders currently in the ordersTable without any repeats. 10. Display all customers where rating is more than 200
	Assignment XIII :	Exercise 3 (cont.) 11. Display all customers where city is „Mumbai‟ rating is more than 100. 12. Display all customers where city is either „Pune‟ or „Mumbai‟ 13. List all customers not having city „Pune‟ or rating more than 100 14. List all orders between order dates 10/03/05 to 30/3/05 15. Display all orders more that 1000 amt. 16. Display names & cities of all salespeople in „Pune‟ with a commission above10. 17. Display all customers excluding those, with rating less than equal to 100,unless they are located in „Nagar‟ 18. Display all sales persons names starting with character „G‟ 19. Display all sales persons names starting with character „G‟, the 4th characteris „A‟ & the rest of characters will be any. 20. Find all records from customers table where city is not known i.e. NULL. 21. Display all the customersnames begin with a letter A to G. 22. Assume each salesperson has a 12% commission on order amt. Displayorderno, snum, commission for that order.

	Assignment XIV : Exercise 3 1. Display all the customers‟ records, arranged on name. 2. Display all customers records arranged on rating in desc. Order. 3. Display all sales persons records arranged on snum 4. Display the count for total number of customers in customers table. 5. Display the count of snum in order table without duplication of snum. 6. Display the counts of all orders for Feb05
Unit IV	**Assignment XV** : Exercise 4 1. Add a column curr_bal in orders table for current balance 2. Increase commission of all sales persons by 200. 3. Delete all orders where odate is less than 5-2-05 **Assignment XVI** : Exercise 5 1. Display names of all customers matched with the salespeople serving them. 2. Find all orders by customers not located in same cities as their salespersons. 3. Display each order number followed by the name of customer who made it. 4. Calculate the amount of salespersons commissions on each order by acustomer with a rating above 100. 5. Display the pairs of salespeople who are living in the same city. Excludecombinations of sales people with themselves as well as duplicate rowswith the order reversed. 6. Display the names & cities of all customers with same rating as Hoffman. **Assignment XVII** : Exercise 6 1. Write a query that uses a sub-query to obtain all orders for the customer named „Gopal‟. Assume you do not know the customer number. 2. Write a query that produces the names & ratings of all customers who haveabove-average orders. 3. Write a query that selects the total amt in orders for each salesperson forwhom this total is greater than the amount of the largest order in table.
Unit V	**Assignment XVIII**: Exercise 7 1. Create a union of two queries that shows the names, cities 7 rat of allcustomers. Those with a rating of 200 or greater will also ha ratings “highrating”, while the others will have the words “low rat

	Assignment XIX :	2. Write a command that produces the name & number of each salesperson& each customer with more than one current order. P results in alphabetical order. Exercise 8 1. Create an index that would permit each salesperson to retrieve herorders grouped by date quickly. 2. Create a view that shows all of the customers who have highest ratings. 3. Create a view that shows number of salespeople in each city.
Text Books	1. SQL, PL/SQL the programming language of Oracle Ivan Bayross	
Reference books	1. Understanding ORACLE Perry J. & Later J. 2. Understanding SQL Martin Gruber, BPB publication 3. SQL Scott Urman 4. ORACLE PL/SQL Programming Scott Urman	
Web References		

Subject Title		**Math-II**			
Subject Ref. No.		**MANC410**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	understand the concept of data types and a frequency distribution for sample data, and be able to summarise the distribution by diagrams and statistics,
CO-2	understand the concepts of confidence intervals and hypothesis tests
CO-3	apply the techniques used in operations research to solve real life problem in industry
CO-4	Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering(Transportation /Assignment / replacement Models).
CO-5	Formulate Nonlinear and Linear Programming Model
CO-6	Formulation and solution of network problems using graph optimization algorithms

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1		X	X	X				X		
CO-2		X	X					X		
CO-3	X	X	X	X	X		X	X		
CO-4	X	X	X	X	X			X		
CO-5		X	X	X	X			X		
CO-6		X	X	X	X			X		
AVG	X	X	X	X	X		X	X		

Prerequisites	Statistical Basic, discrete Mathematics and Data Structure
Unit I	Statistical Tools for Research Methodology, Measures of Central Tendency or Average, Measures of Dispersion, Correlation Analysis. Regression Analysis, Statistical Inference – Test of Significance
Unit II	Linear Programming Application areas of Linear Programming Linear Programming – The Graphical method – Graphical Solution methods of Linear Programming problem, Maximization Linear Programming problem, Maximization Problem. Linear Programming – Simplex Method – Phase I and Phase II of the Simplex Method, The Revised Simplex method, Primal and Dual Simplex Method, Simplex Algorithm for maximization case, Simplex Algorithm for minimization case – Two phase method and the Big –M method. Transportation Problem and its solution, Assignment Problem and its solutions by Hungarian Method.
Unit III	PERT & CPM Basic differences between PERT and CPM. , Arrow Networks, time estimates, earliest, expected time, latest – allowable, occurrences time, Forward Pass Computation, Backward Pass Computation, Representation in Tabular Form Critical Path, Probability of meeting scheduled date of completion, Calculation on CPM network. Various floats for activities, Critical path updating projects. Operation time cost tradeoff Curve project, Time cost – tradeoff Curve- Selection of schedule based on Cost Analysis, Crashing the network
Unit IV	Integer Programming, Gomory Cutting Plan Methods – Branch and Bound , Queuing Theory.
Unit V	Replacement of items that deteriorates. Replacement of items that fails suddenly, Individuals and Group Replacement- Policy, INVENTORY THEORY: Inventory Model Building, Single item deterministic Model, Inventory Control Models without strategies and Inventory, Control Models

	with shortages.
Text Book	Research Methodology methods and Techniques by C.R. Kothari Operation Research J.K. Sharma Operations Research Kanti Swarup, Gupta P.K. and ManMohan. Operation Research - By Hira Gupta S.Chand publication
Reference Books	Comprehensive Statistical Methods, P.N. Arora, SummetArora, S. Arora Operation Research , A.M. Nataranjan , P. BalaSubramani, A. Tamilaraji

Subject Title : Software Engineering				
Subject Ref. No.	**MANC411**	**No. of Credits**	:	04
		No. of Periods/Week	:	04
		Assignments/Sessional	:	20
		Semester Exam.	:	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Draw Functional Decomposition diagram (FDD), Data flow Diagram (DFD), Entity Relationship Diagram (ER).
CO-2	Analyze the software inspection process.
CO-3	Understand the architectural design, interface design, data design of the software.
CO-4	Calculate the software maintenance cost, along with understanding of maintenance & software documentation.
CO-5	Analyze the CASE tools utilized in different phases of software development.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X									
CO-3	X									
CO-4	X									
CO-5	X									
AVG	X			X						

Prerequisite :	Emergence of Software Engineering, Different software life cycle models.

Unit –I :	**1A) Current trends in Software Engineering** 1.1 Software Engineering for projects & products. 1.2 Introduction to Web Engineering and Agile process **1B) Information requirement Analysis:** 1) Decision Analysis Tools: Decision Tree, Decision Table, Structured English 2) Functional Decomposition Diagram 3) Process modeling with physical and logical Data Flow Diagrams 4) Entity Relationship Diagram : Identify Entity &Relationships 4) Data Dictionary Case Studies on Decision analysis tools FDDs, DFDs should be covered
Unit –II :	Software Inspection Inspection team, members, process, steps, documents, checklist, defect recording and recommendation format, evaluation of inspection process, benefits.
Unit –III:	**Design Methods:** 3.1 Data design 3.2 Architectural Design 3.3 Procedural Design 3.4 Interface Design 3.5 Code design
Unit – IV:	**Maintenance** 4.1 Types of Maintenance 4.2 Maintenance Cost 4.3 Reverse Engineering 4.4 Introduction to legacy systems **Documentation** 4.5 Types 4.6 Role of documentation in maintenance
Unit – V :	**CASE TOOLS** CASE tools , types – project management, analysis , designing , programming , prototyping , maintenance , advantages of using CASE tools , I-CASE , future of CASE
Text Books:	1. Software Engineering by Pressman 2. DBMS Concepts – Korth
Reference Books :	1. System Analysis and Design by Jalote 2. Software Engineering by Sommerville 3. Software Engineering - W S Jawadekar 4. System Analysis & Design methods – Whiten, Bentley 5. System Analysis & Design – Elias Awad 6. Object Oriented Modeling& Design – James Rumbaugh 7. Analysis & Design of Information System – James Senn 8. Analysis & Design of Information System – V. Rajaraman 9. Software Engineering Concepts-Richard Fairley

Subject Title		**Data Structure using C++**			
Subject Ref. No.		**MANC412**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	To introduce the concepts of Abstract data Type, data structure, performance measurement, time and space complexities of algorithms
CO-2	To implement linear data structures such as stacks, queues and lists and their applications using Object Orientated Programming Language
CO-3	To introduce various search data structures such as hashing, binary search trees, AVL trees, B+ trees and B*-trees.
CO-4	To implement graph theory concept (Minimum Spanning Tree) in Civil Network Planning, Computer Network Routing Protocol
CO-5	summarize searching and sorting techniques
CO-6	translate the algorithms of Data Structure to application using C++

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**						
AVG	**X**			**X**						

Course Objective	This subject helps to clarify the concepts of data structure which help to enhance programming techniques in procedure oriented and object oriented languages. This subject covers all the techniques of stack, queue, , tree and graph theory and its implementation in normal programming languages i.e. in c or c++
Prerequisites	C& C++ programming knowledge
Unit I	**Introduction To Data Structure :** Introduction, Data Definition, Data Object, Data Types, Built-in Data Type, Derived Data Type, Data Structure, Implementation of Data Structure **Array :** Array as Data Structure, Storage Representation of Arrays, Applications of Arrays, Polynomial Representation Using Arrays, Addition of Two Polynomial, Multiplication of Two Polynomial, Sparse Matrices, Addition of Sparse Matrices, Transpose of a Sparse Matrix ***Stack*** **:** Introduction, Definition, Operation on Stack, Static & Dynamic Implementation of a Stack, Application of Stack, Recursion, Infix, Prefix & Postfix expression, Matching Parentheses in an expression ***Queue*****:** Introduction, Definition of a Queue, Operation on a Queue, Static & Dynamic Implementation of Queue, Types of Queue, Circular Queue, Priority Queue, DEQueue, Application of Queue, Job Scheduling, Reversing Stack using Queue
Unit II	***Linked List :*** Introduction, Drawback of Sequential Storage, Concept of Linked List, Implementation of Linked List, Operation of Linked List, Creating a List, Displaying a List, Inserting an element in the List, Deleting an element, Other Operation & Applications, Reversing a Linked List, Concatenation of Two Lists, Representation of Polynomial, Circular Linked List & Operation, Doubly Linked List & Operation, Doubly Circular Linked List & Operation, Difference between an array and Linked list, Generalized Linked List,
Unit III	**Tree :** Tree Terminology, Binary Tree, Binary Tree Representation, Binary Search Tree (BST), Creating a BST, Binary Search Tree Traversal, Preorder Traversal, Inorder Traversal, Postorder Traversal **Binary Threaded Tree :** AVL tree, B tree, introduction to B tree, insertion in B tree, deletion from B tree, introduction to B+, B* tree, Expression Tree, Threaded Binary Tree

Unit IV	***Graph*** : Introduction, Graph Representation, Adjacency Matrix, Adjacency List, Graph Traversals, Depth First Search, Breadth First Search, Applications of Graph , Minimum Spanning Tree and Algorithms
Unit V	***Searching and Sorting*** : Insertion Sorting , Selection Sorting , Bubble Sorting , Shell Sorting , Merge Sorting, Quick Sorting , Divide and Conquer Sorting, Radix sorting , Heap Sorting , Binary Tree Sort. Binary Search, Hashing and Rehashing, Extendible Hashing, Storage Management, Garbage Collection, Dynamic memory Management, Method to select free block, Freeing Memory, Boundary Tag Method, Budy Systems
Text Book	1. C & Data Structure Balagurusamy, 2. Data Structure through C in depth Shrivastava&Shrivastava , 3. Data Structure through C Y.P. Kanetkar
Reference Books	1. Data Structure Seymour Liptsuz, Data Structure Tannebaum , 2. Data structure and program design in c R.L.Kruse

Subject Title		Practical Based on MANC412			
Subject Ref. No.		MANC455	No. of Credits		2
			No. of Periods / Week		2
			Semester Examination		50

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	To introduce the concepts of Abstract data Type, data structure, performance measurement, time and space complexities of algorithms using C++ language.
CO-2	To implement linear data structures such as stacks, queues and lists and their applications using Object Orientated Programming Language
CO-3	To introduce various search data structures such as hashing, binary search trees, AVL trees, B+ trees and B*-trees
CO-4	To implement graph theory concept (Minimum Spanning Tree) in Civil Network Planning, Computer Network Routing Protocol
CO-5	summarize searching and sorting techniques using C++ language.
CO-6	translate the algorithms of Data Structure to application using C++

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X						
CO-5	X			X						
CO-6	X			X						
AVG	X			X						

Course Objective		
Prerequisites		
Unit I	**Introduction To Data Structure**	
	1.	WAP a C++ program to implement the addition of two Polynomial using an Array .
	2.	WAP a C++ program to implement the multiplication of two Polynomial using an Array .
	3.	WAP a C++ program to convert Array into Sparse Array using an Array .
	4.	WAP a C++ program to implement the stack operations such as push, pop, display & search element using an Array .
	5.	WAP a C++ program to implement the queue operation such as front , rear, display & search using an Array .
	6.	WAP a C++ program to implement the Circular Queue using an Array .
	7.	WAP a C++ program to implement the Priority Queue using an Array
	8.	WAP a C++ program to implement the DeQueue Queue using an Array
	9.	WAP a C++ program to implement the Reverse Stack using Queue implementation.
Unit II	**Linked List**	
	10.	WAP a C++ program to demonstrate the application of malloc, calloc and free function.
	11.	WAP a C++ program to implement the addition of two Polynomial using Linked List.
	12.	WAP a C++ program to implement the multiplication of two Polynomial using using Linked List.
	13.	WAP a C++ program to Create the Linked List and Print it.
	14.	Write a menu driven program in C++ to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search element in ***Linked List***.
	15.	Write a menu driven program in C++ to perform all operations of ***stack*** such as create , delete, insert, display, search element by using Linked List.
	16.	Write a menu driven program in C++ to perform all operations of

		queue such as create , delete, insert, display, search element by using Linked List.
	17.	Write a menu driven program in C++ to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search element in ***Circular Linked List***.
	18.	Write a menu driven program in C++ to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search element in ***Doubly Linked List***.
	19.	Write a menu driven program in C++ to perform all operations such as create , delete (first,last & between), insert(first,last & between), display, search element in ***Doubly Circular Linked List***.
	20.	Write a C++ program to convert normal linked List into ***Reverse Linked List.***
Unit III	**Tree**	
	21.	Write a C++ program to construct Tree by using three arrays.
	22.	Write a C++ program to construct Tree by using one array.
	23.	Write a C++ program to construct Tree by using Linked List
	24.	Write a C++ program to construct BST by using array.
	25.	Write a C++ program to construct BST by using Linked List.
	26.	Write a C++ program to construct Tree by using three arrays and perform inorder, preorder and post order on it.
Unit IV	**Graph**	
	27.	Write a C++ program to construct Graph using Adjacency Matrix.
	28.	Write a C++ program to construct Graph using Adjacency List.
	29.	Write a C++ program to construct Graph using Incidence Matrix.
Unit V	**Searching & Sorting**	
	30.	Write a C++ program to perform Bubble Sorting.
	31.	Write a C++ program to perform Insertion Sorting.
	32.	Write a C++ program to perform Selection Sorting.
	33.	Write a C++ program to perform Merge Sorting.
	34.	Write a C++ program to perform Shell Sorting.
	35.	Write a C++ program to perform Quick Sorting.
Text Book	1. C & Data Structure Balagurusamy, 2. Data Structure through C in depth Shrivastava&Shrivastava ,	

	3. Data Structure through C Y.P. Kanetkar
Reference Books	3. Data Structure Seymour Liptsuz, Data Structure Tannebaum , 4. Data structure and program design in c R.L.Kruse
Websites	4. https://www.tutorialspoint.com 5. opendatastructures.org 6. www.cplusplus.com

Subject Title		**Advanced Web technology Using ASP.NET**			
Subject Ref. No.		**MANC413**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe basic concepts of ASP.NET and identify components of a form.
CO-2	Use various validation controls on respective objects on the form.
CO-3	Establish connectivity with back end using ADO.Net.
CO-4	Implement stored procedures in ASP.NET.
CO-5	Describe use of Authentication services in ASP.NET.
CO-6	Create a mini-project using controls learnt.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**				**X**		**X**
AVG	**X**			**X**				**X**		**X**

Prerequisites	Before attending this course, students must have:

	The ability to create HTML or DHTML, including: • Tables • Images • Forms Programming experience using Visual Basic .NET, including: • Declaring variables • Using loops Using conditional statements
Unit I	Overview of the Microsoft .NET Framework, Using Microsoft Visual Studio .NET, Introduction to the .NET Framework, Overview of ASP.NET, Creating a Microsoft ASP.NET Web Form, Adding Code to a Microsoft ASP.NET Web Form Using Code-Behind Pages, Adding Event Procedures to Web Server Controls
Unit II	Validating User Input Overview of User Input Validation, Using Validation Controls, Page Validation Creating User Controls Adding User Controls to an ASP.NET Web Form, Creating User Controls
Unit III	Accessing Relational Data Using Microsoft Visual, Studio .NET Overview of ADO.NET, Creating a Connection to the Database, Displaying a DataSet in a List-Bound Control Accessing Data with Microsoft ADO.NET Introduction to Using ADO.NET, Connecting to a Database, Accessing Data with DataSets, Using Multiple Tables, Accessing Data with DataReaders
Unit IV	Calling Stored Procedures with Microsoft ADO.NET, Overview of Stored Procedures, Calling Stored Procedures, Reading and Writing XML Data Overview of XML Architecture in ASP.NET, XML and the DataSet Object, Working with XML Data, Using the XML Web Server Control, Securing a Microsoft ASP.NET Web Application
Unit V	Web Application Security Overview Working with Windows-Based Authentication Working with Forms-Based Authentication Overview of Microsoft Passport Authentication
Text Books	1. Programming ASP.NET By Jesse Liberty, Dan Hurwitz, Publisher: O'Reilly Media 2. ASP. NET: a beginner's guide By Dave Mercer, Publisher McGraw-Hill Companies
Reference books	
Web References	www.w3schools.com www.tutorialspoint.com

Subject Title		**Practical Based on MANC413**			
Subject Ref. No.		**MANC-456**	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write Simple programs using C#.
CO-2	Use calendar control and Treeview control in forms.
CO-3	Using various validation controls on objects on the forms.
CO-4	Implement Datagrid control, databinding and connectivity using C#.Net.
CO-5	Learn to use hyperlink control on Forms.
CO-6	Create a minor project using ASP.NET and SQL Server.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X						
CO-5	X			X						
CO-6	X			X				X		X
AVG	X			X				X		X

Prerequisites	HTML and VB.net

Unit I	**Simple application using web controls** A Finding factorial Value B Money Conversion C Quadratic Equation D Temperature Conversion E Login control
Unit II	States of ASP.NET Pages, Adrotator Control, **Calendar Control** A Display messages in a calendar control B Display vacation in a calendar control C Selected day in a calendar control using style D Difference between two calendar dates **Treeview control** A Treeview control and datalist B Treeview operations
Unit III	Validation controls Query textbox and Displaying records Display records by using database Datalist link control Databinding using dropdownlist control Inserting record into a database
Unit IV	Deleting record into a database Databinding using datalist control Datalist control templates Databinding using datagrid Datagrid control template
Unit V	Datagrid hyperlink Datagrid button column Datalist event Datagrid paging Creating own table format using datagrid
Text Books	1. Programming ASP.NET By Jesse Liberty, Dan Hurwitz, Publisher: O'Reilly Media 2. Visual Basic .NET Programming Black Book By Steven Holzner Publisher: Dreamtech Press 3. ASP. NET: a beginner's guide By Dave Mercer, Publisher McGraw-Hill Companies

Subject Title	**:**	**Project**			
Subject Ref. No.	**:**	**MANC457**	**No. of Credits**	**:**	4
			No. of Periods / Week	**:**	4
			Internal	**:**	20
			External	**:**	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide.

SEMESTER - III

Subject Title		**Entrepreneurship Development**			
Subject Ref. No.		**MANC501**	**No. of Credits**	**:**	4
			No. of Periods / Week	**:**	4
			Assignments / Sessional	**:**	20
			Semester End Examination	**:**	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	define, identify and/or apply the principles of entrepreneurial and family business
CO-2	Know the parameters to assess opportunities and constraints for new business ideas
CO-3	Understand the systematic process to select and screen a business idea
CO-4	Design strategies for successful implementation of ideas
CO-5	Write a business plan

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1		**X**								
CO-2		**X**								
CO-3		**X**	**X**							
CO-4			**X**							
CO-5			**X**							**X**
AVG		**X**	**X**							**X**

Pre Requisite		--

Unit – I		**Introduction**: Entrepreneur- Functions and Qualities, Entrepreneurship- Motivating Factors and Obstacles in Entrepreneurship.
Unit – II		**Entrepreneurship in different sectors Part I**: Women Entrepreneurship- Limitations and measures, Rural Entrepreneurship- Need, Problems, How to develop Rural Entrepreneurship. Agri Entrepreneurship- Need, Opportunities, Problems and Suggestions.
Unit – III		**Entrepreneurship in different sectors Part II:** Social Entrepreneurship- (Brief Introduction) Entrepreneurial Opportunities in small scale sector. Online Sector and Ecommerce.
Unit – IV		**Starting New Venture: Idea Generation**- Brain Storming, Creativity, Checklist, Focus Groups, and Problem Inventory Analysis.
Unit – V		**Formulation and Appraisal of Project Report:** Content of Project Report, Preparation of different project reports of different small scale units. Methods of Project Appraisal (Financial Analysis, Economic Analysis, Market Analysis, Technical Feasibility, Managerial Competence)
Text Books		Entrepreneurial Development (2013), Dr. S.S. Khanka- S. Chand & Company, New Delhi Dynamics of Entrepreneurial Development and Management by Vasant Desai, Himalya Publication House. Entrepreneurship- Second Edition, Rajeev Roy, Oxford University Press, New Delhi. Entrepreneurship- Fifth Edition, Robert D. Hisrich, Michel P. Peters, Tata Macgraw Hill Edition.
Additional Reference Books		Dynamics of Business Entrepreneurship G. S. Sudha, RSBA Publishers, Jaipur. Entrepreneurial Development E. Gordan, Dr. Natarajan, Himalya Publication House.

Subject Title :	**Artificial Intelligence**		
Subject Ref. No.	**MANC502**	No. of Credits	04
		No. of Periods/Week	04
		Assignments/Sessional	20
		Semester Exam.	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write algorithms for Heuristics searching techniques.
CO-2	Solve resolution problems.
CO-3	Represent the knowledge in the form of frames, script, and associative network.
CO-4	Solve AI problems using AI techniques.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3	**X**									
CO-4	**X**									
AVG	**X**									

Prerequisite :	
Unit –I :	**Introduction** a. AI Techniques – Importance of AI – Representation of Knowledge, Knowledge Base Systems b. State Space Search – Production Systems – Problem Characteristics of 8-Queens, Traveling Salesman, Missionary & Cannibals, Crypt Arithmetic, Monkey Banana Problem, Tower of Hanoi and Block World.

Unit –II :	**Heuristics Search Techniques** a. Generate & test – Hill Climbing, Depth First Search, Breadth First Search, Best First Search, **Expert Systems** a. Architecture – Need and Justification of Expert Systems – Knowledge acquisition and validation.
Unit –III :	**Predicate & Logic** a. Representing simple facts in Logic - Computable functions in predicates, resolution – unification – forward vs. backward reasoning. b. Probabilistic reasoning – Bayes's Theorem – Certainty Factors – Demphster–Shafer Theory – Fuzzy Sets, Reasoning with Fuzzy Logic, Natural Language Computation with Fuzzy Logic.
Unit – IV :	**Structured Knowledge Representation** a. Associative Networks, Semantic Nets, Frames Structures, Conceptual Dependencies & Scripts Learning – Concept of Learning – Learning Automata, Genetic Algorithm, Learning by induction.
Unit – V :	**Natural Language Processing** Overview of Linguistics, Grammars and Languages, basic Parsing techniques, semantic analysis and representation structures. Natural Language generation and Natural Language Systems.
Text Books :	a. Introduction to AI and Expert Systems - Patterson. b. Artificial Intelligence - Rich E and Knight K c. Principles of Artificial Intelligence - Nilsson.
Reference Books :	d. Artificial Intelligence – An Engineering Approach - Schalkoff R J e. Introduction to Expert System - Peter Jackson f. Artificial Intelligence - Janakiraman

Subject Title		**JAVA**			
Subject Ref. No.		**MANC503**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write, compile, and execute Java programs that may include basic data types and control flow constructs using J2SE or other Integrated Development Environments (IDEs) such as Eclipse, NetBeans, and JDeveloper
CO-2	demonstrate the use of good object-oriented design principles including encapsulation ,information hiding, Inheritance , Full Abstraction and Partial Abstraction
CO-3	Create GUI Application using Applet & HTML
CO-4	Implement the Multithreading Concept with real time application
CO-5	Control & Maintain Run-Time Exception occurred during web based software development
CO-6	Maintain the file using File handling concepts and provide the ability to inspect & modify the runtime behavior of application using Reflection

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**						
AVG	**X**			**X**						

Prerequisites	Fundamentals of Computer System , operating system , C and C++ Language
Unit I	Java Fundamentals , J2SE, J2EE, J2ME, Features of Java , OOPs concepts, benefits of JAVA, Hardware / Software requirement, Support system and Environment of JAVA, System Variable, Environment Variable, Path and Class Path. JAVA API. Application of More JAVA, application with two classes , program structure , tokens, statements installing and configuration JAVA , implementing JAVA program, JAVA virtual M/C Architecture and different alias with functionality, command line arguments, program style, keywords , data types, Operators, Decision Making and Branching , looping Statement . Predefined classes (Scanner, Date, Random …….)
Unit II	Class objects and methods: class definition,class types-Bean Class, POJO class, Factory Class, Singleton Class, Runtime class, Inner Class. methods, fields declaration.Object, ways to create an object and operations on it. Garbage Collector. constructor , overloading , static members , nesting methods , Inheritance, overloading , Final class and Methods , array string and vector, Interfaces : definition , implementation , accessing Interface Variables , Packages : introduction, uses , creating , accessing adding a class to package hiding class
Unit III	Multithreaded Programming : Introduction , creating threads stopping and blocking a threads , Life cycle of a thread, its exceptions priority, synchronization, Managing Errors and Exception : types of error , exception , syntax of exception Handling , multiple catch statement, throwing our own exception Applet Programming : Introduction , preparing to write Applets building Applets code, creating an executable Applet , designing a web page , applet tag, adding Applet Tag, running applet more HTML tags , event handling
Unit IV	AWT programming : introduction , create JAVA application using AWT, creating JAVA Applet using AWT , execute applet, execute applet in browse,

	message in the status bar, get HTML and AREA size , window and event, Graphic Programming : introduction, Graphic class, lines and rectangles, circle, ellipse, arcs poly, line graphs, using control loops in Applets , Bar charts , Text Field, Label , button , check box layouts , text area, scroll list , selection control, scrollbar, menu, dialog.
Unit V	Managing Input / Output Files in JAVA : streams, streams classes, Byte streams classes , reading and writing characters , bytes, Random Access Files , Interactive I/p and o/p, Reflection API- class identification, interface identification, parent class information and methods information.
Text Book	Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies, Core Java, Dietel and Dietel
Reference Books	The complete reference JAVA2, Herbert schildt. TMH, Java Programming John P. Flynt Thomson 2nd, Java Programming Language Ken Arnold Pearson , Big Java, Cay Horstmann 2nd edition, Wiley India Edition

Subject Title		Practical Based on MANC503			
Subject Ref. No.		MANC551	No. of Credits		2
			No. of Periods / Week		2
			Semester Examination		50

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Design the fundamentals of object oriented application, and have the ability to apply them
CO-2	Identify, formulate and solve problems by using object oriented programming
CO-3	Use APIs (Application Programmer Interfaces) and design/program APIs
CO-4	Implement Inheritance , Association and Abstraction using OOPs concepts
CO-5	Maintain the Exceptions in Software Development & Design GUI using AWT controls
CO-6	Develop Webpage using Applet & Implement multithreading concept in real application

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X						
CO-4	X			X						
CO-5	X			X						
CO-6	X			X						
AVG	X			X						

Prerequisites	Fundamentals of Computer System , operating system , C and C++ Language	
Unit I	**Java Fundamentals**	
	1.	Practical demo on JDK installation, Path setting , Classpath Setting , Run program on Console, MyEclipse
	2.	WAP a to demonstrate the primitive data types with their default values.
	3.	WAP a to demonstrate the Looping and decision statements in Java.
	4.	WAP a to demonstrate the function of Predefined class ***Scanner***.
	5.	WAP a to demonstrate the function of Predefined class ***Date***.
	6.	WAP a to demonstrate the function of Predefined class ***Random***.
Unit II	**Class objects and methods**	
	7.	WAP a program to demonstrate the use of Static member and static method
	8.	WAP a program to demonstrate the use of Static member, static block and static method
	9.	WAP a program to demonstrate the use of this, Instance Initializer block
	10.	WAP a program to demonstrate the application of Inheritance using IS-A relation & Has-A relation.
	11.	WAP a program to demonstrate the application of constructors in Inheritance concept using IS-A relation & Has-A relation.
	12.	WAP to implement static binding in JAVA.
	13.	WAP to implement dynamic binding in JAVA.
	14.	WAP to demonstrate the use of super keyword in inheritance.
	15.	WAP to demonstrate the use of final keyword with instance variable , with method and with class name.
	16.	WAP to demonstrate the implementation of an Array & Vector in Java and its access methods using enhance for a& Enumeration
	17.	WAP to demonstrate all Access Modifiers in JAVA. Default, public, private & protected.
	18.	WAP that demonstrate the applications of abstract class and interface in JAVA
	19.	WAP that demonstrate the applications of package in JAVA
	20.	WAP that demonstrate how to import package, class and how to access the static members and methods of class in JAVA

Unit III	Multithreaded Programming	
	21.	WAP to demonstrate the implementation of Multi Threading using Thread Class.
	22.	WAP to demonstrate the implementation of Multi Threading using Runnable Interface.
	23.	WAP to demonstrate the implementation of sleep() & join() methods with Multi-Threading.
	24.	WAP to demonstrate the application of Daemon thread in java.
	25.	WAP to demonstrate the application of Synchronized thread for Mutual Exclusion in java.
	26.	WAP to manage the ArithmeticException in Java.
	27.	WAP to manage the NullPointerException in Java.
	28.	WAP to manage the NumberFormatException in Java.
	29.	WAP to manage the ArrayIndexOutOfBoundsException in Java.
	30.	WAP to management nested Exceptions
	31.	WAP to demonstrate a Simple Applet Functionality in JAVA.
	32.	WAP to demonstrate various shapes avaiLabel in Graphics class which can be implements in JAVA Applet.
	33.	WAP to demonstrate the Applet with FontSize, Font, Color.
	34.	WAP to implement Mutli threading in Applet.
	35.	WAP to configure the components in HTML file and fetch it in Applet & manipulate.
	36.	WAP to configure the number in HTML file and print its table in Applet.
	37.	WAP to create Random Circles in Applet using Random Class and Multi Threading.
	38.	WAP to create Random Circles in different colors in Applet using Random Class and Multi Threading.
Unit IV	**AWT programming**	
	39.	WAP a program to Create a Frame by using Inheritance and Association
	40.	WAP to demonstrate the BorderLayout Layout Manager
	41.	WAP to demonstrate the GridLayout Layout Manager
	42.	WAP to demonstrate the FlowLayout Layout Manager

	43.	WAP to demonstrate the BoxLayout Layout Manager
	44.	WAP to demonstrate the CardLayout Layout Manager
	45.	WAP a program to validate Login Page using TextField & Button
	46.	WAP to create a Calculator in awt
	47.	WAP to enter two numbers and print its addition using Label, Button & TextField
	48.	WAP to perform All Arithmetic Operations on two numbers and print its addition using Label, TextField & Button ActionListener Interface
	49.	WAP to add Checkbox & Label. And apply ItemListener Interface application on it.
	50.	WAP to add CheckboxGroup & Label. And apply ItemListener Interface application on it.
	51.	WAP to add Choice & Label. And apply ActionListener on it
	52.	WAP to add List & Label. And apply ActionListener on it
	53.	WAP a create four Buttons and Two Lists and write code of each Button click to perform different operations
	54.	WAP to demonstrate Canvas Implementation.
	55.	WAP to create Scrollbar application using Label.
	56.	WAP to create MenuBar using Menu and MenuItem application using Label.
	57.	WAP to create MenuBar using Menu and MenuItem application using Label and apply ActionListener Interface
	58.	WAP to demonstrate the Use of Dialog Box.
	59.	WAP to enter two numbers in Dialog Box and perform Addition on it
	60.	WAP to demonstrate the Use of ActionListener on Different Components.
	61.	WAP to demonstrate the Use of MouseListener.
	62.	WAP to demonstrate the Use of ItemListener on Difference Components.
	63.	WAP to demonstrate the Use of KeyListeners .
	64.	WAP to demonstrate the Use of WindowsListeners.
	65.	WAP to demonstrate the Use of Adapter Classes .
	66.	WAP to implement WindowCloseEvent .

	67.	WAP to implement Awt control in Applet
	68.	WAP to implement Awt control & Multi Threading concept in Applet
	69.	WAP program to implement Awt control , Multi Threading & Exception concept in Applet
Unit V	**Managing Input / Output Files in JAVA**	
	70.	WAP to write & read a character to File.
	71.	WAP to write & read a string to File.
	72.	WAP to write & read the data from&to File using BufferedOutputStream & BufferedInputStream
	73.	WAP to read the data from two files and writes into another file using FileStreams and SequenceStreams.
	74.	WAP to demonstrate the use of Write & Reader classes.
	75.	WAP to demonstrate the use of FileWrite & FileReader classes.
	76.	WAP to demonstrate the use of CharArrayReader & CharArrayWritr classes.
		Reflection in JAVA
	77.	WAP to demonstrate the use of newInstance() method
	78.	WAP to demonstrate the use of javap tool.
	79.	Few program of Refection Concepts
Text Book	1. Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies, Core Java, Dietel and Dietel 2. SCJP by Kathy and Sierra.	
Reference Books	1. The complete reference JAVA2, Herbert schildt. TMH, 2. Java Programming John P. Flynt Thomson 2nd, 3. Java Programming Language Ken Arnold Pearson , Big Java, Cay Horstmann 2nd edition, Wiley India Edition 4. Head First Java by Kathy Sierra	
websites	1. http://www.java2s.com 2. http://www.roseindia.net 3. http://www.java-tips.org 4. http://www.jguru.com 5. http://www.tutorialpoint.com 6. http://www.javatpoint.com	

Subject Title		**Design and Analysis of Algorithms**			
Subject Ref. No.		**MANC504**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester End Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Analyze the asymptotic performance of algorithms.
CO-2	Write rigorous correctness proofs for algorithms.
CO-3	Demonstrate a familiarity with major algorithms using data structures.
CO-4	Apply important algorithmic design paradigms and methods of analysis

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**	**X**								
CO-3		**X**	**X**							
CO-4			**X**	**X**						
AVG	**X**	**X**	**X**	**X**						

Pre Requisite		Discrete Maths, Graph Theory and Data Structure.
Unit – I		**Analysis of Algorithm:** What is an algorithm?, The efficient algorithm, Average, Best and worst case analysis, Asymptotic Notations, Analyzing control statement, Loop invariant and the correctness of the algorithm, Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort, Heap sort, Sorting in linear time : Bucket sort, Radix sort
Unit – II		**Divide and Conquer Algorithm:** Introduction, Recurrence and different methods to solve recurrence, GCD, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-

		Min problem, Sorting (Merge Sort, Quick Sort).
Unit – III		**Greedy Algorithm**: General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Activity selection problem, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code.
Unit – IV		**Dynamic Programming:** Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Multi-Stage Graph 0/1 Knapsack problem, All Points Shortest path, Longest Common Subsequence
Unit – V		**Backtracking and Branch and Bound:** The N Queen's problem, Hamiltonian cycle and 0/1 knapsack problem **Max flows Network:** Ford-Fulkerson Algorithm **Geometric algorithms:** convex hull **Amortized analysis**
Text Books		1. Cormen, Leiserson, and Rivest, "*Algorithms"*, MIT Press, 2010 2. E. Horowitz and S. Sahni.," *Fundamentals of Computer Algorithms"*, Galgotia, 2008
Additional Reference Books		1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "*The Design and Analysis of Computer Algorithms",* Addison Wesley, 2010

Subject Title		**Practical Based on MANC504**			
Subject Ref. No.		**MANC552**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Assignments / Sessional	**:**	10
			Semester End Examination	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write rigorous correctness proofs for algorithms.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**	**X**	**X**	**X**						
AVG	**X**	**X**	**X**	**X**						

Course Objective		In this laboratory after completing experiments student has to learn how to analyze a problem & design the solution for the problem. In addition to that, solution must be optimum, i.e., time complexity & memory usage of the solution must be very low
		Prepare any Five Assignment in detail (Each for 2 Marks)
Assignment No 1		Write C/C++/Java/C# programs to implement the following: a) Bubble Sort b) Selection Sort c) Insertion Sort
Assignment No 2		Write C/C++/Java/C# programs to implement the following: a) GCD b) Binary Search
Assignment No 3		Sort a given set of elements using the Merge method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
Assignment No 4		Write C/C++/Java/C# programs to implement the following: a) Knapsack Problem
Assignment No 5		Write C/C++/Java/C# programs to implement the following: a) Prim's algorithm. b) Kruskal's algorithm
Assignment No 6		Write C/C++/Java/C# programs to implement the following: a)Multistage Graph
Assignment No 7		Write C/C++/Java/C# programs to implement the following: a) Travelling Salesman Problem
Assignment No 8		Write C/C++/Java/C# programs to implement the following: a) N-Queens Problem
Assignment No 9		Write C/C++/Java/C# programs to implement the following: a) Ford Fulkerson Algorithm
Assignment No 10		Write C/C++/Java/C# programs to implement the following: a) Convex Hull

Subject Title		**Advanced Database Management System**			
Subject Ref. No.		**MANC505**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe architecture of parallel Dbs and distributed DBs.
CO-2	Describe Data warehousing and associated terms.
CO-3	Discuss life cycle approach towards project management using variou schemas.
CO-4	Describe OLAP concepts.
CO-5	Implement various ODBMS concepts like ADTs.
CO-6	Implement concepts learnt in a small project.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**				**X**		**X**
AVG	**X**			**X**				**X**		**X**

Prerequisites	DBMS
Unit I	**Parallel and Distributed databases** Architecture for Parallel databases, Parallelizing Individual operations, Parallel query Evaluation, Introduction to DDBMS, Architecture of DDBs, Storing data in DDBs, Distributed catalog management, Distributed query processing, Distributed concurrency control and recovery, Transaction Processing
Unit II	Data warehousing Data Marts, Getting data into the warehouse, Extraction, Transformation, Cleansing, Loading, Summarization, Meta data, Data warehousing & ERP, Data warehousing & KM, Data warehousing & CRM
Unit III	**Planning & Project Management** Life-cycle approach, The Development Phases, Dimensional Analysis, Dimensional Modeling, Star Schema, Snowflake Scheme
Unit IV	**OLAP** OLAP Architecture, Relational OLAP, Multidimensional OLAP, Relational vs. Multidimensional OLAP, Web based OLAP
Unit V	**Object Databases Systems** Introduction, User-defined ADTs, Structured types, Object, object identity and references, Inheritance, Database design for ORDBMS, New Challenges in implementing ORDBMS, Storage & access methods, Query processing & Optimization
Text Books	Database system concept, Korth Fundamentals of Database Sysems, Elmasri Navathe Database Management Systems, Bipin Desai
Reference books	1. Raghu Ramakrishnan, Johannes Gerhke, "Database Management Systems" McGraw Hill. 2. Decision support & database system –Efrem G. Mallach. 3. Datawarehousing fundamental – Paulraj Ponniah Wiley. 4. Introduction to data mining with case studies – G.K. Gupta. 5. Data Warehousing (OLAP) S. Nagabhushana New Age.
Web References	Implement concepts learnt in a small project.

Subject Title		**Practical Based on MANC505**			
Subject Ref. No.		**MANC553**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Execute and create Triggers and write Advanced Triggers
CO-2	Implement Cursors Management in PL/SQL
CO-3	Write Subprograms and implement them.
CO-4	Write Functions and use them in PL/SQL.
CO-5	Write programs to perform Error Handling using PL/SQL.
CO-6	

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**				**X**		**X**
AVG	**X**			**X**				**X**		**X**

Prerequisites	SQL

Unit I	Review of SQL and Triggers. Advanced Triggers
Unit II	Cursors Management
Unit III	Subprograms
Unit IV	Functions
Unit V	Error Handling in PL/SQL
Text Books	SQL, PL/SQL the programming language of Oracle – Ivan Bayross
Reference books	1) Oracle PL/SQL Language Pocket Reference, 5th Edition by Steven Feuerstein; **Bill Pribyl**; **Chip Dawes**. 2) Oracle PL/SQL by Example By: Benjamin Rosenzweig; Elena Rakhimov. 3) Oracle Database 11g PL/SQL Programming Workbook By: Michael McLaughlin; John M.
Web References	

Subject Title	**:**	**In-plant Training Project**			
Subject Ref. No.	**:**	**MANC554**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	50
			External	**:**	-

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide. OR

Students may join any IT company for the duration of inplant and work on the live projects running in the companies. They get better understanding of technology usage, communication within team.

Subject Title	**:**	**Project**			
Subject Ref. No.	**:**	**MANC555**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	10
			External	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide.

OPEN ELECTIVE COURSE : GROUP A

Subject Title		**Cloud Computing**			
Subject Ref. No.		**MANC521**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester End Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	learn how to use Cloud Services
CO-2	implement Virtualization
CO-3	implement Task Scheduling algorithms

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**									
CO-2	**X**			**X**						**X**
CO-3	**X**			**X**						**X**
AVG	**X**			**X**						**X**

Unit – I		**Understanding Cloud Computing**: Cloud computing: Introduction, Cloud application architectures, Value of cloud computing, Cloud Infrastructure models, Cloud Services, History of Cloud Computing, Advantages of Cloud Computing, Disadvantages of Cloud Computing, Companies in the Cloud Today, Amazon Web Services, Google services, IBM Cloud, Windows Azure **Before the move into the cloud**: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications **Ready for the cloud:** Web Application Design, Machine Image Design, Privacy Design, Design, Database Management
Unit – II		**Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/Tools and

		Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation **Case Studies:** Cloud centers in detail, Comparing approaches, Xen, Eucalyptus, Cloud-Stack, OpenStack
Unit – III		**Scaling a Cloud Infrastructure:** Capacity Planning, Cloud Scale. **Cloud Security:** Data Security, Network Security, Host Security, Compromise Response **Disaster Recovery**: Disaster Recovery Planning, Disasters in cloud, Cloud Disaster Management
Unit – IV		**Cloud Computing Software Security Fundamentals -**Cloud information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation
Unit – V		**Cloud Computing Risk Issues:** The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks
Text Books		1. Cloud Application Architectures, George Reese, O'Reilly (Units I,II, III) 2. Cloud Security, Ronald L. Krutz and Russell Dean Vines, Wiley Publishing (Unit IV)
Additional Reference Books		1. Distributed & Cloud Computing From Parallel Processing to the Internet of Things, Kai Hwang. Geoffrey C. Fox, Jack J.Dongarra, Morgan Kauffman Publishers 2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing 3. Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide David S. Linthicum Addison-Wesley Professional.

Subject Title :	**Emerging Trends In Information Technology**		
Subject Ref. No.	**MANC522**	No. of Credits:	04
No. of Periods/Week	:		04
Assignments/Sessional	:		20%
Semester Exam.	:		80%

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understand the e-commerce and e-banking concepts.
CO-2	Analyze the different biometric technologies.
CO-3	Identify the role of CRM in business.
CO-4	Understand the GPS , e-logistics techniques.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**									
CO-2	**X**									
CO-3	**X**									
CO-4	**X**									
AVG	**X**									

Prerequisite :	Students must have knowledge of internet.
Unit –I :	**1A) E-Commerce** Model of E-Commerce, Application with respect to models, BPR & E-Commerce, Creation of E-Commerce sites (ethics): com/edu/org sites, Introduction to ERP Packages **1B) E-Banking** Transactions : Inter Banking, Intra Banking, Electronic Payments, (Payment – Gateway Example) Securities in E-banking (SSL, Digital Signatures – Examples) Services Provided : ATM, Smart Card ECS(Electronic Clearing System)

	e.g. Telephone, Electricity Bills
Unit –II :	**E – Governance & E – Agriculture** E –Governance Models : (G2B,G2C,C2G,G2G), Challenges to E – Governance, Strategies and tactics for implementation of E – Governance, Types of Agriculture information (Soil, Water, Seeds, Market rate) & Technique dissemination , Future trade marketing, Corp Management, Query redresses System, (Information Kiosk, IVR etc), Case Study
Unit –III :	**3A) E – Logistics** Logistics & Supplier Chain Management, Warehousing Management, Transportation/ Distribution Management **3B) GIS / GPS** What is GIS? Nature of Geographic data, Spatial Objects & Data Models, Getting map on Computers, GIS standards & Standardization Process of GIS development, Implementation and Deployment phases **3C) Embedded Systems** Features and Type of Embedded Systems, Components of Embedded System, Application of Embedded System, Palm Devices
Unit – IV :	**4A) CRM** Sales, Marketing and Service Management, What is BPO/BCP, Why it is required? Guidelines, Merits/De-Merits, Call Center – brief perspective technology wise, Functioning, Ethics, Disaster Recovery Management, Case Study **4B) Knowledge management** What is KM? (Components and Type of Knowledge), Knowledge Building Models, KM Cycle & KM architecture, KM tools, KM approaches
Unit – V :	5A) Biometric Technologies RFID, Retina Scanning, Facial Reorganization, Finger Print scanning, hand geometry , DNA (Working principles) Application area :Case Study 5B) Content Management And Disseminations E-learning – Models WBT, CBT, Virtual Campus, LMS & LCMS, Video Conferencing, Chatting Bulleting, Building Online Community, Asynchronous/ Synchronous Learning, Case Study
Text Books :	1. Management Information System: Jawadekar 2. E – Commerce : Milind Oka
Reference Books :	1. Management Information System: Laudon & Laudon 2. E – Commerce : C.V.S. Murty 3. Fire Wall and Internet Security: William Cheswick, Stevens, Aviel Rubin 4. The Essential Guide to Knowledge management :Amrit Tiwana 5. The GIS Book: George B. Karte. 6. Internet (Use of Search Engines Google & yahoo etc)

Subject Title		**Cyber Law**			
Subject Ref. No.		**MANC523**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Possess a fundamental knowledge of Cyber Security.
CO-2	Have the knowledge of IPR in India.
CO-3	Know basic and fundamental risk management principles as it relates to Cybe Security.
CO-4	Have the knowledge needed to practice safer computing and safeguard you information. Understand basic technical controls in use today,such as firewall and Intrusion Detection systems.
CO-5	Describe the need of cyberlaw in a country and the IT Act.
CO-6	Read two-case studies and discuss in open forum (class –level).

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**	**X**					
CO-2	**X**			**X**	**X**					
CO-3	**X**			**X**	**X**					
CO-4	**X**			**X**	**X**					
CO-5	**X**			**X**	**X**					
CO-6	**X**			**X**	**X**			**X**		**X**
AVG	**X**			**X**	**X**			**X**		**X**

Prerequisites	NA
Unit I	**Introduction** Cyberspace, cyber security, cyber security policy, cyber-crime, nature of threat, enabling people, IT Act, emerging trends of cyber laws.
Unit II	**Intellectual property rights** Types, advantages, IPR in India, Intellectual property in cyber space, strategies for cyber security.
Unit III	**Cyber Risks** Policies to mitigate cyber risk, reducing supply chain risks, cyber security awareness, information sharing, cyber security framework
Unit IV	**Network Security** Firewall, Antivirus, network security devices, content filtering, intrusion detection systems, digital signatures, electronic signature
Unit V	**IT ACT** Salient features of IT Act, scheme, application, amendments, offence and penalties
Text Books	1. Cyber Law and Information Security- Dreamtech MISL 2. Cyber Laws and Information Technology- Dr. Jyoti Rattan, Vijay Rattan
Reference books	1. Cyber Laws and IT Protection – Chander H 2. Textbook on Cyber Laws – Pavan Duggal
Web References	

SEMESTER - IV

Subject Title		**Verbal & Non- Verbal Aptitude**			
Subject Ref. No.		**MANC506**	**No. of Credits**		4
			No. of Periods / Week		4
			Semester Examination		100

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Analyze and evaluate written material and synthesize information obtained from it, to analyze relationships among component parts of sentences, and to recognize relationships among words and concepts.
CO-2	Non-Verbal is not as reliant on the English language; rather, the questions use drawings, shapes or codes, and student's will need to work out sequences, similarities and differences between these figures or break the code.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**									
CO-2	**X**									
AVG	**X**									

Prerequisites	
Unit I	Reading Comprehension
Unit II	Visual Reasoning - Basic, Series, odd man out, analogies & sequence
Unit III	Syllogisms & Venn Diagram
Unit IV	Critical Reasoning
Unit V	Analogy & Odd Man Out
Text Books	1. OBJECTIVE NON-VERBAL REASONING By S. Chand 2. OBJECTIVE VERBAL REASONING By S. Chand

Subject Title :	**Software Testing And Quality Assurance**		
Subject Ref. No.	**MANC507**	No. of Credits :	04
No. of Periods/Week	:		04
Assignments/Sessional	:		20%
Semester Exam.	:		80%

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understand different testing types associated with software.
CO-2	Identify the importance of black box and white box testing.
CO-3	Design Test case for software.
CO-4	Perform manual testing to uncover different classes of errors.
CO-5	Use the any automation testing tool.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3	**X**			**X**				**X**		**X**
CO-4	**X**									
CO-5	**X**			**X**				**X**		**X**
AVG	**X**			**X**				**X**		**X**

Prerequisite :	Students must have knowledge of Software development life cycle.
Unit –I :	**A) Software Testing Fundamentals** Testing objectives How test information flows Testing lifecycle

	Test Cases – What it is?, Test Case Designing **B) Levels of Testing** Unit Testing Integration Testing System Testing Acceptance Testing Alpha testing & Beta testing Static vs. Dynamic testing Manual vs. Automatic testing Testers workbench steps of testing process (Only steps should be covered) **Different types of Testing** Installation Testing Usability testing Regression testing Performance Testing - Load Testing - stress testing Security testing
Unit –II :	**Static & Dynamic Testing** Static Testing Techniques Review types : Informal Review, Technical or peer review, Walkthrough, Inspection, static analysis Review Meeting , Review Reporting & Record keeping, Review guidelines & Review checklist , Data flow analysis , Control flow analysis , Cyclometric Analysis Dynamic testing – need & Advantages
Unit –III :	**Black Box & White Box Testing (Test Case Design Techniques)** Functional Testing (Black Box) - Equivalence partitioning, BVA, Cause- Effect graphing, Syntax testing (Concept & Test case generation only) Structural Testing (White Box) - Coverage testing, Statement coverage, Branch & decision coverage, Path coverage Domain Testing Nonfunctional testing techniques Validation testing Activities - Low level testing, High level testing Black box vs. White Box
Unit – IV :	**A) Software Quality Assurance** Quality Concept Definition of Quality, QA, SQA Quality factors Software Quality Metrics Process Improvement

	- Process and Product Quality - The SEI Process Capability Maturity model , ISO ,Six-Sigma - Process Classification **B) Verification & Validation** Verification & Validation Planning Software inspections Automated static Analysis Clean room Software Development
Unit – V :	**Automation Testing Basics** Basics of automation testing – why, when and how to perform automation testing, Which Test Cases to Automate? ,Automated Testing Process: ,Test tool selection, Define the scope of Automation ,Planning, Design and Development, Test Execution, Framework in Automation, Automation Tool Best Practices, Benefits of Automation Testing, How to Choose an Automation Tool?, Automation Testing Tools – Give Demonstration of any one Testing Tool (Selenium, Tricentis, QTP, Rational Functional Tester, WATIR, SilkTest)
Reference Books :	A. Software Engineering by R. Pressmen – 6th Ed B. Software Engineering by Sommerville C. Introducing Software Testing by Louise Tamres D. Effective Methods for software Testing by William Perry E. Software Testing in Real World by Edward Kit F. Software Testing Techniques by Boris Beizer

Subject Title		**Advance Data Communication and Networks**			
Subject Ref. No.		**MANC-508**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe basics of Networking and all switching techniques.
CO-2	Possess knowledge of components of Common network architecture and LAN.
CO-3	Understand working of TCP/IP and OSI reference model and IPV4 and IPV6 And difference between the two.
CO-4	Describe various terms associated with broad Band Networks.
CO-5	Have knowledge of basic terms of HTTP Communication and Network Applications.
CO-6	Make presentations on latest-in-market technology in networking.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1		**X**		**X**					**X**	
CO-2		**X**		**X**					**X**	
CO-3		**X**		**X**					**X**	
CO-4		**X**		**X**					**X**	
CO-5		**X**		**X**					**X**	
CO-6		**X**		**X**					**X**	
AVG		**X**		**X**					**X**	

Prerequisites	Basic information regarding networking.
Unit I	**Introduction to Networking:** Hardware Architecture:- Topologies, Media, Devices Transmission Techniques:-Twisted Pair, Coaxial Cable, Fiber Optics, Wireless Transmission Switching: - Circuit Switching, Message Switching, Packet Switching
Unit II	**Common Network Architecture:** Connection oriented N/Ws, Connectionless N/Ws , P2P, X.25, ATM, Virtual Circuits, Wi-Fi, modes **Local Area Networks:** Components & Technology , Access Technique Transmission Protocol & Media, Ethernet
Unit III	**The OSI Reference Model:** Protocol Layering, TCP/IP Model, OSI vs TCP/IP , IPV4, IPV6, Sliding window protocol
Unit IV	**Broad Band Networks** Integrated Service Digital Networks (ISDN), Broad Band ISDN, ATM, ATM Traffic Management, Introduction to Very Small Aperture Terminal(VSAT)
Unit V	**Network Applications (HTTP, Email, etc)** **Hyper Text Transfer Protocol (HTTP)** **HTTP communications**: - HTTP request, Request Headers, Responses, Status Code, Error Status Code Email : Sending & Receiving Emails, Email Addressing, Message Structure MIME – Multipurpose Internet Mail Extensions SMTP – Simple Mail Transfer Protocol with Examples Mail Exchangers – Delivering a message, Mail Boxes POP – Post Office Protocol IMAP – Internet Message Access Protocol FTP – File Transfer Protocol Telnet – Remote Communication Protocol, Proxy Server, Proxy Web Servers
Text Books	1. Computer Networks , Abndrew S. Tanenbaum 4e
Reference books	1. Internetworking Technology Handbook , CISCO System 2. Introduction to Networking and Data Communications, Eugene Blanchard 3. Computer Networks and Internets with Internet Applications, Douglas E. Comer 4. Firewalls and Internet Security, William R. Cheswick
Web References	

Subject Title :	**Object Oriented Analysis And Design**		
Subject Ref. No.	**MANC509**	No. of Credits:	04
No. of Periods/Week	:		04
Assignments/Sessional	:		20%
Semester Exam.	:		80%

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Design UML diagrams as Class, sequence, use case, activity, component, deployment, state.
CO-2	Understand object oriented methodologies.
CO-3	Generate the documentation associated with SDLC using UML.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**				**X**		
CO-2	**X**									
CO-3	**X**			**X**				**X**		
AVG	**X**			**X**				**X**		

Prerequisite :	Students must have knowledge of Software development life cycle.
Unit –I :	**1A) Two views of software Developments:** SSAD and OOAD. Why Object –Orientation? **1B) Object Oriented Methodologies** Object Oriented Design -Booch Object Modeling Techniques - Rumbaugh Object – Oriented Analysis - Cood Yourdon Object – Oriented Software engineering – Ivar Jacobson Unified Approach

Unit –II :	**Object-Oriented Systems Development Process** 2.1 Rational Unified Process - Four Major phases:- Inception ,Elaboration, Construction, Transition Requirements Engineering Problem analysis. Understanding Stockholders need Type of requirements. Use-case Model: Writing Requirements
Unit –III :	**Analysis** 3.1 Behavioral Analysis 3.2 Domain Analysis or Business Object Analysis 3.3 Use-case Driven Object Oriented analysis The UML approach. 3.3.1 Develop use-case Model 3.3.2 Use-case Description 3.3.3 Documentation 3.3.4 Activity Diagram 3.4 Identify the classes. 3.4.1 Introduction to different approaches for identifying classes 3.4.2 “Noun Phrase” approach OR 3.4.3 “Conman Class Pattern” approach Or 3.4.4 “CRC” approach Or 3.4.5 Use case Driven Approach. 3.5 Containment and Composition 3.6 Aggregation 3.7 Inheritance, Subtypes and IS-A Hierarchies. 3.8 Association and Link Relationships. 3.9 Diagramming System Events.
Unit – IV :	**Design Phases** 4.1 Translating Analysis Concept into Design. 4.2 Optimizing classes and Objects: The Multi-tiered Architecture View 4.3 Mapping System functions to objects. 4.4 Objects-to-Object Visibility. 4.5 Collaboration Diagram 4.6 Sequential Diagram 4.7 Specification Class Diagram 4.8 State Transition Diagram 4.9 Designing the Data Access layer. 4.10 Design User Interface layer 4.11 Designing System Interfaces, Controls and Security.
Unit – V :	**Implementation** 5.1 Component diagram 5.2 Deployment diagram **Patterns** 5.3 Benefits of patterns. 5.4 Using patterns During Analysis. 5.5 Using Pattern During Design

Text Books :	1. Object Oriented Analysis and Design with Applications - Grady Booch., Benjamin / Cummings , 1994. 2. Object – Oriented Modeling and Design - J Rumbaugh, M Blaha, W .Premerlani
Reference Books :	1. Principles of Object- Oriented Software Development - Anton Eliens , Addison Wesley. 2. Object Oriented System Development - Ali Bahrami McGRAW-HILL International Edition. 3. Object-Oriented Software Engineering - Ivar Jacobson Pearson Education INC 4. Applying UML And Pattern - Craig Larman Pearson Education INC 5. UML Distilled - Martin Flowler Pearson Education INC 6. The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, Ivar Jacobson-Pearson Education INC 7. The Unified Modeling Language Reference Guide - Grady Booch, James Rumbaugh, Ivar Jacobson-Pearson Education INC 8. Design Object- Oriented Software - Rebecea Wrifs - Brock. Brian Wilkerson, Lauren Wiener 9. Object Oriented Analysis and Design - Bennett , Simon McGraw Hill. 10. Designing Flexible Object Oriented System with UML - Charless Richter, Techmedia 11. Instant UML – Muller – Apress LP 12. UML Instant – Thomas A Pendar – Wiley Publication 13. UML in Nutshell

Subject Title	**:**	**Practical Based on MANC509**			
Subject Ref. No.	**:**	**MANC556**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	10
			External	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Implement the UML tools such as STAR UML for drawing UML diagrams.
CO-2	Use the STAR UML tools along with different features & functionalities offered by the software.
CO-3	Design UML diagrams as Class, sequence, use case, activity, component, deployment, state.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**				**X**		
CO-2	**X**			**X**				**X**		
CO-3	**X**			**X**				**X**		
AVG	**X**			**X**				**X**		

Content	**:**	Assignment containing CASE study on UML diagrams will be covered.

Subject Title		**Linux Administration and Server Configuration**			
Subject Ref. No.		**MANC510**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester End Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understanding the basic set of commands and utilities in Linux/UNIX systems.
CO-2	To learn to develop software for Linux/UNIX systems
CO-3	To learn the important Linux/UNIX library functions and system calls
CO-4	To understand the inner workings of UNIX-like operating systems
CO-5	To Design live server.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3			**X**							
CO-4			**X**							
CO-5			**X**							**X**
AVG	**X**		**X**							**X**

Pre Requisite		Operating System Concepts, Windows Platform
Unit – I		**Introduction:** Basic Linux System Concepts, GNU, Free Software, and Open Source Software, Open Source Software Licenses, Distributions of Linux O.S, Installing Ubuntu, The GNOME Desktop, Linux Commands
Unit – II		**Managing the basics:** User Administration, Linux File-System Administration, File Permissions, and Networking Management.
Unit – III		**Software Installation**: The Package Management, Vi/Vim Editor, Regular Expressions. Open SSH Server, VNC Server, Installation of Python.

Unit – IV		**Server Configuration**: FTP Server, NFS Server, Samba Server, HTTP/Apache Server, DNS Server, DHCP Server, Mail Server, And Database Server: MySQL.
Unit – V		**Maintenance** : Backing Up and Restoring Files, Security and Firewall, Monitoring
Text Books		1. "Ubuntu Server Guide" by UBUNTU LTD.
Additional Reference Books		1. Online Free books available for UBUNTU

Subject Title		**Practical Based on MANC510**			
Subject Ref. No.		**MANC557**	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester End Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understanding the basic set of commands and utilities in Linux/UNIX systems.
CO-2	To learn to develop software for Linux/UNIX systems
CO-3	To learn the important Linux/UNIX library functions and system calls
CO-4	To understand the inner workings of UNIX-like operating systems
CO-5	To Design live server.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3			**X**							
CO-4			**X**							
CO-5			**X**							**X**
AVG	**X**		**X**							**X**

Subject Title	**:**	**Project**			
Subject Ref. No.	**:**	**MANC561**	**No. of Credits**	**:**	4
			No. of Periods / Week	**:**	4
			Internal	**:**	20
			External	**:**	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide.

OPEN ELECTIVE COURSE : GROUP B

Subject Title		**Advanced JAVA**			
Subject Ref. No.		**MANC524**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Develop Swing-based GUI application & understand the real application of Collections in Software Development
CO-2	Develop the server side programming using Servlet
CO-3	Connect the server side database and its implementation in client server terminology using JDBC
CO-4	Develop client/server application and TCP/IP socket programming using Networking Technology
CO-5	Develop component-based Java software using JavaBeans
CO-6	Develop distributed applications using Remote Method Invocation

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X				X		
CO-2	X			X				X		
CO-3	X			X				X		
CO-4	X			X				X		
CO-5	X			X				X		
CO-6	X			X				X		
AVG	X			X				X		

Prerequisites	Concepts of OOPs and Core JAVA
Unit I	SWINGS : introduction , JApplet , JFrame, Jcomponent , Labels, TextFields, Buttons, Check Boxes, Radio Buttons, Combo Boxes, Tabbed Panes, Scroll Panes, Tree, Tables, GenericProgramming : class, methods bounds for type variable , generic code and the virtual machine, translating generic expressions and methods, calling legacy code, restrictions and limitations , Inheritance rules for Generic type, wildcard types , reflection and generic
Unit II	COLLECTION : collection interfaces , concrete collections : Linked List, Array List, Hash Sets, Tree Sets. NETWORKING : introduction, Socket Overview, Client/Server, InetAddress class, TOP-UP socket : Socket, Server Socket, Datagrams, Address indetifiers , URL connection
Unit III	JDBC: Overview, who and why JDBC, JDBC architecture JDBC API, Types of JDBC Drivers, JDBC basic –java Database connectivity steps, Test JDBC driver Installation, Test JDBC connection, JDBC driver name and version, JDBC create table JDBC insert Data into SQL Tables, JDBC select data, JDBC update Data.
Unit IV	SERVLETS: What is servlets, advantages servlets over traditional CGI , Basic structure of servlets, A simple servlets generating plain text, computing, and installing the servlet, running servlet interface and life cycle. Request and response Objects, Request onto, , A servlet that Generates HTML, Simple HTML building utilities, cookies , The servlet cookies API, generating cookies , reading cookies from client , some minor cookies utilities, session tracking , the session tracking API, associating the information with a session
Unit V	JAVA RMI :overview, The RMI architecture , Operation on an RMI distributed system summary, Note on code mobility, writing RMI services , writing a RMI client , developing of RMI.
Text Book	1. Core Java Vol 2 Advanced Features by Cay Horstmann, Gary Cornell 2. Head First Java by Kathy Sierra & Bert Bates

	3. The Complete Reference –J2EE Jim Keogh
Reference Books	1. Swing a Beginner's Guide by Herbert Schildt 2. An Introduction to object-oriented programming with JAVA by C. Thomas WU 3. Graphic JAVA Mastering the JFC-David Geary 4. Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam Second Edition by Bryan Basham (Author), Kathy Sierra (Author), Bert Bates (Author) 5. Murach's Java Servlets and JSP, 3rd Edition (Murach: Training & Reference) 3rd Edition by Joel Murach (Author), Michael Urban (Author

Subject Title		**Practical Based on MANC524**			
Subject Ref. No.		**MANC558**	**No. of Credits**		2
			No. of Periods / Week		2
			Semester Examination		50

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Develop Swing-based GUI application & understand the real application of Collections in Software Development	
CO-2	Develop the server side programming using Servlet	
CO-3	Connect the server side database and its implementation in client server terminology using JDBC	
CO-4	Develop client/server application and TCP/IP socket programming using Networking Technology	
CO-5	Develop component-based Java software using JavaBeans	
CO-6	Develop Distributed Applications using Remote Method Invocation	

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**				**X**		
CO-2	**X**			**X**				**X**		
CO-3	**X**			**X**				**X**		
CO-4	**X**			**X**				**X**		
CO-5	**X**			**X**				**X**		
CO-6	**X**			**X**				**X**		
AVG	**X**			**X**				**X**		

Prerequisites	Concepts of OOPs and Core JAVA	
	SWING	
Unit I	1.	WAP to create Login Validation form using JButton , JLabel, JTextField ,JPasswordField and ActionOperformed & KeyPressedListeners
	2.	WAP to create Arithmetic operation GUI form using JButton , JLabel & ActionOperformed Listener
	3.	WAP to demonstrate the use of JTextArea control with its methods.
	4.	WAP to create JCheckBox and implement ItemListener interface
	5.	WAP to create a application of multiple JCheckBox with ItemListener
	6.	WAP to demonstrate the use of JRadioButton control with JOptioPane & ActionListener Interface
	7.	WAP programto create JOptionPane with showMessageDialog, showInputDialog, showConfirmationDialog.
	8.	WAP to create a JScrollBar with AdjustmentListener
	9.	WAP to create a note application using JMenubar, JMenu, JMenuItem & ActionListener
	10.	WAP to create JPopupMenu withMouseListener & ActionListener
	11.	WAP to create JCheckBoxMenuItem & JSeparator using ActionListener
	12.	WAP to create JProgressBar & JScrollBar with all methods.
	13.	WAP to create JTable, JTree & JSlider with all methods.
	14.	WAP to create JColorChooser with ActionListener.
	15.	WAP to demonstrate use of JFileChooser control in Swing
	16.	WAP to demonstrate all LayoutManagers in swing
	17.	Demonstration of other controls available in swing
Unit II	**JDBC**	
	18.	WAP to create JDBC Connection Type-1 (JDBC-ODBC bridge driver)
	19.	WAP to create JDBC Connection Type-2 (Native-API driver (partially java drive
	20.	WAP to create JDBC Connection Type-3 (Network Protocol driver (fully java driver)

	21.	WAP to create JDBC Connection Type-4 (Thin driver (fully java driver)
	22.	WAP to implement Statement Interface in JDBC. (Insert, Delete, update and Display the records from oracle table)
	23.	WAP to implement PreparedStatement Interface in JDBC. (Insert, Delete, update and Display the records from oracle table)
	24.	WAP JDBC program to write & read a BLOB and CLOB to Table
	25.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for IN parameter
	26.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for OUT parameter
	27.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for INOUT parameter
	28.	WAP to demonstrate the CollableStatment Interface to retrieve the function from SQL.
	29.	WAP to demonstrate how to get primary key value(Auto generated keys) from inserted queries using JDBC
	30.	WAP for CallableStatement statement with batch execution.
	31.	WAP to execute SQL cursor using CallableStatement Interface.
	32.	WAP to demonstrate the batch update using Statement Interface.
	33.	WAP to demonstrate the batch update using PreparedStatement Interface.
	34.	Write an example for scrollable result set with read only mode.
	35.	WAP to get JDBC Connection object using properties file.
Unit III	**Servlet**	
	36.	WAP to print a Welcome Message in servlet using Serlvet Interface
	37.	WAP to print a Welcome Message in servlet using GenericServlet class
	38.	WAP to print a Welcome Message in servlet using HttpSerlvet Class
	39.	WAP to retrieve the Client Input Data in Servlet using getParameter()
	40.	WAP to retrieve the Client Input Data in Servlet using getParameterValues()
	41.	WAP to retrieve the Client Input Data in Servlet using getParameterNames()
	42.	WAP to demonstrate the application of ServletConfig Interface.

	43.	WAP to demonstrate the application of ServletContext Interface.
	44.	WAP to connect servlet to database.
	45.	WAP to create login Application using JDBC concept.
	46.	WAP that demonstrate the implementation of RequestDispatcher Interface..
	47.	WAP to demonstrate the difference between forward() & sendRedirect() method
	48.	WAP to demonstrate the difference types of attributes in Servlet i.e. request scope, session scope & application scope.
	49.	WAP to demonstrate how session tracking can be achieve by Cookies
	50.	WAP to create a Login & Logout application using Cookies.
	51.	WAP to demonstrate how session tracking can be achieve by Cookies
	52.	WAP to create a Login & Logout application using Cookies.
	53.	WAP to demonstrate how session tracking can be achieve by Hidden Form Field
	54.	WAP to create a Login & Logout application using Hidden Form Field.
	55.	WAP to demonstrate how session tracking can be achieve by URL rewriting
	56.	WAP to demonstrate how session tracking can be achieve by HttpSession.
	57.	WAP to create a Login & Logout application using **HttpSession**.
	58.	WAP to demonstrate CRUD implementation in Servlet.
Unit IV	**Collection & Networking in JAVA**	
	59.	WAP to add the elements in collection object.
	60.	WAP to demonstrate all methods of Collections class.
	61.	WAP to demonstrate the use of Enumeration Cursor in Collection.
	62.	WAP to demonstrate the use of Inte WAP to perform all operations of ArrayList & iterate it.rator Cursor in Collection.
	63.	WAP to demonstrate the use of ListInterator Cursor in Collection.
	64.	WAP to perform all operations of ArrayList & iterate it.
	65.	WAP to perform all operations of LinkedList & iterate it.
	66.	WAP to perform all operations of Stack & iterate it.
	67.	WAP to perform all operations of Vector & iterate it.

	68.	WAP to perform all operations of LinkedHashSet & iterate it.
	69.	WAP to perform all operations of TreeSet & iterate it.
	70.	WAP to perform all operations of Queue & PriorityQueue and iterate it.
	71.	WAP to perform all operations of Deque & ArrayDeque and iterate it.
	72.	WAP to perform all operations of Map Interface & iterate it.
	73.	WAP to perform all operations of HashMap Interface & iterate it.
	74.	WAP to perform all operations of LinkedHashMap Interface & iterate it.
	75.	WAP to perform all operations of TreeMap Interface & iterate it.
	76.	WAP to perform all operations of HashTable Interface & iterate it.
	77.	WAP to perform natural sorting using Comparable Interface.
	78.	WAP to perform customize sorting using Comparator Interface.
	79.	WAP to create a URL.
	80.	WAP to create a File URL.
	81.	WAP to create a URL object with all propertirs.
	82.	WAP to get URL Properties.
	83.	WAP to get URL object with relative path .
	84.	WAP to read URL content, encode & decode URL content.
	85.	WAP to get machine IP address, IP address of host, host name by IP address, machine host name .
	86.	WAP to get all IP address of a Host
	87.	WAP to create Connection Oriented client server application using ServerSocket & Socket
	88.	WAP to create Connection Oriented client server chatting application using ServerSocket & Socket
	89.	WAP to create Connection less client server application using DatagramSocket & DatagramPocket
Unit V	**Remote Method Invocation**	
	90.	WAP to create RMI application using Remote
Text Book	4. Core Java Vol 2 Advanced Features by Cay Horstmann, Gary Cornell 5. Head First Java by Kathy Sierra & Bert Bates 6. The Complete Reference –J2EE Jim Keogh	

Reference Books	6. Swing a Beginner's Guide by Herbert Schildt 7. An Introduction to object-oriented programming with JAVA by C. Thomas WU 8. Graphic JAVA Mastering the JFC-David Geary 9. Head First Servlets and JSP: Passing the Sun Certified Web Component Developer Exam Second Edition by Bryan Basham (Author), Kathy Sierra (Author), Bert Bates (Author) 10. Murach's Java Servlets and JSP, 3rd Edition (Murach: Training & Reference) 3rd Edition by Joel Murach (Author), Michael Urban (Author
Websites	1. https://docs.oracle.com 2. https://www.javatpoint.com/java-swing 3. https://www.tutorialspoint.com 4. https://beginnersbook.com 5. https://www.studytonight.com 6. https://www.guru99.com

Subject Title		**C Sharp**			
Subject Ref. No.		**MANC525**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Learn about MS.NET framework developed by Microsoft.
CO-2	Implement the XML in C#.NET specifically ADO.NET and SQL server.
CO-3	understand use of C# basics, Objects and Types, Inheritance & develop, implement and creating Applications with C#.
CO-4	develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web
CO-5	understand and be able to explain Security in the .NET framework and Deployment in the .NET.
CO-6	develop Assemblies and Deployment in .NET, Mobile Application Development

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X				X	X	
CO-2	X			X				X	X	
CO-3	X			X				X	X	
CO-4	X			X				X	X	
CO-5	X			X				X	X	
CO-6	X			X				X	X	
AVG	X			X				X	X	

Prerequisites	C Programming, Knowledge of object-oriented programming would be an advantage
Unit I	**Introduction/Overview of .Net :** Introduction to .Net ,Platform for the .Net, Drawbacks of Current Trend, Net Framework – BCL & CLR l Key design goals, CLR, CTS, MSIL & other tools. Multiple Language , Interaction & support l Moving from Project to Assemblie , Security in .NET – CAS. **.Net Framework [Advanced] :** Advantages/Disadvantages , Features of .Net, Assemblies in Detail, GAC, Strong Names , Language Interop. Reflection. **Visual C#.Net Language :**Advantages/Disadvantages , Why C#/ Why Not C#, Where does C# Fit in, C, C++ to Visual C#, Features of C#, .NET Namespaces. **.Net Installations/C#.Net :** .NET Versions – 1.1/2.0/3.0/3.5 Beta, Visual Studio.NET , 2003/2005/Orcas/2008, Windows Vista – New Look, Gadgets/SideBars/UAC – relation with .NET, Hardware/Software Requirements, FAQ's with detailed answers. **Programming Using Visual C#.Net :** The start of the application, C#.Net Program Design, Variables and types, Value types and reference types (CTS), Strings and arrays, The Console class, String formatting, Statements and flows, Programming Structures, Command-line arguments, VS.NET to Create C#.NET Apps, C# 3.0/3.5 features – Implicit types , Extention Methods and more
Unit II	**Introduction To Windows Forms – I :** Windows forms library – WinForms, Layout Enhancements, Forms and controls – Hierarchy, Creating simple GUI by hand, Event handling, Basic controls, Windows forms – buttons, check boxes, radio buttons, panels, group boxes, list boxes, picture boxes. **Windows Forms – II :** Menus, Built-in dialog boxes and printing, Extender Controls, ToolStrips, StatusStrips and progress bars, A new MDI forms strategy, Inheritance with forms, New Controls – Web Browser, Property Grid etc. **Object Oriented Concepts (Basic) :** Classes & objects, Abstract & override methods, Creating and using your own classes l Data members and member methods l Instantiate an object, This keyword, Properties – Read Only Write Only…, Build process using windows class library l Generate classes for other clients, How to use classes as part of project, **Object Oriented Concepts (Advanced):** Accessibility levels, specifiers, Constructors, Method overloading, Class (static) variables & methods, Object destruction, 'ref' and 'out' parameters, Constant values, Enumerations, Inheritance and Polymorphism, The root of all classes, Creating derived classes, Method overriding and hiding, Polymorphism and virtual functions, Casting objects, Abstract classes, Sealed classes, Static classes. **Object Oriented Concepts (Implementation Oriented) :** Case Studies, Class Diagram in VS.Net, Refactoring & others, FAQ's

Unit III	**Error Handling :** Unstructured error handling support, Structured error handling, Error categories, Debugging the application, Debug and Trace classes, Code Optimization, Testing and strategies.**Ado.Net 1.1/2.0/LINQ :** History and background, From DAO to ADO.NET, ADO.NET LINQ, ADO.NET design goals, The ADO.NET architecture and its components, ADO.NET in relation to the other .NET tools, DataSet in RealTime Scenarious. **ADO.Net Components :** Connected and disconnected environment, ADO.NET object model, Data sources, providers and connections, Commands and data readers, Data sets and data adaptors, Data tables, rows and columns, Constraints and relations, Data-centric applications – New ADO.Net Hierarchy. **Data Sources And .Net Data Providers:** Connecting to a data source, SQL Server .NET data provider, OLE-DB .NET data provider, Connections and connection strings, SQL-Server integrated security, Connection pooling, ADO.NET exceptions. **Accessing Data In The Connected Environment :** Commands, Creating and executing commands, Reading data using a data reader, Batch queries & single result queries, Parameterised queries (input & output parameters), Adding, editing and deleting data, Stored procedures
Unit IV	**Accessing Data In Disconnected Environment :** Why using a disconnected environment? DataSet and DataAdapter features. Filling data sets using data adapters. Read data using data tables, rows and columns, Batch queries and data sets, Visual Studio Data Menu & tools, DataSet Navigation, DataSet Functionality, DataSet Optimistic Concurrency. **Sorting, Searching And Filtering:** Searching in data sets, Find on primary keys, Searching on any column, Searching on row state, Wildcard searches, Sorting and filtering using data views, Searching in a data view .**Live Case Study and Implementation Of ADO.NET in N-Tier :** Client Server Basics, N-Tier – Classical and New, N-Tier importance w.r.t other .Net technologies, Build User Interface Layer – importance, Business Layer in N-Tier – advantages & disadvantages, Data Access Layer – Generic/Specific Advantages, N-Tier DataBase Application, SQLHelper, CodeSmith etc tools awareness. **XML :** XML Basics – Importance in Todays world, XML designers/support in VS.NET, XML Derived Technologies – XSD ,XSL , SOAP ,WSDL **XML IN .NET :** System.Xml Namespace, Stream Model XML, XML DOM, XmlTextReader,TextWriter, XmlTextReader, TextWriterXMLDocument/ XmlDataDocumentClasses, Dom Objects – XMLNode/XMLNodeList, XPATH- Query Language for XML, DOM – Navigation & Access Case Studies
Unit V	**Creating Custom Windows Controls :** About user – defined controls, Understanding the control class with Container, Add Properties/Methods/Events to Control, Pack & use control in other windows applications, Create & implement a windows control.

	Windows Services: Understanding services, Creating windows services, Setting properties, Compile, run & install services, Event log services. **.Net Remoting :** About Distributed Applications, COM/DCOM in Distributed Environment, Drawbacks of DCOM, .NET Remoting – New distributed environment, Advantages & Disadvantages, Remoting – Web Services comparisons, MBR, MBV, Channels, Formatters, Programming Model – Object Styles & Lifestyles, Activation, Case Study – Implementation using Remoting. **Crystal Reports:** Reporting Need in the application, Crystal Reports – Reporting Tool, Different Versions of Crystal Reports, Developing a Crystal Report, Different ways to Invoke/Deploy Crystal Reports. **Application Deployment :** Packaging Code, ClickOnce Deployment,Configuring the .Net framework, Deploying the application in Web Server, Deployment – other methods.
Text Book	1. Head First C#: A Learner's Guide to Real-World Programming with C#, XAML, and .NET 3rd Edition,Kindle Edition 2. Pro C# 5.0 and the .NET 4.5 Framework (Expert's Voice in .NET) 6th ed. Edition, Kindle Edition by Andrew Troelsen (Author) 3. C# in Depth, 3rd Edition Third Edition by Jon Skeet (Author) 4. Beginning ASP.NET 4.5 in C# (APRESS) Paperback – 2012 by Matthew MacDonald (Author)
Reference Books	1. Programming C# 5.0: Building Windows 8, Web, and Desktop Applications for the .NET 4.5 Framework 1st Edition, Kindle Edition by Ian Griffiths (Author) 2. MCSD Certification Toolkit (Exam 70-483): Programming in C# 1st Edition by Tiberiu Covaci (Author), Rod Stephens (Author), Vincent Varallo (Author), Gerry O'Brien (Author)
Website	http://www.learncs.org/ https://www.w3schools.com https://www.tutorialspoint.com www.tutorialsteacher.com/csharp https://www.javatpoint.com/

Subject Title		**Practical Based on MANC525**			
Subject Ref. No.		**MANC559**	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Learn about MS.NET framework developed by Microsoft.
CO-2	Implement the XML in C#.NET specifically ADO.NET and SQL server.
CO-3	understand use of C# basics, Objects and Types, Inheritance & develop, implement and creating Applications with C#.
CO-4	To develop, implement, and demonstrate Component Services, Threading, Remoting, Windows services, web
CO-5	To understand and be able to explain Security in the .NET framework and Deployment in the .NET.
CO-6	To develop Assemblies and Deployment in .NET, Mobile Application Development

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X				X	X	
CO-2	X			X				X	X	
CO-3	X			X				X	X	
CO-4	X			X				X	X	
CO-5	X			X				X	X	
CO-6	X			X				X	X	
AVG	X			X				X	X	

Prerequisites	C Programming, Knowledge of object-oriented programming would be an advantage
Unit I	**Installation , Configuration and different programs on:**
Unit II	**Programs on :** Class, object, abstract class, static binding, dynamic binding, casting, access modifiers , Form designing, Menu designing , MDI form, Web Browser controls , property grid
Unit III	**Programs on :** Error Handling, dataset, Data Tables, Object Model, Database Connection & Constraints, Connection Pooling, Exception and String Manipulations
Unit IV	**Programs on :** DataSet, DataAdapter, Batch queries, DataSet Navigation, Sorting & Searching, Data Filtering
Unit V	**Programs on :** Windows Control, Windows Services, Event Log services , .net Remoting, web services, crystal report, deployment of application
Text Book	1. Head First C#: A Learner's Guide to Real-World Programming with C#, XAML, and .NET 3rd Edition,Kindle Edition 2. Pro C# 5.0 and the .NET 4.5 Framework (Expert's Voice in .NET) 6th ed. Edition, Kindle Edition by Andrew Troelsen (Author) 3. C# in Depth, 3rd Edition Third Edition by Jon Skeet (Author) 4. Beginning ASP.NET 4.5 in C# (APRESS) Paperback – 2012 by Matthew MacDonald (Author)
Reference Books	1. Programming C# 5.0: Building Windows 8, Web, and Desktop Applications for the .NET 4.5 Framework 1st Edition, Kindle Edition by Ian Griffiths (Author) 2. MCSD Certification Toolkit (Exam 70-483): Programming in C# 1st Edition by Tiberiu Covaci (Author), Rod Stephens (Author), Vincent Varallo (Author), Gerry O'Brien (Author)
Website	http://www.learncs.org/ https://www.w3schools.com https://www.tutorialspoint.com www.tutorialsteacher.com/csharp https://www.javatpoint.com/

Subject Title		**Data Mining**			
Subject Ref. No.		**MANC526**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Process raw data to make it suitable for various data mining algorithms and understand the different data mining tasks.
CO-2	Evaluate models/algorithms with respect to their accuracy & Demonstrate capacity to perform a self directed piece of practical work that requires the application of data mining techniques.
CO-3	Develop hypotheses based on the analysis of the results obtained and test them.
CO-4	Analysis the results of a data mining exercise.
CO-5	Discover and measure interesting patterns from different kinds of databases
CO-6	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X	X	X	X	X	X	X	X	X	
CO-2	X	X	X	X				X	X	
CO-3	X	X	X	X	X			X	X	
CO-4	X	X	X	X	X			X	X	
CO-5	X	X	X	X				X	X	
CO-6	X	X	X	X	X			X	X	
AVG	X	X	X	X				X	X	

Prerequisites	Students should have the basic knowledge of basics of Linear, Algebra, Probability and Statistics, and should be comfortable with programming. Basic knowledge of R software should be known for the primary analysis.
Unit I	***Overview of Data Mining***: background on data objects and statistical concepts. general classification of data-mining tasks. What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics Data Mining Goals , Stages of the Data Mining Process ,Data Mining Techniques , Knowledge Representation Methods , Applications , Example: weather data . ***Data Warehouse and OLAP*** : Data Warehouse and DBMS , Multidimensional data model , OLAP operations , Example: loan data set
Unit II	***Data preprocessing*** : Data cleaning , Data transformation , Data reduction , Discretization and generating concept hierarchies , Installing Weka 3 Data Mining System , Experiments with Weka - filters, discretization . ***Data mining knowledge representation :*** Task relevant data , Background knowledge , Interestingness measures , Representing input data and output knowledge , Visualization techniques , Experiments with Weka - visualization .
Unit III	***Attribute-oriented analysis*** : Attribute generalization ,Attribute relevance,,Class comparison , Statistical measures, Experiments with Weka - using filters and statistics, ***Data mining algorithms***: Association rules, Motivation and terminology, Example: mining weather data, Basic idea: item sets , Generating item sets and rules efficiently, Correlation analysis, Experiments with Weka - mining association rules, ***Data mining algorithms***: Classification , Basic learning/mining tasks, Inferring rudimentary rules: 1R ***algorithm***, Decision trees, Covering rules, Experiments with Weka - decision trees, rules
Unit IV	***Data mining algorithms***: Prediction, The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models, Experiments with Weka – Prediction. ***Evaluating what's been learned*** : Basic issues, Training and testing,

	Estimating classifier accuracy (holdout, cross-validation, leave-one-out), Combining multiple models (bagging, boosting, stacking), Minimum Description Length Principle (MLD), Experiments with Weka - training and testing. ***Mining real data*** : Preprocessing data from a real medical domain (patients with Hepatitis). Applying ***various*** data mining techniques to create a comprehensive and accurate model of the data.
Unit V	**Clustering** : Basic issues in clustering, First conceptual clustering system: Cluster/2, Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering, Conceptual clustering: Cobweb, Experiments with Weka - k-means, EM, Cobweb. ***Advanced techniques, Data Mining software and applications***: Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing). Bayesian approach to classifying text,Web mining: classifying web pages, extracting knowledge from the web, Data Mining software and applications.
Text Book	1. Han J & Kamber M, "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2011. 2. Data Mining and Business Analytics with R, Johannes Ledolter, Wiley, 2013, ISBN: 978-1118447147 (online access via Pitt network) (primary book, hereafter referred as "DMR") **3.** Data Mining: Concepts and Techniques Paperback – 2007, by Han
Reference Books	1. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (2nd ed.), Bing Liu, Springer, 2011, ISBN: 978-3642194597 (available online) (secondary book, hereafter referred as "WDM") 2. Practical Data Science with R, Nina Zumel and John Mount, Manning Publications 2014, ISBN: 9781617291562 (online access via Pitt network) (third book, hereafter referred as "DSR 3. Data Mining: Concepts and Techniques (The Morgan Kaufmann Series in Data Management Systems) 4. Data Warehousing & Data Mining PB Paperback – Jan 2013, by Singh M 5. Data Mining and Analysis Fundamental Concepts and Algorithms by Zaki & Meira (2014).
Websites	1. https://www.tutorialspoint.com/data_mining/index.htm 2. https://www.guru99.com/data-mining-tutorial.html 3. http://www.zentut.com/data-mining/

Subject Title		Practical Based on MANC526			
Subject Ref. No.		MANC560	No. of Credits		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Process raw data to make it suitable for various data mining algorithms and understand the different data mining tasks.
CO-2	Evaluate models/algorithms with respect to their accuracy & Demonstrate capacity to perform a self directed piece of practical work that requires the application of data mining techniques.
CO-3	Develop hypotheses based on the analysis of the results obtained and test them.
CO-4	Analysis the results of a data mining exercise.
CO-5	Discover and measure interesting patterns from different kinds of databases
CO-6	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X	X	X	X	X	X	X	X	X	
CO-2	X	X	X	X				X	X	
CO-3	X	X	X	X	X			X	X	
CO-4	X	X	X	X	X			X	X	
CO-5	X	X	X	X				X	X	
CO-6	X	X	X	X	X			X	X	
AVG	X	X	X	X				X	X	

Prerequisites	Students should have the basic knowledge of basics of Linear, Algebra, Probability and Statistics, and should be comfortable with programming. Basic knowledge of R software should be known for the primary analysis.
Unit I	Practical Experiments of Unit -I
Unit II	Practical Experiments of Unit -II
Unit III	Practical Experiments of Unit -III
Unit IV	Practical Experiments of Unit -IV
Unit V	Practical Experiments of Unit -V
Text Book	1. Han J & Kamber M, "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2011. 2. Data Mining and Business Analytics with R, Johannes Ledolter, Wiley, 2013, ISBN: 978-1118447147 (online access via Pitt network) (primary book, hereafter referred as "DMR") 3. Data Mining: Concepts and Techniques Paperback – 2007, by Han (Author)
Reference Books	6. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (2nd ed.), Bing Liu, Springer, 2011, ISBN: 978-3642194597 (available online) (secondary book, hereafter referred as "WDM") 7. Practical Data Science with R, Nina Zumel and John Mount, Manning Publications 2014, ISBN: 9781617291562 (online access via Pitt network) (third book, hereafter referred as "DSR 8. Data Mining: Concepts and Techniques (The Morgan Kaufmann Series in Data Management Systems) 9. Data Warehousing & Data Mining PB Paperback – 1 Jan 2013, by Singh M (Author). 10. Data Mining and Analysis Fundamental Concepts and Algorithms by Zaki & Meira (2014).
Websites	1. https://www.tutorialspoint.com/data_mining/index.htm 2. https://www.guru99.com/data-mining-tutorial.html 3. http://www.zentut.com/data-mining/

SEMESTER - V

Subject Title		**Software Project Management**			
Subject Ref. No.		**MANC-701**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Implement processes for successful resource, communication, and risk and change management.
CO-2	Conduct project planning activities that accurately forecast project costs, timelines, and quality.
CO-3	Understand the QA and QC activities and their conduction.
CO-4	Demonstrate effective project execution and control techniques that result in successful projects.
CO-5	Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders.
CO-6	Create documentation for ongoing project in semester based on given lessons.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X						
CO-2	X			X						
CO-3	X			X	X					
CO-4	X			X						
CO-5	X			X						
CO-6	X			X				X		X
AVG	X			X	X			X		X

Prerequisites	Students must have knowledge of SDLC
Unit I	Project Management Framework Overview of project Management Project Organization Planning a s/w project Project management life cycle Risk management Identification of Risks Risk Analysis Risk Planning & Monitoring
Unit II	S/w Project Estimation Project Estimation Different methods of estimation (COCOMO model, Delphi cost estimation etc.) Function point analysis Project Management Tools & Techniques PERT & Gantt Charts Introduction to Microsoft Project
Unit III	Software Quality Management & Testing Quality Assurance & Standards Quality Planning Quality control Role of testing in Software development Testing Procedure Defect Management
Unit IV	Configuration Management(CM) CM planning Change Management Version and Release Management Configuration Management Tools
Unit V	S/W Team Management Characteristics of Performance management High performance Directive and collaborative styles Team Structure Team Communication 98 Managing customer expectations Group Behavior Role of User in Projects User role in project management User role in various stages of S/W Development User role in System implementation
Text Books	1. Software Project management Edwin Bennatan 2. Software Engineering Roger S. Pressman
Reference books	1. Software Engineering concepts Richard Fairley 2. Software Project Management S.A. Kelkar 3. Software Engineering IAN Sommerville 4. System Analysis and Design Methods Whitten, Bentley and Dittman
Web References	

Subject Title		**Quantitative Aptitude**			
Subject Ref. No.		**MANC702**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		--
			Semester Examination		100

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	apply general mathematical models to solve a variety of problems
CO-2	solve problems and correctly arrive at meaningful conclusions regarding their answers.
CO-3	manipulate equations and formulas in order to solve for the desired variable.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3	**X**									
AVG	**X**									

Prerequisites	
Unit I	**Simple equations :** Definition of Linear Equations, Formation of simple equations, Problems on Ages, Fractions and Digits, Indeterminate system of equations, Special cases in indeterminate system of equations.
Unit II	**Ratio and proportion :** Definition of Ratio, Properties of Ratios, Comparison of Ratios, Problems on Ratios, Compound Ratio
Unit III	**Percentages :** Introduction, Converting a percentage into decimals, Converting a Decimal into a percentage, Percentage equivalent of fractions Problems on percentages, **Profit And Loss** : Problems on Profit and Loss percentage, Relation between Cost Price and Selling price, Discount and Marked Price, Two different articles sold at same Cost Price, Two different articles sold at same Selling Price, Gain%

	/ Loss% on Selling Price
Unit IV	**Partnership :** Introduction, Relation between capitals, Period of investments and Shares
Unit V	**Simple Interest :** Definitions, Problems on interest and amount, Problems when rate of interest and time period are numerically equal, **Compound Interest :** Definition and formula for amount in compound interest Difference between simple interest and compound interest for 2 years on the same principle and time period.
Text Books	1. GL Barrons, Mc Graw Hills, Thorpe's verbal reasoning, LSAT Materials 2. R S Agarwal, S Chand, 'Quantitative Aptitude' 3. Quantitative Aptitude - G. L BARRONS 4. Quantitative Aptitude - Abhijit Guha Mc Graw Hills
Reference books	
Web References	

Subject Title :	**Ethical Hacking**			
Subject Ref. No.	**MANC703**	No. of Credits	:	04
No. of Periods/Week			:	04
Assignments/Sessional			:	20%
Semester Exam			:	80%

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Understand basics of Ethical Hacking.
CO-2	Analyse different ways of hacking.
CO-3	Understand email, wireless hacking.

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**									
CO-2	**X**									
CO-3	**X**									
AVG	**X**									

Unit –I :	Introduction Networking Footprinting/Reconnaissance Google Hacking Scanning
Unit –II :	System Hacking: Win7 and Linux Android & iPhone Hacking Malwares SQL Injection Cross Site Scripting

Unit –III :	Sniffing Social Engineering Identity Theft Fraud Denial of Service Session Hijacking
Unit – IV :	Penetration Testing Exploit Writing & Buffer Overflow Cryptography & Steganography Firewalls & Honeypots IDS & IPS Hacking Web Server
Unit – V :	Wireless Hacking Physical Security Reverse Engineering Email Hacking Security Compliance and Auditing Incident Handling & Computer forensics
Reference Books :	1. Hacking by Harsh Bothra 2. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2ed 2011 by Dafydd Stuttard and Marcus Pinto 3. The Unrevealed Secrets of Hacking and Cracking - Hack Before You Get Cracked 2012 by Prateek Shukla and Navneet Mehra

Subject Title :	**Web Development Using PHP**		
Subject Ref. No.	**MANC704**	No. of Credits:	04
No. of Periods/Week	:		04
Assignments/Sessional	:		20%
Semester Exam.	:		80%

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write code for implementing basic concept of PHP as loops, conditions, arrays, strings.
CO-2	Connect the My Sql database with PHP for performing operations such as insert, update, delete, retrieve.
CO-3	Implement the concepts of COOKIES and SESSION handling using PHP.
CO-4	Write the programs using concepts of HTML + JAVASCRIPT + PHP + MYSQL.
CO-5	Design the Web portals to fulfill the requirements.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**	**X**		**X**	**X**	**X**	**X**
AVG	**X**			**X**	**X**		**X**	**X**	**X**	**X**

Prerequisite :	Students must have knowledge of HTML, JavaScript.
Unit –I :	**Introduction to PHP** PHP Basics

	Conditions and Branches Loops Variables and Arrays Strings
Unit –II :	**Form Handling** Dealing with functions Forms Super global variables Super global array A script to acquire user input Importing user input Accessing user input Combine HTML and PHP code Using hidden fields Redirecting the user File upload and scripts Delete a File
Unit –III :	**Cookies , Sessions and Authentication** Using Cookies in PHP Setting a cookie Accessing cookie Destroying Cookie HTTP Authentication Storing Username and Passwords Using Sessions Starting a session Ending a session Session Security
Unit – IV :	**Database Operations with PHP** Built-in Database Functions, Connecting to a MySQL, Selecting a Database, Building and Sending the Query to Database Engine, Retrieving , Updating and Inserting Data in database
Unit – V :	**Classes And Objects** Object oriented concepts Define a class Class attributes An Object Creating an object Object properties Object methods Object constructors and destructors Class constants Static method Class inheritance Abstract classes Final keyword Implementing Interface

	Object serialization Understanding Advance and New Checking for class and method existence Iterators
Reference Books :	1. *PHP and MySQL Web Development* by Luke Welling, and Laura Thomson 2. *PHP, MySQL, and JavaScript* by Robin Nixon 3. *PHP 6 and MySQL 5 for Dynamic Web Sites: Visual QuickPro Guide* by Larry Ullman 4. *PHP Cookbook* by Adam Trachtenberg, and David Sklar 5. PHP Object – Oriented Solution by David Powers 6. *Head First PHP & MySQL* by Lynn Beighley, and Michael Morrison 7. *Beginning PHP and MySQL* From Novice to Professional, Third Edition by W.J. Gilmore

Subject Title	**:**	**Practical Based on MANC704**			
Subject Ref. No.	**:**	**MANC751**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	10
			External	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write code for implementing basic concept of PHP as loops, conditions, arrays, strings.
CO-2	Connect the My Sql database with PHP for performing operations such as insert, update, delete, retrieve.
CO-3	Implement the concepts of COOKIES and SESSION handling using PHP.
CO-4	Write the programs using concepts of HTML + JAVASCRIPT + PHP + MYSQL.
CO-5	Design the Web portals to fulfill the requirements.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**	**X**		**X**	**X**	**X**	**X**
AVG	**X**			**X**	**X**		**X**	**X**	**X**	**X**

Content	**:**	Assignment based on the PHP & supporting languages will be covered.

Subject Title		**JSP (Java Server Page)**			
Subject Ref. No.		**MANC705**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Develop a web application using Servlet and Java Server Pages
CO-2	Implement server side validations with session
CO-3	Retrieve data effectively from database using JDBC
CO-4	Design reusable web application components using JavaBeans
CO-5	Create a well-structured MVC web application in JAVA & Deploy it
CO-6	Deploy web-based enterprise applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	**X**			**X**				**X**		
CO-2	**X**			**X**				**X**		
CO-3	**X**			**X**				**X**		
CO-4	**X**			**X**				**X**		
CO-5	**X**			**X**				**X**		
CO-6	**X**			**X**				**X**		
AVG	**X**			**X**				**X**		

Prerequisites	OOPs using Java, HTML basics , XML basics, Database Application, SQL

Unit I	***Development Environment*** Overview of IDE, Installation, Parts : Windows, Menus and Views, Workspace, Build - Compile - Run Project, ***Java EE*** Introduction: Java Programming, JRE, JVM, Java Platform, Enterprise Architecture: Definition, Objectives and Application, Types of Architecture Java EE: Features, Architecture, Container Types Configuration of Web server - Apache Tomcat Server ***Web Applications*****:** Introduction, Components, Web Architecture Models
Unit II	**Servlets :** Introduction, Features, Life Cycle, Anatomy of Servlet, ServletConfig and ServletContext Objects Servlet Request: HttpServletRequest, Handling Form Data, Reading Form Data, Reading Request Headers, Status Code Servlet Response: HttpServletResponse, Response Headers, Response Redirections, Auto Refresh **Cookies and Session :** Cookies: Introduction, Handling Cookies, Sending and Receiving Cookies, Using Cookie Attributes Session: Introduction, Session Tracking, Need for Session Tracking
Unit III	**JDBC :** Introduction, Architectures, Types of Drivers, Features, JDBC API, DriverManager, Connection, Statements, PreparedStatement, CallableStatement, ResultSet, DatabaseMetaData, ResultSetMetaData **JSP:** Features, Advantages over Java Servlet, Architecture, Life cycle, Comments, Expression, Scriplet, Declaration, Implicit Objects, Directives, Action Tags, Introduction to EL and EL Functions
Unit IV	**MVC Architecture :** MVC Architecture for Web Applications, RequestDispacher, Data Sharing between Servlet and JSP, Scope Variables, JavaBeans in JSP: <jsp:useBean>, <jsp:getProperty>, <jsp:setProperty> **JSTL** Tag Library - Basics, Using JSTL - c:out, c:forEach, c:forTokens, c:if, c:choose, c:set, c:remove, c:import, c:url, c:param, c:redirect and c:catch Tags
Unit V	**JAVA EE APIs** Struts Overview, Environment Configuration, Anatomy of Struts, Control Tags, Data Tags, Form Tags, Overview of Hibernate and Java Mail
Text Book	1. Title: Core Servlets and Java Server Pages Volume - 1, 2nd edition , Pearson Education, Author(s): Marty Hall, Larry Brown 2. Title: Core Servlets and Java Server Pages Volume - 2, 2nd edition , Pearson Education Author(s): Marty Hall, Larry Brown, Yaakov Chaikin

Reference Books	1. Title: The Complete Reference J2EE 5th Edition, Tata McGraw-Hill Edition Author(s): Jim Keogh Title: Java Server Programming, Java EE6, Black Book 2. Author(s): Dreamtech Press, Edition 2010. Title: Professional Java Server Programming, J2EE 1.3 Edition, Apress publications Authors: Subrahmanyam Allamaraju, Cedric Buest
websites	1. https://docs.oracle.com 2. https://www.javatpoint.com/java-swing 3. https://www.tutorialspoint.com 4. https://beginnersbook.com 5. https://www.studytonight.com 1. https://www.guru99.com

Subject Title		**Practical Based on MANC705**			
Subject Ref. No.		**MANC752**	**No. of Credits**		2
			No. of Periods / Week		2
			Semester Examination		50

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Develop a web application using Servlet and Java Server Pages
CO-2	Implement server side validations with session
CO-3	Retrieve data effectively from database using JDBC
CO-4	Design reusable web application components using JavaBeans
CO-5	Create a well-structured MVC web application in JAVA & Deploy it
CO-6	Deploy web-based enterprise applications

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X				X		
CO-2	X			X				X		
CO-3	X			X				X		
CO-4	X			X				X		
CO-5	X			X				X		
CO-6	X			X				X		
AVG	X			X				X		

Prerequisites	OOPs using Java, HTML basics , XML basics, Database Application, SQL

Unit I		***Development Environment & Web Application***
	1.	Practical to make an installation of JDK & Tomcat Apache and test the configuration of Apache Server with JDK
	2.	Practical to Install MyEclipse and Configure the additional library with MyEclipse IDE.
	3.	Practical to test configuration of Library with JDk with help of different programs
Unit II		**Servlets**
	4.	WAP to print a Welcome Message in servlet using Serlvet Interface
	5.	WAP to print a Welcome Message in servlet using GenericServlet class
	6.	WAP to print a Welcome Message in servlet using HttpSerlvet Class
	7.	WAP to retrieve the Client Input Data in Servlet using getParameter()
	8.	WAP to retrieve the Client Input Data in Servlet using getParameterValues()
	9.	WAP to retrieve the Client Input Data in Servlet using getParameterNames()
	10.	WAP to demonstrate the application of ServletConfig Interface.
	11.	WAP to demonstrate the application of ServletContext Interface.
	12.	WAP to connect servlet to database.
	13.	WAP to create login Application using JDBC concept.
	14.	WAP that demonstrate the implementation of RequestDispatcher Interface..
	15.	WAP to demonstrate the difference between forward() & sendRedirect() method
	16.	WAP to demonstrate the difference types of attributes in Servlet i.e. request scope, session scope & application scope.
	17.	WAP to demonstrate how session tracking can be achieve by Cookies
	18.	WAP to create a Login & Logout application using Cookies.
	19.	WAP to demonstrate how session tracking can be achieve by Cookies
	20.	WAP to create a Login & Logout application using Cookies.
	21.	WAP to demonstrate how session tracking can be achieve by Hidden Form Field
	22.	WAP to create a Login & Logout application using Hidden Form Field.

	23.	WAP to demonstrate how session tracking can be achieve by URL rewriting
	24.	WAP to demonstrate how session tracking can be achieve by HttpSession.
	25.	WAP to create a Login & Logout application using **HttpSession**.
	26.	WAP to demonstrate CRUD implementation in Servlet.
	27.	WAP to demonstrate the Filters in Servlet
Unit III	***JDBC & JSP***	
	28.	WAP to create JDBC Connection Type-1 (JDBC-ODBC bridge driver)
	29.	WAP to create JDBC Connection Type-2 (Native-API driver (partially java drive
	30.	WAP to create JDBC Connection Type-3 (Network Protocol driver (fully java driver)
	31.	WAP to create JDBC Connection Type-4 (Thin driver (fully java driver)
	32.	WAP to implement Statement Interface in JDBC. (Insert, Delete, update and Display the records from oracle table)
	33.	WAP to implement PreparedStatement Interface in JDBC. (Insert, Delete, update and Display the records from oracle table)
	34.	WAP JDBC program to write & read a BLOB and CLOB to Table
	35.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for IN parameter
	36.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for OUT parameter
	37.	WAP to demonstrate the CollableStatment Interface to retrieve the procedure for INOUT parameter
	38.	WAP to demonstrate the CollableStatment Interface to retrieve the function from SQL.
	39.	WAP to demonstrate how to get primary key value(Auto generated keys) from inserted queries using JDBC
	40.	WAP for CallableStatement statement with batch execution.
	41.	WAP to execute SQL cursor using CallableStatement Interface.
	42.	WAP to demonstrate the batch update using Statement Interface.
	43.	WAP to demonstrate the batch update using PreparedStatement Interface.
	44.	Write an example for scrollable result set with read only mode.

	45.	WAP to get JDBC Connection object using properties file.
	46.	Simple program of JSP in Note IDE and MyEclipse , compilation and execution
	47.	WAP to demonstrate the application of Scriptlet tag, Expression tag and Declaration tag
	48.	WAP to demonstrate the use of the out and request implicit object by using .html and .jsp file.
	49.	WAP to demonstrate the use of the response application implicit object by using .html , xml and .jsp file.
	50.	WAP to demonstrate the use of the session implicit object by using .html , xml and .jsp file.
	51.	WAP to demonstrate the use of the pageContext implicit object by using .html , xml and .jsp file.
	52.	WAP to demonstrate the use of the page implicit object
	53.	WAP to demonstrate the use of the exception implicit object
	54.	WAP to demonstrate the use of the JSp Page directive & attribute such as import , contentType
	55.	WAP to demonstrate the use of the JSp include directive.
	56.	WAP to demonstrate the use of the JSp Taglib directive.
	57.	WAP to demonstrate the use of errorPage and isErrorPage / <error-page> tag
	58.	WAp to demonstration implementation of Action Tag such as <jsp: forward> < Jsp:include>
	MVC	
Unit IV	59.	WAp to demonstration implementation of Action Tag such as <jsp: useBean> < Jsp:setProperty> < Jsp:getProperty> < Jsp:param>
	60.	WAP to demonstration implementation of Java Bean in JSP using getProprty amd setProperty tag.
	61.	WAP to demonstrate the application of Expression Language in JSP
	62.	WAP to demonstrate the JSTL library(out, set , if, choose, when foreach parameter)
	63.	WAP to implement MVC in JSP
Unit V	**Hibernate and Spring Introduction**	
	64.	Practical demo to configure hibernate jab library to MyEclipse

	65.	WAP to perform CRUD operation on SQL table
	66.	Configuration of Spring Library
	67.	WAP that demonstrate the Application of Spring in Dynamic Web Application
Text Book	3. Title: Core Servlets and Java Server Pages Volume - 1, 2nd edition , Pearson Education, Author(s): Marty Hall, Larry Brown 4. Title: Core Servlets and Java Server Pages Volume - 2, 2nd edition , Pearson Education Author(s): Marty Hall, Larry Brown, Yaakov Chaikin	
Reference Books	3. Title: The Complete Reference J2EE 5th Edition, Tata McGraw-Hill Edition Author(s): Jim Keogh Title: Java Server Programming, Java EE6, Black Book 4. Author(s): Dreamtech Press, Edition 2010. Title: Professional Java Server Programming, J2EE 1.3 Edition, Apress publications Authors: Subrahmanyam Allamaraju, Cedric Buest	
websites	6. https://docs.oracle.com 7. https://www.javatpoint.com/java-swing 8. https://www.tutorialspoint.com 9. https://beginnersbook.com 10. https://www.studytonight.com 2. https://www.guru99.com	

Subject Title	**:**	**In-plant Training Project**			
Subject Ref. No.	**:**	**MANC756**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	50
			External	**:**	-

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide. OR

Students may join any IT company for the duration of inplant and work on the live projects running in the companies. They get better understanding of technology usage, communication within team.

Subject Title	**:**	**Project**			
Subject Ref. No.	**:**	**MANC757**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	10
			External	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
AVG	**X**			**X**			**X**	**X**	**X**	

A Collaborative approach is taken in which all the students of MCA – I, II & III year are divided into several teams. Social requirement will be fulfilled by these teams using different technologies under the guidance of faculty or guide.

OPEN ELECTIVE COURSE :GROUP C

Subject Title :	**Android Development**			
Subject Ref. No.	**MANC721**	No. of Credits	:	04
No. of Periods/Week			:	04
Assignments/Sessional			:	20%
Semester Exam.			:	80%

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write code for implementing concept of Android as different layouts, Services, components, activities
CO-2	Design User interface using Menus, labels, text control, button control, toggle button, images etc.
CO-3	Write the programs using concepts of JAVA + SQLite
CO-4	Write the programs using concepts of JAVA + PHP + MYSQL.
CO-5	Write programs for handling Bluetooth, camera, GPS services.
CO-6	Design Android applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**						
CO-6	**X**			**X**	**X**		**X**	**X**	**X**	**X**
AVG	**X**			**X**	**X**		**X**	**X**	**X**	**X**

Prerequisite :	Experience in Object Oriented programming language, Knowledge in XML

	format
Unit –I :	**1) Introduction To Mobile Apps** I. Why we Need Mobile Apps II. Different Kinds of Mobile Apps III. Briefly about Android **2) Introduction Android** I. History Behind Android Development II. What is Android? III. Pre-requisites to learn Android IV. Brief Discussion on Java Programming **3) Android Architecture** I. Overview of Android Stack II. Android Features III. Introduction to OS layers **4) Deep Overview in Android Stack** I. Linux Kernel II. Libraries III. Android Runtime IV. Application Framework V. Dalvik VM **5) Installing Android Machine** I. Configuring Android Stack II. Setting up Android Studio III. Working with Android Studio IV. Using Older Android Tools
Unit –II :	**1) Creating First Android Application** I. Creating Android Project II. Debugging Application through DDMS III. Setting up environment IV. AVD Creation V. Executing Project on Android Screen **2) Android Components** I. Activities II. Services III. Broadcast Receivers IV. Content Providers **3) Hello World App** I. Creating your first project II. The manifest file III. Layout resource IV. Running your app on Emulator
Unit –III :	**1) Building UI with Activities** I. Activities II. Views, layouts and Common UI components III. Creating UI through code and XML IV. Activity lifecycle

	V. Intents VI. Communicating data among Activities **2) Advanced UI** I. Selection components (GridView, ListView, Spinner) II. Adapters, Custom Adapters III. Complex UI components IV. Building UI for performance V. Menus VI. Creating custom and compound Views **3) Notifications** I. Toast, Custom Toast II. Dialogs III. Status bar Notifications
Unit – IV :	**1) Working with Database** I. SQLite Introducing SQLite SQLiteOpenHelper and creating a database Opening and closing a database Working with Inserts, updates, and deletes operations II. PHP + MySql Introduction to basic PHP & MySql Connectivity Using PHP code with Android Performing insert, delete, update, view operations on MySql Database
Unit – V :	**1) Camera** I. Taking pictures II. Media Recorder III. Rendering previews **2) Bluetooth** I. Controlling local Bluetooth device II. Discovering and bonding with Bluetooth devices III. Managing Bluetooth connections IV. Communicating with Bluetooth **3)Location Based Services and Google Maps** I. Using Location Based Services II. Finding current location and listening for changes in location III. Proximity alerts IV. Working with Google Maps i. Showing google map in an Activity ii. Map Overlays iii. Itemized overlays iv. Geocoder v. Displaying route on map

Reference Books :	1. Android Application Development All-In-One for Dummies, 2ed 2015 by Barry Burd 2. Android Application Development (With Kitkat Support), Black Book 2014 by Pradeep Kothari and Kogent Learning Solutions Inc. 3. Head First Android Development: A Brain-Friendly Guide, 2nd Edition by Dawn Griffiths and David Griffiths

Subject Title	**:**	**Practical Based on MANC721**			
Subject Ref. No.	**:**	**MANC753**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Internal	**:**	10
			External	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Write code for implementing concept of Android as different layouts, Services, components, activities
CO-2	Design User interface using Menus, labels, text control, button control, toggle button, images etc.
CO-3	Write the programs using concepts of JAVA + SQLite
CO-4	Write the programs using concepts of JAVA + PHP + MYSQL.
CO-5	Design Android applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**						
CO-2	**X**			**X**						
CO-3	**X**			**X**						
CO-4	**X**			**X**						
CO-5	**X**			**X**	**X**		**X**	**X**	**X**	**X**
AVG	**X**			**X**	**X**		**X**	**X**	**X**	**X**

Content	**:**	Assignment based on the Android will be covered.

Subject Title		**Image Processing**			
Subject Ref. No.		**MANC722**	**No. of Credits**	**:**	4
			No. of Periods / Week	**:**	4
			Assignments / Sessional	**:**	20
			Semester End Examination	**:**	80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Analyze general terminology of digital image processing
CO-2	Examine various types of images, intensity transformations and spatial filtering
CO-3	Develop Fourier transform for image processing in frequency domain
CO-4	Evaluate the methodologies for image segmentation, restoration

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X	X								
CO-2		X	X							
CO-3		X		X						
CO-4		X		X						X
AVG	X	X	X	X						X

Pre Requisite		DBMS
Unit – I		**Introduction** Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization. **Spatial Domain Filtering** Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.
Unit – II		**Filtering in the Frequency domain** Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering. **Image Restoration** Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations,

		Estimation of Degradation functions, Restoration from projections.
Unit – III		**Image Compression** Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation
Unit – IV		**Wavelet based Image Compression** Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding, Digital Image Watermarking.
Unit – V		**Morphological Image Processing** Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.
Text Books		Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education..

Subject Title		**Practical Based on MANC722**			
Subject Ref. No.		**MANC754**	**No. of Credits**	**:**	2
			No. of Periods / Week	**:**	2
			Assignments / Sessional	**:**	10
			Semester End Examination	**:**	40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Analyze general terminology of digital image processing
CO-2	Examine various types of images, intensity transformations and spatial filtering
CO-3	Develop Fourier transform for image processing in frequency domain
CO-4	Evaluate the methodologies for image segmentation, restoration

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**	**X**								
CO-2		**X**	**X**							
CO-3		**X**		**X**						
CO-4		**X**		**X**						**X**
AVG	**X**	**X**	**X**	**X**						**X**

Subject Title		**Hadoop**			
Subject Ref. No.		**MANC723**	**No. of Credits**		4
			No. of Periods / Week		4
			Assignments / Sessional		20
			Semester Examination		80

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe Hadoop distributions, Explain the components of the Hadoop Ecosystem and their functions & Identifying elements of the Hadoop framework.
CO-2	Understand the fundamentals of Big cloud and data architectures.
CO-3	Understand the concept HDFS file structure and Mapreduce frameworks, and implement them to solve complex problems.
CO-4	Use relational data in a Hadoop environment map the data in Hadoop Ecosystem using Hive and Hbase tools
CO-5	Understand The Hive Shell & the Comparison with traditional databases.
CO-6	demonstrate an understanding of cloud computing by Comparing and contrasting Big Data cloud providers and Identifying cloud services

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X				X	X	
CO-2	X	X		X				X	X	
CO-3	X	X	X	X	X			X	X	
CO-4	X	X	X	X	X			X	X	
CO-5	X	X	X	X				X	X	
CO-6	X	X	X	X	X			X	X	
AVG	X	X	X	X				X	X	

Prerequisites	Database Management Systems, Object Oriented Programming Through Java
Unit I	Introduction to Big Data. What is Big Data. Why Big Data is Important. Meet Hadoop. Data. Data Storage and Analysis. Comparison with other systems. Grid Computing. A brief history of Hadoop. Apache hadoop and the Hadoop coSystem. Linux refresher; VMWare Installation of Hadoop.
Unit II	The design of HDFS. HDFS concepts. Command line interface to HDFS. Hadoop File systems. Interfaces. Java Interface to Hadoop. Anatomy of a file read. Anatomy of a file write. Replica placement and Coherency Model. Parallel copying with distcp, Keeping an HDFS cluster balanced.
Unit III	Introduction. Analyzing data with unix tools. Analyzing data with hadoop. Java MapReduce classes (new API). Data flow, combiner functions, Running a distributed MapReduce Job. Configuration API. Setting up the development environment. Managing configuration. Writing a unit test with MRUnit. Running a job in local job runner. Running on a cluster.Launching a job. The MapReduce WebUI.
Unit IV	Classic Mapreduce. Job submission. Job Initialization. Task Assignment. Task execution. Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side. Configuration tuning. MapReduce Types. Input formats. Output formats ,Sorting. Map side and Reduce side joins.
Unit V	The Hive Shell. Hive services. Hive clients. The meta store. Comparison with traditional databases. HiveQl. Hbasics. Concepts. Implementation. Java and Mapreduce clients. Loading data, web queries.
Text Book	1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization Paperback – 2016 2. Big Data and Hadoop Paperback – 1 Jun 2015 by V. K. Jain (Author) 3. Beginning Apache Hadoop Administration : The First Step towards Hadoop Administration and Management Kindle Edition by Prashant Nair (Author) 4. Hadoop Beginner's Guide Paperback – Import, 22 Feb 2013 by Garry Turkington (Author)

Reference Books	1. Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012 2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw- Hill Osborne Media; 1 edition, 2011
Websites	1. http://www.cloudera.com/content/cloudera-content/clouderadocs/ HadoopTutorial/CDH4/Hadoop-Tutorial.html 2. https: //www.ibm.com / developerworks / community / blogs / Susan Visser Editionntry/flash book understanding big dataanalytics for enterprise class hadoop and streaming data? Langen 3. https://www.tutorialspoint.com/hadoop/index.htm 4. https://www.javatpoint.com/hadoop-tutorial

Subject Title		**Practical Based on MANC723**			
Subject Ref. No.		**MANC755**	**No. of Credits**		2
			No. of Periods / Week		2
			Assignments / Sessional		10
			Semester Examination		40

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Describe Hadoop distributions, Explain the components of the Hadoop Ecosystem and their functions & Identifying elements of the Hadoop framework.
CO-2	Understand the fundamentals of Big cloud and data architectures.
CO-3	Understand the concept HDFS file structure and Mapreduce frameworks, and implement them to solve complex problems.
CO-4	Use relational data in a Hadoop environment map the data in Hadoop Ecosystem using Hive and Hbase tools
CO-5	Understand The Hive Shell & the Comparison with traditional databases.
CO-6	demonstrate an understanding of cloud computing by Comparing and contrasting Big Data cloud providers and Identifying cloud services

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	X			X				X	X	
CO-2	X	X		X				X	X	
CO-3	X	X	X	X	X			X	X	
CO-4	X	X	X	X	X			X	X	
CO-5	X	X	X	X				X	X	
CO-6	X	X	X	X	X			X	X	
AVG	X	X	X	X				X	X	

Prerequisites	Database Management Systems, Object Oriented Programming Through Java
Unit I	Installation , Configuration and Mapping of all resources to perform Hadoop practical. VMWare Installation of Hadoop. Apache hadoop and the Hadoop coSystem. Linux refresher **10 assignments' on Unit I**
Unit II	***Programs on*** a file read. a file write. Replica placement and Coherency Model. Parallel copying with distcp, Keeping an HDFS cluster balanced. **10 assignments' on Unit II**
Unit III	***Programs on*** : Analyzing data with unix tools. Analyzing data with hadoop. Java MapReduce classes (new API). Writing a unit test with MRUnit. Running a job in local job runner. Running on a cluster. Launching a job. The MapReduce WebUI. **10 assignments' on Unit III**
Unit IV	***Programs on*** : Classic Mapreduce. Job submission. Job Initialization. Task Assignment. Task execution. Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side. Configuration tuning. MapReduce Types. Input formats. Output formats ,Sorting. Map side and Reduce side joins. **10 assignments' on Unit IV**
Unit V	***Programs on :*** The Hive Shell. Hive services. Hive clients. The meta store. Comparison with traditional databases. HiveQl. Hbasics. Concepts. Implementation. Java and Mapreduce clients. Loading data, web queries **10 assignments' on Unit V**
Text Book	1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization Paperback – 2016 2. Big Data and Hadoop Paperback – 1 Jun 2015 by V. K. Jain (Author) 3. Beginning Apache Hadoop Administration : The First Step towards Hadoop Administration and Management Kindle Edition by Prashant Nair 4. Hadoop Beginner's Guide Paperback – 22 Feb 2013 by Garry Turkington
Reference Books	1. Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012 2. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw- Hill Osborne Media; 1 edition, 2011
Websites	1. http://www.cloudera.com/content/cloudera-content/clouderadocs/ HadoopTutorial/CDH4/Hadoop-Tutorial.html 2. https: //www.ibm.com / developerworks / community / blogs / Susan Visser Editionntry/flash book understanding big dataanalytics for enterprise class hadoop and streaming data? Langen 3. https://www.tutorialspoint.com/hadoop/index.htm 4. https://www.javatpoint.com/hadoop-tutorial

SEMESTER - VI

Subject Title	**:**	**Major Project**			
Subject Ref. No.	**:**	**MANC758**	**No. of Credits**	**:**	14
			No. of Periods / Week	**:**	14
			Internal	**:**	70
			External	**:**	280

Course Outcomes (COs)

At the end of the course, students will be able to:

CO-1	Use modern designing & coding tools to fulfill requirement.
CO-2	Demonstrate the project functioning.
CO-3	Collaborate across team & understand the individual role needs to play in team.
CO-4	Present the project work in the form of Power point presentation.
CO-5	Work on live/real social and professional requirement for solving real life problems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) (Course Articulation Matrix)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**
CO-1	**X**			**X**			**X**	**X**	**X**	
CO-2	**X**			**X**			**X**	**X**	**X**	
CO-3	**X**			**X**			**X**	**X**	**X**	
CO-4	**X**			**X**			**X**	**X**	**X**	
CO-5	**X**			**X**			**X**	**X**	**X**	**X**
AVG	**X**			**X**			**X**	**X**	**X**	**X**

Student's works in IT companies under the guidance of experts from Industry and report to the Faculties of the department as a reviews.