

Regulations and Curriculum for  
Master of Computer Applications (MCA)

**Version 2022.03**



(Established under Section 3 of UGC Act, 1956)  
Placed under Category 'A' by MHRD, GoI | Accredited with 'A+' Grade by NAAC

Regulations and Curriculum for

**Master of Computer Applications (MCA)**

Choice Based Credit System (CBCS)

Effective from AY 2023-24



Deemed to be University under Section 3 of UGC Act, 1956)  
(Placed under Category 'A' by MHRD, Govt. of India, Accredited with 'A+' Grade by NAAC)  
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## VISION

*To build a humane society through excellence in the education and healthcare*

## MISSION

*To develop*

*Nitte (Deemed to be University)*

*As a centre of excellence imparting quality education,*

*Generating competent, skilled manpower to face the scientific and social*

*challenges with a high degree of credibility, integrity,*

*ethical standards and social concern*



**NMAM INSTITUTE  
OF TECHNOLOGY**

off-campus Institution of Nitte (Deemed to be University)  
NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India ISO 9001:2015  
Certified, Accredited by NAAC with “A” Grade

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## **Vision Statement**

Pursuing Excellence, Empowering people, Partnering in  
Community Development

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## **Mission Statement**

To develop N.M.A.M. Institute of Technology, Nitte, as Centre of  
Excellence by imparting Quality Education to generate  
competent,  
Skilled and Humane Manpower to face emerging Scientific,  
Technological,  
Managerial and Social Challenges  
with Credibility, Integrity, Ethics and Social Concern.

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## **MCA DEPARTMENT VISION**

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Equipping students with computing and programming domain expertise with the state of the art technology solutions to enable them to meet global professional challenges.

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## **MCA DEPARTMENT MISSION**

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The department strives to create an environment conducive to equipping students with teamwork ability, Professional Ethics. Sound Technical Knowledge and Skills to Handle Technological Challenges.

# **MCA SYLLABUS**

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Effective from  
Academic Year  
2023 – 2024

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Version 2022.03

**With Scheme of Teaching & Examination**

**REGULATIONS: 2022.03**  
**for**  
**MCA Program**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**  
**(Academic year 2023-24)**

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**Regulations for Master of Computer Applications (MCA)  
Under Nitte (Deemed to be University)**

**PREAMBLE**

The Department was established in the year 1993 and currently offers two-year MCA program with the intake of 180. The program is recognized by the AICTE and offered at NMAM Institute of Technology, Nitte, Off Campus Center of Nitte (Deemed to be University). MCA is an educational program in Computer Applications leading to the award of Degree. It involves events/ activities, comprising of lecturers/ tutorials/ laboratory work/ field work, outreach activities/ project work/ vocational training/ viva/ seminars /internship/ assignments/ presentation/ quiz/ self-study, etc., or a combination of some of these. The core subjects of this program are designed to introduce students to the various areas of Computer Science and Engineering. The departmental laboratories provide good work ambience with state-of-the-art computing facilities to enable the students to carry out projects and acquire expertise in emerging technologies. The students are offered special inputs in aptitude, soft skills, and overall personality development regularly to enhance their employability.

**INTRODUCTION**

Regulations for the MCA program under Nitte (Deemed to be University) govern the policies and procedures including selection, admission, imparting of instructions, conduct of examinations, evaluation and certification of candidate's performance and all amendments thereto, leading to the award of MCA degree. The regulations shall come into effect from the academic year 2023-24 and are applicable to the batch admitted from 2023-24 and onwards. This set of regulations shall be binding on all the candidates undergoing the said program.

## 1. KEY INFORMATION

Program Title	Master of Computer Applications
Short Description	Two-year, Four Semester Choice Based Credit System (CBCS) type of post graduate program as per NEP 2020, with English as medium of Instruction
Program Code	22CMPA20D2
Revision version	2022.03 These regulations may be modified from time to time as mandated by the policies of the University. Revisions are to be recommended by the Board of Studies for Computer Applications and approved by the Academic Council.
Effective from	01-08-2023 and amendments effective from 09-03-2024 vide approval 3
Approvals	<ol style="list-style-type: none"> <li>1. Approved in the 51<sup>st</sup> meeting of Academic Council of NITTE (Deemed to be University), held on 19-09-2022 and vide Notification of NITTE (DU), N(DU)/REG/AC-NMAMIT/2022-23/235 dated 12-10-2022.</li> <li>2. Notification of Nitte (DU), Ref: N(DU)/REG/AC-SA/2022-23/909 dated 24-04-2023.</li> <li>3. Approved in the 56th Academic Council meeting of NITTE (Deemed to be University), held on 23.02.2024 and vide Notification Ref: N(DU)/REG/AC-NMAMIT/2023-24/923 dated 09.03.2024.</li> </ol>
Program offered at	N M A M Institute of Technology, Nitte NITTE (Deemed to be University) (OFF CAMPUS CENTRE)
Grievance and dispute resolution	All disputes arising from this set of regulations shall be addressed to the Board of Computer Applications. The decision of the Board of Computer Applications is final and binding on all parties concerned. Further, any legal disputes arising out of this set of regulations shall be limited to jurisdiction of Courts of Mangalore only.

## 2. ELIGIBILITY FOR ADMISSION

### 2.1 Entry requirements

Admission options	Entry requirements
Admission into two-year MCA Program	Passed BCA/ bachelor's degree in computer science engineering or equivalent Degree. OR Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 level or at Graduation Level (with additional bridge courses as per the norms of the concerned University). Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

\* Eligibility will be determined by the University based on evaluation of equivalency of qualification

\* The candidates should have appeared for NUCAT Entrance Examination conducted by Nitte (Deemed to be University) [Nitte (DU)].

## 2.2 Qualifications from foreign countries

Candidates with qualifications from educational institutions outside of India, may be admitted to the program(s) subject to establishment of equivalence by the university. The Program Committee will evaluate and establish the eligibility of such candidates.

## 3. COURSE

A “Course” is defined as a unit of learning that typically lasts one semester, led by one or more teachers, for a fixed roster of students. Often referred to as a “subject” or “paper”, a course has identified course outcomes, modules / units of study, specified teaching-learning methods and assessment schemes. A course may be designed to include lectures, tutorials, practical, laboratory work, field work, project work, internship experiences, seminars, self-study components, online learning modules etc. in any combination of some of these.

### 3.1 Types of Courses

**The following types of courses are included in the MCA Program:**

- 3.1.1 **Professional Core Courses (PCC):** These are the professional Core Courses, relevant to the chosen specialization/ branch. The core courses shall be compulsorily studied by students, and it is mandatory to complete them to fulfill the requirements of a Program.
- 3.1.2 **Professional Elective Courses (PEC):** These are Professional Electives, relevant to the chosen specialization/branch and can be chosen from the pool of courses. It shall be supportive to the discipline providing extended scope/enabling exposure to some to other discipline /domain and nurturing student proficiency skills.
- 3.1.3 **Seminar (SEM):** Each student has to present the seminar on a specific topic chosen from the relevant field /list provided by the department under the supervision of a faculty coordinator.
- 3.1.4 **Internship (INT):** The internship (a form of experimental learning) program is a workplace based professional learning experience that offers supervised exposure to real life work experience in an area related to field of study or career interest. An internship may be undertaken at a workplace such as industry/ R&D organization / Government organization, or any other reputed organization / institution recognized for the purpose by the University. The internship program not only helps fresh pass-outs in gaining professional know-how but also benefits corporate sectors. The internship also enhances the employability skills of the student passing out from Technical Institutions.
- 3.1.5 **Project Work (PROJ):** Provide experiential learning opportunities for students. Students are required individually, or in a small group, select and complete a project that may include review, design, development, curation, analysis, etc., with application of skills and knowledge relevant to area of study. Mini-project and Project work carried out at the parent institution, or any university / Government recognized organization/

Industry without affecting the regular class work are such courses.

**3.1.6 Research Methodology (RM):** Helps to understand the meaning, objectives and characteristics of research. Undergoing the course enables a student to select and define research problems. It helps students understand research designs, methods and also ethics in research and publications. The course also provides information on Intellectual property rights.

**3.1.7 Mandatory Non-Credit Course (MNC):** This course is mandatory for the students who have completed their bachelor's degree program in non-computer disciplines.

Typically, MCA program has the following component of courses.

SN	Category	Minimum Credits to be earned for the MCA degree
1	Core Courses (PCC)	57 (43 +14 Lab)
2	Elective Courses (PEC)	15
3	Research Methodology (RM)	02
4	Seminar (SEM)	01
5	Mini Project (PROJ)	04
6	Internship (INT)	03
7	Major Project (PROJ)	18
	TOTAL	100

#### 4. ACADEMIC YEAR

Refers to the sessions of two consecutive semesters (odd followed by an even) including periods of vacation.

#### 5. COURSE REGISTRATION

The faculty advisors will guide the students in registering for courses. Course Registration refers to formal registration for the Courses of a semester by every student under the supervision of a faculty advisor (also called Mentor, Counselor etc.,) in each semester for the Institution to maintain proper record.

#### 6. CREDITS

Refers to a unit by which the Course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of lecture or two hours of laboratory/ practical courses/ tutorials/ field work per week etc.

Credit Limits	Regular Semester
Minimum credits per Semester	16
Maximum credits per Semester	28

## 7. REGISTRATION FOR ELECTIVES

- 7.1 Elective options will be offered based on feasibility.
- 7.2 Registration to elective options will be on first-come, first-served basis.
- 7.3 Registration will be subject to minimum and maximum enrolment requirements specified by the department. Typically, the minimum enrolment requirement is 15 and the maximum enrolment limit is 60.
- 7.4 If a course option is not offered due to that lack of minimum enrolments, students who pre-register for it will be transferred to other course options, based on their preference, subject to availability.

## 8. REQUIREMENTS FOR PROGRESSION

- 8.1 A student may progress from Semester 1 to 2, from Semester 3 to 4 irrespective of the grades obtained in the courses of these odd Semesters.
- 8.2 A student may carry over not more than 4 courses from 1st& 2nd Semester (put together) to progress to 3rd semester.

## 9. PROGRAM STRUCTURE

I Semester MCA								
SN	Code	Course Type	Subject	Contact Hour/week L-T-P	Marks		SEE (Hours)	Credits
					CIE	SEE		
1	22MCA101	PCC	Data Structures with Algorithms	3-1-0	50	50	3	4
2	22MCA102	PCC	Advanced Database Systems	3-1-0	50	50	3	4
3	22MCA103	PCC	Computer Organization and Architecture	3-1-0	50	50	3	4
4	22MCA104	PCC	Mathematical Foundation for Computer Applications	3-1-0	50	50	3	4
5	22MCA105	PCC	Software Engineering and Testing	3-1-0	50	50	3	4
6	22MCA106	RM	Research Methodology and Publication Ethics	2-0-0	50	50	3	2
7	22MCA107	PCC	Data Structures with Algorithms Lab	0-0-4	50	50	3	2
8	22MCA108	PCC	Advanced Database Systems Lab	0-0-4	50	50	3	2
9	22MCA109	MNC	Fundamentals of Programming *	0-0-4 (For 2weeks)	50	--	--	0
			Total	17-5-12=34	450	400	24	26

\*The course 22MCA109, Fundamentals of Programming is a mandatory noncredit Bridge Course only for the students who have completed their Bachelor's degree program in non-computer disciplines.

II Semester MCA								
SN	Code	Course Type	Subject	Contact Hours/week L-T-P	Marks		SEE (Hours)	Credits
					CIE	SEE		
1	22MCA201	PCC	Data Communication and Networks	3-0-0	50	50	3	3
2	22MCA202	PCC	Enterprise Java	3-0-0	50	50	3	3
3	22MCA203	PCC	Operating Systems with UNIX	3-0-0	50	50	3	3
4	22MCA204	PCC	Data Warehousing and Data Mining	3-1-0	50	50	3	4
5	22MCA205	PCC	Professional Communication Skills	1-1-0	50	50	3	2
6	22MCA206	PCC	Data Communication and Networks Lab	0-0-4	50	50	3	2
7	22MCA207	PCC	Enterprise Java Lab	0-0-4	50	50	3	2
7	22MCA208	PCC	Operating Systems with UNIX Lab	0-0-4	50	50	3	2
8	22MCA209	SEM	Technical Seminar and Report Writing	0-0-2	50	--	--	1
9	22MCA21X	PEC	Elective - I	3-0-0	50	50	3	3
10	22MCA22X	PEC	Elective - II	3-0-0	50	50	3	3
			Total	19-2-14=35	550	500	30	28

III Semester MCA								
SN	Code	Course Type	Subject	Contact Hours/week L-T-P	Marks		SEE (Hours)	Credits
					CIE	SEE		
1	22MCA301	PCC	Artificial Intelligence and Machine Learning	3-1-0	50	50	3	4
2	22MCA302	PCC	Advanced Web Technologies	3-1-0	50	50	3	4
3	22MCA303	PCC	Artificial Intelligence and Machine Learning Lab	0-0-4	50	50	3	2
4	22MCA304	PCC	Advanced Web Technologies Lab	0-0-4	50	50	3	2
5	22MCA305	PROJ	Mini Project	0-0-12	50	50	3	4
6	22MCA33X	PEC	Elective – III	3-0-0	50	50	3	3
7	22MCA34X	PEC	Elective – IV	3-0-0	50	50	3	3
8	22MCA35X	PEC	Elective – V	3-0-0	50	50	3	3
			Total	15-2-20=37	400	400	24	25

IV Semester MCA								
SN	Code	Course Type	Subject	Contact Hours/week	CIE Marks	SEE Marks		Credits
						Evaluation	Viva Voce	
1	22MCA401	INT	Internship*	Full Time (4 weeks)	50	--	50	3
2	22MCA402	PROJ	Major Project**	Full Time (18 weeks)	100	100	100	18
			Total	Full Time	150	100	150	21

\* The internship should be completed after third semester examinations and before the commencement of fourth semester.

\*\*The Major Project should be carried out preferably in the industry for a minimum duration of 18 weeks.

### Electives:

Elective Group – I	
Code	Subject
22MCA211	Digital Image Processing & Pattern Recognition
22MCA212	Environmental Studies and Green IT
22MCA213	Soft Computing
22MCA214	Parallel Processing
22MCA216	Distributed Computing

Elective Group – II	
Code	Subject
22MCA221	E-Commerce
22MCA222	Health Care Analytics
22MCA223	Accountancy and Financial Management
22MCA224	Bioinformatics
22MCA226	.NET Framework and C#

Elective Group – III	
Code	Subject
22MCA331	Mobile Computing & Application Development
22MCA332	Digital and Social Media Marketing
22MCA335	Software Risk Identification and Management
22MCA336	Industrial and Medical IOT



Elective Group – IV	
Code	Subject
22MCA343	Block Chain Technology
22MCA344	Network and Cyber Security
22MCA345	Cyber Forensics
22MCA346	Quantum Information and Cryptography

Elective Group – V	
Code	Subject
22MCA351	Cloud Computing & Big Data Analytics
22MCA352	Natural Language Processing
22MCA355	Management Information Systems
22MCA356	Time Series Analysis and Prediction

## 10. ATTENDANCE

- 10.1** MCA is a full-time program.
- 10.2** Students are not permitted to enroll in any other program offered by this or other University without prior permission.
- 10.3** All students must attend every lecture, tutorial and practical classes. To account for approved leave of absence (e.g. representing the University in sports, games or athletics, placement activities, NCC/NSS activities etc.) and/ or any other such contingencies like medical emergencies etc., the attendance requirement shall be a minimum of 85% of the classes conducted.
- 10.4** A candidate having shortage of attendance in one or more subjects shall have to repeat those courses. Such students shall re-register for the same subjects in the subsequent semester/ academic year. Semesters are subjected to maximum permissible credits.
- 10.5** A candidate, who does not satisfy the attendance requirement mentioned as above, in minimum number of credit requirement shall not be eligible to appear for the examination of that semester and not promoted to higher semester. The candidate shall be required to repeat that semester along with regular students later.
- 10.6** If a candidate, for any reason, discontinues the course in the middle, he/she may be permitted to register to continue the course along with subsequent batch, subject to the condition that he/she shall complete the class work, lab work and seminar including the submission of dissertation within maximum stipulated period. Such candidate is not eligible to be considered for the award of rank.
- 10.7** The Head of the Department shall notify regularly, the list of such candidates who fall short of attendance. The list of the candidates falling short of attendance shall be sent to the Principal with a copy to Controller of Examinations.

## 11. ABSENCE DURING THE SEMESTER

- 11.1 Leave of Absence:** If the period of leave is more than two days and less than three weeks, prior application for leave shall have to be submitted to the Head of the Department concerned, with the recommendation of the Faculty-Advisor stating fully the reasons for the leave request along with supporting documents. It will be the responsibility of the student to intimate the course instructors, Head of the Department and also Chief Warden of the hostel, regarding his/her absence before availing leave.
- 11.2 Absence during Mid-Semester Examinations:** A student who has been absent from a Mid-Semester Examination (MSE) due to illness and other contingencies may give a request for additional MSE within two working days of such absence to the office of the respective Head of the Department (HOD) with necessary supporting documents and certification from authorized personnel. The HOD may consider such requests depending on the merits of the case and may permit an additional Mid-Semester Examination for the concerned student.
- 11.3 Absence during Semester End Examination:** In case of absence for a Semester End Examination, on medical grounds or other special circumstances the student can apply for 'I' grade in that course with necessary supporting documents and certifications by authorized personnel to the Controller of Examination through Chairman of The Department. The Controller of Examination may consider the request depending on the merits of the case and permit the make-up Semester End Examination for the concerned student. The student may subsequently complete all course requirements within the date stipulated by DPGC (which may be extended till first week of next semester under special circumstances) and 'I' grade will then be converted to an appropriate letter grade. If such an application for the 'I' grade is not made by the student, then a letter grade will be awarded based on his in-semester performance.

## 12. WITHDRAWAL FROM THE PROGRAM

### 12.1 Temporary Withdrawal

A student who has been admitted to a Post Graduate Degree program of the College may be permitted to withdraw temporarily, for a period of one semester or more on the grounds of prolonged illness or grave calamity in the family etc. The student should abide by the applicable rules and regulations of the college/University at the time of Temporary Withdrawal.

### 12.2 Permanent Withdrawal

Any student who withdraws admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account. Once the admission for the year is closed, the following conditions govern withdrawal of admissions: a) A student who wants to leave the College for good, will be permitted to do so (and can take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and

clearing all other dues, if any. b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts in addition to those mentioned in (a) above. The decision of the Principal of the Institute regarding withdrawal of a student is final and binding.

### **13. EVALUATION**

#### **13.1 Course Evaluation**

For all courses evaluation will be based on both formative assessment (Continuous Internal Evaluation, CIE) and summative assessment (Semester End Evaluation, SEE). CIE and SEE will carry 50 % and 50% respectively, to enable each course to be evaluated for 100 marks, irrespective of its credits. Weightage for CIE and SEE will be 50% each.

#### **13.2 Continuous Internal Evaluation (CIE)**

CIE refers to the evaluation of students' achievement in the learning process. The course instructor will perform the Continuous Internal Evaluation (CIE) for 50 marks which includes tests, homework, problem solving, group discussion, quiz, mini-project and seminar throughout the semester, with weightage for the different components being fixed at the University level as follows.

- |   |   |          |
|---|---|----------|
| 1. Quizzes, tutorials, assignments, etc., | - | 20 marks |
| 2. Mid Semester Examination               | - | 30 marks |

An additional MSE may be conducted for those students absent for valid reasons/ with prior permission. For those students who could not score minimum required CIE marks (25 marks), an additional MSE may be conducted, and however the maximum CIE marks shall be restricted to 25 out of 50.

#### **13.3 Semester End Examinations (SEE)**

Refers to examination conducted at the University level covering the entire Course Syllabus. The Syllabi is modularized and SEE questions are selected from each module, with a choice confined to the concerned module only. SEE is also termed as university examination.

**13.4 For Technical Seminar and Fundamentals of Programming**, the evaluation will be based on formative assessment (Continuous Internal Evaluation) only.

**13.5 For the major project, the dissertation** will be evaluated by two examiners, one of the examiners shall be the guide of the candidate and the other examiner shall be preferably an external expert in the area of the dissertation being evaluated. The evaluation of the dissertation shall be made independently by each examiner.

- Examiners shall evaluate the dissertation normally within a period of not more than two weeks from the date of receipt of dissertation through email.
- The examiners shall independently submit the marks for the dissertation during the viva-voce examination date.

- c) Sum of marks awarded by the two examiners shall be the final evaluation marks for the dissertation.
- d) Viva-Voce examination of the candidate shall be conducted, if the dissertation work and the reports are accepted by the external examiner.
- e) If the external examiner finds that the dissertation work is not up to the expected standard and the minimum passing marks cannot be awarded, the dissertation shall not be accepted for SEE.
- f) If the dissertation is rejected during the Project work, then the second examiner (external) will be appointed by the COE against whom the candidate has to re-present the same dissertation. The decision of the Second Examiner (external) will be final.
- g) If the second examiner (external) accepts the dissertation, then the viva-voce examination of the candidate shall be conducted as per the norms. If the second examiner (external) rejects the dissertation, then the student has to take an extension for a minimum period of 3 months and re-work on the project. After the completion of the extension period, viva-voce examination of the candidate shall be conducted as per the norms, if the dissertation work is accepted by the external examiner.
- h) Viva-voce examination of the candidate shall be conducted jointly by the external examiner and internal examiner/guide at a mutually convenient date.
- i) The relative weightages for the evaluation of dissertation and the performance at the viva-voce shall be as per the scheme of teaching and examination.
- j) The marks awarded by both the examiners at the viva-voce examination shall be sent jointly to the office of the Controller of Examination immediately after the examination.
- k) The candidates who fail to submit the dissertation work within the stipulated time have to apply for the extension of the Project duration through the Guide and the head of the department to the office of the Controller of Examination. Such candidate is not eligible to be considered for the award of rank.

#### **14. THE TRANSITIONAL GRADES**

'I', 'W' and 'X' would be awarded in the following cases. These would be converted into one or the other of the letter grades (O to F) after the student completes the course requirements.

**14.1 Grade "I":** To a student having attendance  $\geq 85\%$  and CIE  $\geq 70\%$ , in a course, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

- i. Illness or accident, which disabled him/her from attending SEE.
- ii. A calamity in the family at the time of SEE, which required the student to be away from the College.
- iii. However, the committee chaired by the Principal is authorized to relax the requirement of CIE  $\geq 70\%$  if the student is hospitalized or

advised to have long term rest after discharge from the hospital by the Doctor.

- iv. Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of that examination for which he or she is absent, failing which they will not be given permission.

**14.2 Grade “W”:** To a student having satisfactory attendance at classes but withdrawing from that course before the prescribed date in a semester as per faculty advice.

**14.3 Grade “X”:** To a student having attendance  $\geq 85\%$  and CIE  $\geq 70\%$ , in a course but SEE performance could result in a ‘F’ grade in the course. (No “F” grade awarded in this case, but student’s performance record will be maintained separately).

**14.4** The Make Up Examination facility would be available to students who may have missed attending the SEE of one or more courses in a semester for valid reasons and given the 'I' grade. Also, students having the 'X' grade shall also be eligible to take advantage of this facility. The makeup examination would be held as per dates notified in the Academic Calendar. However, it should be made possible to hold a make-up examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of SEE would be the same as the normal SEE.

- Make Up examination will be conducted for the candidates who has a CIE  $\geq 35$  marks and may have missed to attend the SEE covering the entire course syllabus. The standard of the Make Up Examination is same as that of the SEE.
- All the 'W' grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/summer semester and fulfill the passing standards for their CIE and (CIE+SEE).
- The suggested passing standards are CIE to have  $\geq 50\%$  and CIE+SEE to have a grade better or at least equal to C. For maintaining high standards, the students scoring less than 50% in CIE are advised to withdraw and to re-register for the course when offered next. The letter grade ‘W’ to be entered in the grade card against the subject and not to be taken into account while calculating SGPA & CGPA

**14.5 SUMMER SEMESTER:** Summer semester is primarily to assist weak and/or students having N/F grade in courses, for duration of 4 weeks after the completion of regular even SEE. The institute may also offer Add-on/ Audit Courses during this semester.

**14.6 SUPPLEMENTARY EXAMINATION:** Refers to the examination conducted to assist slow learners and/or failed students through make up courses for duration of 8 weeks. This comprises of both the CIE & SEE and will be conducted after the completion of First year MCA even semester.

### 15. QUALIFYING STANDARD

- Sessional (CIE): Score:  $\geq 50\%$  ( $\geq 25$  marks)
- Terminal (SEE): Score:  $\geq 40\%$  ( $\geq 20$  marks)

#### For securing a final Pass:

Total 50 % of the Course maximum marks (100) i.e., sum of the CIE and SEE marks prescribed for the Course is desired.

### 16. GRADING SYSTEM: ABSOLUTE GRADING

The performance of a candidate in a course shall be evaluated according to a Letter Grading System, based on both CIE and SEE. The letter grades (O, A+, A, B+, B, C and F) indicate the level of academic achievement assessed on a 10-point scale (0 to 10) (See Table below).

#### Letter grade system and corresponding marks range

Marks Range (%)	Grade Point	Letter Grade	Descriptor
90 & above	10	O	Outstanding
80-89	9	A+	Excellent
70-79	8	A	Very Good
60-69	7	B+	Good
55-59	6	B	Above Average
50-54	5	C	Average
Below 50	0	F	Fails
Absent	0	F	Absent

CGPA	Classification
7.00-& above	<b>First Class with Distinction</b>
6.00-6.99	<b>First Class</b>
5.00-5.99	<b>Second Class</b>
<b>CGPA &lt; 5.00</b>	<b>Fails</b>

- 16.1** A candidate shall be considered to have completed a course successfully and earned the credits assigned, if he/she secures an acceptable letter grade in the range O to C.
- 16.2** The letter grade 'F' in any course implies failure in that course and no credit is earned.
- 16.3** A candidate having satisfactory attendance at classes and meeting the passing standard at CIE in a course but remained absent from SEE shall be awarded 'I' grade in that course. No credit is earned in such a case.
- 16.4** Grade point averages: The overall performance of a candidate will be indicated by Grade Point Average (GPA).
- 16.5** Semester Grade Point Average (SGPA) is computed as follows.

$$SGPA = \frac{[\sum(\text{Course Credit}) \times (\text{Grade Point})]}{[\sum(\text{Course Credit})]}$$

All courses of the semester for which a letter grade has been awarded, including F, will be included in this calculation.

- 16.6** Cumulative Grade Point Average (CGPA) is computed as follows.

$$CGPA = \frac{[\sum(\text{Course Credit}) \times (\text{Grade Point})]}{[\sum(\text{Course Credit})]}$$

All courses of the all the semesters for which a letter grade has been awarded, excluding F, will be included in this calculation.

- 16.7** **Grade Card:** Based on the secured letter grades, grade points, SGPA and CGPA, a grade card for each semester shall be issued. On specific request on paying prescribed fee, a transcript indicating the performance in all semesters may be issued.

- 16.8** **Conversions of Grades into Percentage and Class Equivalence**

Conversion formula for the conversion of CGPA into percentage is given below:

Percentage of marks secured, 'P' = CGPA Earned  $\times$  10

Illustration: for A CGPA of 8.18:

$$\text{'P'} = \text{CGPA Earned } 8.18 \times 10 = 81.8 \%$$

## **17. AWARD OF CLASS**

- 17.1** The candidate, who has passed all the courses prescribed, shall be declared to have passed the program
- 17.2** A candidate who secures  $CGPA \geq 7.00$  and above shall be declared to have passed in 'First Class with Distinction'.
- 17.3** A candidate who secures  $CGPA \geq 6.00$  or more but less than 7.00 shall be declared to have passed in 'First Class'.
- 17.4** A candidate who secures  $CGPA \geq 5.00$  or more but less than 6.00 shall be declared to have passed in 'Second Class'.
- 17.5** An attempt means the appearance of a candidate in one or more courses either in part or full in a particular re-examination including supplementary semester's examinations.
- 17.6** A candidate who fails in the main examination and passes one or more subjects/courses or all subjects/courses in the supplementary examination, such candidate's attempts shall be considered as multiple attempts.
- 17.7** If a candidate submits application for appearing for the regular examination but does not appear for any of the courses/subjects in the regular University examination, he can appear for supplementary examination provided other conditions such as attendance requirement, internal assessment marks, etc. are fulfilled and his appearing in the supplementary examination shall be considered as the first attempt.

## **18. MERIT CERTIFICATES AND UNIVERSITY GOLD MEDALS**

Merit Certificates and University Gold Medals will be awarded on the basis of overall CGPA.

- 18.1** Only those candidates who have completed the MCA Program and fulfilled all the requirements in the minimum number of years prescribed (i.e., 2 years for master's degree) and who have passed each semester in the first attempt is eligible for the award of Merit Certificates and /or University Gold Medals.
- 18.2** Award of University Gold Medals, if any, are governed by the specific selection criteria that may be formulated by the University for such Medals / Awards
- 18.3** Candidates with W, N, I, X and F grades and passes the courses in the supplementary examinations are not eligible for the award of Gold Medal or Merit Certificate.

## **19. RULES FOR GRACE MARKS**

- 19.1** Grace marks up to 1% of the maximum total marks of eligible courses out of registered credited courses in the examination or 10 marks whichever is less shall be awarded to the failed course(s), provided on the award of such grace marks the candidate passes in that course(s).
- 19.2** For the students who have secured a minimum pass grade in all the courses without any grace marks, there shall be a provision to award grace marks of 0.5% of maximum marks or 5 marks whichever is less in a semester for



improvement of Grade Point (GP) in the course(s) registered in that semester.  
(Excluding Project work and Internship).

## **20. CHALLENGE EVALUATION**

If a student is not satisfied with the marks allotted to him/her in the semester end examinations, he/she could apply for challenge evaluation within the prescribed time specified. In such cases the answer papers will be valued by the DPGC committee and marks secured by the students in the challenge evaluation will be final.

## **21. AWARD OF DEGREE REQUIREMENTS**

The Degree requirements of a student for the MCA Degree program are as follows:

- 21.1** The maximum duration for a student to comply with the Degree requirements is 8 semesters from the date of first registration for his first semester.
- 21.2** A student shall be declared to have completed the Degree of Master of Technology, provided the student has undergone the stipulated course work as per the regulations and has earned the prescribed credits, as per the scheme of teaching and examination of the program.
- 21.3** A student shall be declared successful at the end of the program for the award of Degree only on obtaining  $CGPA \geq 5.00$ , with none of the courses remaining with F grade.
- 21.4** In case the CGPA falls below 5.00, the student shall be permitted to appear again for SEE for required number of courses (other than seminar, practical, internship and project) subject to the provision of University, to make up  $CGPA \geq 5.0$ . The student should reject the SEE results of previous attempt and obtain written permission from the Controller of Examinations to reappear to the subsequent SEE.

## **22. TERMINATION FROM THE PROGRAM/READMISSION**

A student shall be required to leave the college without the award of the degree, under the following circumstances:

- i. Failing to complete the degree requirements in double the duration of the program.
- ii. Based on the disciplinary actions suggested by the Academic Council/Governing Council

## **23. GRADUATION REQUIREMENTS AND CONVOCATION**

- 23.1** A student shall be declared to be eligible for the award of the Degree if he has Fulfilled Degree Requirements
- 23.2** No Dues to the College, Departments, Hostels, Library Central Computer Centre and any other center
- 23.3** No disciplinary action pending against him.

- 23.4** The award of the Degree must be recommended by the Academic council and approved by Governing Council of Nitte (DU)
- 23.5 Convocation:** Degree will be awarded in person to the students who have graduated during the preceding academic year. Degrees will be awarded in absentia to such students who are unable to attend the convocation. Students are required to apply for the convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements within the specified date in order to arrange for the award of the degree during convocation.

## **24. PROGRAM OUTCOMES**

By the end of the program the student will be able to acquire:

- 24.1 Disciplinary Knowledge:** Master of Computer Applications is the culmination of in-depth knowledge in several branches of Computer Science, Statistics and Mathematics. This also leads to study the related areas such as Information Technology and other allied subjects.
- 24.2 Communication Skills:** Ability to communicate various statistical and mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to proficiency in analytical reasoning which can be used for modelling and solving of real-life problems.
- 24.3 Critical thinking and analytical reasoning:** The students undergoing this program acquire the ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real-life problems. They acquire analytical skills involving paying attention to details and ability to construct logical arguments using correct technical language related to statistics and ability to translate them with popular language when needed.
- 24.4 Problem Solving:** The Mathematical knowledge gained by the students through this program develops an ability to analyze the problems, identify and define appropriate computing requirements for its solutions, analyze and interpret the data which will help policy makers to take a proper decision. This program enhances students' overall development and also equips them with mathematical modeling ability, problem solving skills, analyze problems related to computer science and exhibit a sound knowledge on data structures and algorithms.
- 24.5 Research related skills:** Undertake research projects by using research skills- preparation of questionnaire, conducting sample survey, research projects using sample survey, sampling technique.
- 24.6 Information/digital Literacy:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge of programming languages of various levels.
- 24.7 Self – directed learning:** The student completing this program will develop the ability of working independently and to make an in-depth study of various notions of Mathematics, Statistics and Computer Science.

- 24.8 Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general.
- 24.9 Design and Development of Solutions:** Ability to design and develop algorithmic solutions to real world problems and acquiring knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.
- 24.10 Lifelong learning:** This program provides self-directed learning and lifelong learning skills. This program helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
- 24.11 Modern Tool Usage:** Identify, select and use modern scientific and IT tools or techniques for modeling, prediction, data analysis and solving problems in the area of Computer Science and making.

## Master of Computer Applications

### CREDIT DISTRIBUTION

Sl. No.	Category	Minimum Credits to be earned for the MCA degree
1	Core Subjects	57 (43 +14 Lab)
2	Elective Subjects	15
3	Research Methodology and Publication Ethics	02
4	Seminar	01
5	Mini Project	04
6	Internship	03
7	Major Project	18
	<b>Total Credits to be earned</b>	<b>100</b>

**I SEMESTER MCA**

1. 22MCA101 - Data Structures with Algorithms	- 04 Credits
2. 22MCA102 - Advanced Database Systems	- 04 Credits
3. 22MCA103 - Computer Organization and Architecture	- 04 Credits
4. 22MCA104 - Mathematical Foundation for Computer Applications	- 04 Credits
5. 22MCA105 - Software Engineering and Testing	- 04 Credits
6. 22MCA106 - Research Methodology and Publication Ethics	- 02 Credits
7. 22MCA107 - Data Structures with Algorithms Lab	- 02 Credits
8. 22MCA108 - Advanced Database Systems Lab	- 02 Credits
9. 22MCA109 - Fundamentals of Programming – Bridge Course	- 00 Credits

**Total Credits - 26 Credits**

**II Semester MCA**

1. 22MCA201 - Data Communication and Networks	- 03 Credits
2. 22MCA202 - Enterprise Java	- 03 Credits
3. 22MCA203 - Operating Systems with UNIX	- 03 Credits
4. 22MCA204 - Data Warehousing and Data Mining	- 04 Credits
5. 22MCA205 - Professional Communication Skills	- 02 Credits
6. 22MCA21X - Elective – I	- 03 Credits
7. 22MCA22X - Elective – II	- 03 Credits
8. 22MCA206 - Data Communication and Networks Lab	- 02 Credits
9. 22MCA207 - Enterprise Java Lab	- 02 Credits
10. 22MCA208 - Operating Systems with UNIX Lab	- 02 Credits
11. 22MCA209 - Technical Seminar and Report Writing	- 01 Credits

**Total Credits - 28 Credits**

**Electives :**

Elective Group – I	Elective Group – II
22MCA211 - Digital Image Processing & Pattern Recognition	22MCA221 - E-Commerce
22MCA212 - Environmental Studies and Green IT	22MCA222 - Health Care Analytics
22MCA213 - Soft Computing	22MCA223 - Accountancy and Financial Management
22MCA214 - Parallel Processing	22MCA224 - Bioinformatics
22MCA216 - Distributed Computing	22MCA226 - .NET Framework and C#

### III SEMESTER MCA

- |  |              |
|--|--------------|
| 1. 22MCA301 - Artificial Intelligence and Machine Learning     | - 04 Credits |
| 2. 22MCA302 - Advanced Web Technologies                        | - 04 Credits |
| 3. 22MCA33X - Elective – III                                   | - 03 Credits |
| 4. 22MCA34X - Elective – IV                                    | - 03 Credits |
| 5. 22MCA35X - Elective – V                                     | - 03 Credits |
| 6. 22MCA303 - Artificial Intelligence and Machine Learning Lab | - 02 Credits |
| 7. 22MCA304 - Advanced Web Technologies Lab                    | - 02 Credits |
| 8. 22MCA305 - Mini Project Lab                                 | - 04 Credits |

**Total Credits - 25 Credits**

#### Electives :

<b>Elective Group – III</b>	<b>Elective Group – IV</b>	<b>Elective Group – V</b>
22MCA331 - Mobile Computing & Application Development	22MCA343 - Block Chain Technology	22MCA351 - Cloud Computing and Big Data Analytics
22MCA332 - Digital and social media Marketing	22MCA344 - Network and Cyber Security	22MCA352 - Natural Language Processing
22MCA335 - Software Risk Identification And Management	22MCA345 - Cyber Forensics	22MCA355 - Management Information Systems
22MCA336 - Industrial and Medical IOT	22MCA346 - Quantum Information and Cryptography	22MCA356 - Time Series Analysis and Prediction

### IV SEMESTER MCA

- |                             |              |
|-----------------------------|--------------|
| 1. 22MCA401 - Internship    | - 03 Credits |
| 2. 22MCA402 - Major Project | - 18 Credits |

**Total Credits- 21 Credits**

**MCA: Scheme of Teaching and Examinations 2023-25**  
**Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**  
 (Effective from the academic year 2022-23)

**I Semester MCA - Scheme**

Sl. No	Course Type	Code	Subject	Teaching Department	Contact Hour/week			Marks			SEE Hours	Credits
					L	T	P	CIE	SEE	Total		
1	PCC	22MCA101	Data Structures with Algorithms	MCA	3	1	0	50	50	100	03	04
2	PCC	22MCA102	Advanced Database Systems	MCA	3	1	0	50	50	100	03	04
3	PCC	22MCA103	Computer Organization and Architecture	MCA	3	1	0	50	50	100	03	04
4	PCC	22MCA104	Mathematical Foundation for Computer Applications	MCA	3	1	0	50	50	100	03	04
5	PCC	22MCA105	Software Engineering and Testing	MCA	3	1	0	50	50	100	03	04
6	PCC	22MCA106	Research Methodology and Publication Ethics	MCA	2	0	0	50	50	100	03	02
7	PCC	22MCA107	Data Structures with Algorithms Lab	MCA	0	0	4	50	50	100	03	02
8	PCC	22MCA108	Advanced Database Systems Lab	MCA	0	0	4	50	50	100	03	02
9	PCC	22MCA109	Fundamentals of Programming - Bridge Course	MCA	0	0	4	--	--	--	--	00
				Total	17	05	12	400	400	800	24	26

## II Semester MCA – Scheme

Sl. No	Course Type	Code	Subject	Teaching Department	Contact Hours/week			Marks			SEE Hours	Credits
					L	T	P	CIE	SEE	Total		
1	PCC	22MCA201	Data Communication and Networks	MCA	3	0	0	50	50	100	03	03
2	PCC	22MCA202	Enterprise Java	MCA	3	0	0	50	50	100	03	03
3	PCC	22MCA203	Operating Systems with UNIX	MCA	3	0	0	50	50	100	03	03
4	PCC	22MCA204	Data Warehousing and Data Mining	MCA	3	1	0	50	50	100	03	04
5	PCC	22MCA205	Professional Communication Skills	MCA	1	1	0	50	50	100	03	02
6	PEC	22MCA21X	Elective - I	MCA	3	0	0	50	50	100	03	03
7	PEC	22MCA22X	Elective - II	MCA	3	0	0	50	50	100	03	03
8	PCC	22MCA206	Data Communication and Networks Lab	MCA	0	0	4	50	50	100	03	02
9	PCC	22MCA207	Enterprise Java Lab	MCA	0	0	4	50	50	100	03	02
10	PCC	22MCA208	Operating Systems with UNIX Lab	MCA	0	0	4	50	50	100	03	02
11	PCC	22MCA209	Technical Seminar and Report Writing	MCA	0	0	2	50	--	50	--	01
Total					19	02	14	550	500	1050	30	28



### III Semester MCA - Scheme

Sl. No	Course type	Code	Subject	Teaching Department	Contact Hours/week			Marks			SEE Hours	Credits
					L	T	P	CIE	SEE	Total		
1	PCC	22MCA301	Artificial Intelligence and Machine Learning	MCA	3	1	0	50	50	100	03	04
2	PCC	22MCA302	Advanced Web Technologies	MCA	3	1	0	50	50	100	03	04
3	PEC	22MCA33X	Elective – III	MCA	3	0	0	50	50	100	03	03
4	PEC	22MCA34X	Elective – IV	MCA	3	0	0	50	50	100	03	03
5	PEC	22MCA35X	Elective – V	MCA	3	0	0	50	50	100	03	03
6	PCC	22MCA303	Artificial Intelligence and Machine Learning Lab	MCA	0	0	4	50	50	100	03	02
7	PCC	22MCA304	Advanced Web Technologies Lab	MCA	0	0	4	50	50	100	03	02
8	PCC	22MCA305	Mini Project	MCA	0	0	4+9*	50	50	100	03	04
Total					15	02	21	400	400	800	24	25

\* Self Learning

### IV Semester MCA – Scheme

Sl. No.	Code	Subject	Contact Hours/week	CIE Marks	SEE Marks			Credits
					Evaluation	Viva-Voce	Total	
1	22MCA401	Internship	Full Time	50	--	50	50	03
2	22MCA402	Major Project	Full Time	100	100	100	300	18
Total				150	100	150	350	21

**Note:** PCC: Professional Core Course, PEC: Professional Elective Course  
 L –Lecture, T – Tutorial, P- Practical  
 CIE: Continuous Internal Evaluation  
 SEE: Semester End Examination.

<b>Data Structures with Algorithms</b>			
<b>Course Code:</b>	<b>22MCA101</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites:</u></b>			
Students must have basic knowledge of C programming.			
<b><u>Course Objectives:</u></b>			
<b>1.</b>	Understand the concept of Data structures and ADT. Implement the Stack data structures.		
<b>2.</b>	Study and implement the concept of Recursion. Implement the Queue data structures.		
<b>3.</b>	Study the concept of Linked lists and implement it. Understand the Implementation of Stack and Queue data structures dynamically using linked lists.		
<b>4.</b>	Learn the complexity of the algorithms and analyze the algorithms. Understand the Implementation of Tree Data structures.		
<b>5.</b>	Implement and Illustrate various Sorting and Searching Techniques. Define and implement Graph Data Structures.		
<b>UNIT - I</b>			
<b>Introduction :</b> Introduction to data structure, Abstract data type, Overview of C: Data types in C, Arrays, Structures and Pointers.			<b>06 Hours</b>
<b>Stacks :</b> Definition and Primitive operations, Representing and implementing stacks in C, Applications of stacks: Evaluating a postfix expression, converting an expression from infix to postfix.			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Recursion :</b> Recursion: definition and processes, Implementation of recursion program in C, Examples (Factorial function, Multiplication of natural numbers, Fibonacci sequence, Binary search, Towers of Hanoi problem).			<b>06 Hours</b>
<b>Queues :</b> Definition and Primitive operations, C implementation of ordinary queues and circular queues.			<b>04 Hours</b>
<b>UNIT - III</b>			
<b>Lists :</b> Introduction to Linked lists, Types of linked lists, C implementation of Singly Linked Lists, Doubly linked lists, Circular lists, Stacks and Queues.			<b>10 Hours</b>
<b>UNIT - IV</b>			
<b>Analysis of Algorithm :</b> Introduction, Fundamentals of the Analysis of Algorithm Efficiency Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive			<b>05 Hours</b>

and Non-recursive algorithms.															
<b>Binary trees :</b> Operations on binary trees, Applications of binary trees. Binary tree representation: Node representation of binary tree, Array representation of binary trees, Binary tree traversals and related properties, Threaded binary trees.													<b>05 Hours</b>		
<b>UNIT - V</b>															
<b>Sorting :</b> Brute Force: Selection Sort and Bubble Sort. Divide-and-Conquer Merge sort, Quick sort, Decrease-and-Conquer Insertion Sort, Shell sort.													<b>04 Hours</b>		
<b>Searching :</b> Sequential searching, Indexed sequential search, Binary search, Binary Tree Search.													<b>03 Hours</b>		
<b>Graphs :</b> Definitions, Application of graphs, C representation of graphs, Graph traversals, Depth First and Breadth First Search, Topological sorting. Greedy Technique Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.													<b>05 Hours</b>		
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Understand and demonstrate the concepts of Data Structures and ADT. Implement the Stack Data Structures statically and demonstrate the applications.														
2.	Implement the Recursion Techniques. Understand and Implement the Queue Data Structures statically.														
3.	Understand the concept of Linked lists and implement. Discuss the Implementation of Stack and Queue data structures dynamically.														
4.	Discuss the complexity of the algorithms and analyze the algorithms. Implement Tree Data structures.														
5.	Implement and Illustrate various Sorting and Searching Techniques. Describe and Implement Graph Data Structures.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>	
<b>↓Course Outcomes</b>													1	2	
<b>22MCA101.1</b>	3	3	3	3	2		3	3	2	3	3		3	2	
<b>22MCA101.2</b>	3	3	2	2	3		3	3	3	3	2		3	2	
<b>22MCA101.3</b>	3	3	2	2	3		3	3	3	3	2		3	2	
<b>22MCA101.4</b>	3	3	3	3	2		3	3	3	3	3		3	2	
<b>22MCA101.5</b>	3	3	3	3	2		3	3	3	3	3		3	2	
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	Yedidyah Langsam and Moshe J Augenstein and Aaron M Tenenbaum: Data Structures using C and C++, Second Edition, Pearson Education Asia, 2002.														
2.	Jean-Paul Tremblay: An Introduction to Data Structures with applications, Tata McGraw Hill														
3.	Introduction to the Design and Analysis of Algorithms. Anany Levitin, Pearson Education, 2nd Edition.														

<b>4.</b>	Horowitz E., Sahani S., Rajashekharan S: Computer Algorithm, Galgotia Publications.
<b>REFERENCE BOOKS:</b>	
<b>1.</b>	Robert L Kruse : Data Structures and Program Design , Third Edition, Prentice – Hall of India.
<b>2.</b>	Mark Allen Weiss : Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education Asia, 1997.
<b>3.</b>	Richard F Giberg and Behrouz A Forouzan : Data Structures - A Pseudocode Approach with C, Third Reprint, Thomson Course Technology, 2005.
<b>4.</b>	A.M. Padma Reddy : Systematic Approach to Data structures (with C), Seventh Edition 2007.
<b>5.</b>	Coreman T.H., Leiserson C.E., and Rivest R.L.: Introduction to algorithms, PHI.

<b>Advanced Database Systems</b>			
<b>Course Code:</b>	<b>22MCA102</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have basic knowledge of computer system- hardware/software and File Programming.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the importance of database management systems and have thorough understanding of terminologies used		
<b>2.</b>	Implement concepts of relational model using SQL.		
<b>3.</b>	Use the features of PL/SQL to write procedural programs		
<b>4.</b>	Design the databases and to use different levels of normalization		
<b>5.</b>	Understand the working of NoSQL, MongoDB, its features.		
<b>UNIT - I</b>			
<b>Introduction to Database and Entity-Relationship Model :</b>			<b>10 Hours</b>
Introduction, Characteristics of Database approach, Advantages and Implications of using DBMS approach, Disadvantages of DBMS. Data Models, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design.			
<b>UNIT - II</b>			
<b>SQL - The Relational Database Standard :</b>			<b>12 Hours</b>
SQL Data Definition and Data Types, Specifying basic constraints in SQL, statements in SQL, Aggregate functions, Complex SQL Queries. Sub-queries and co-related sub-queries, Joins and Views in SQL.			
<b>UNIT - III</b>			
<b>Introduction to PL/SQL :</b>			<b>10 Hours</b>
Introduction, The PL/SQL execution environment, The PL/SQL syntax and block structure. Locks, Cursors, Error handling, Stored procedures, Database Triggers.			
<b>UNIT - IV</b>			
<b>Relational Database Design :</b>			<b>07 Hours</b>
Informal Design Guidelines for Relation Schema's, Functional Dependencies, Normal Forms, Closure sets, Decomposition.			
<b>Transaction Processing :</b>			<b>03 Hours</b>
Introduction to Transaction Processing, Transaction States, Desirable Properties of Transactions.			
<b>UNIT - V</b>			
<b>Introduction to NoSQL :</b>			<b>03 Hours</b>
Where it is used, Types of NoSQL databases, Why NoSQL, Advantages of NoSQL, Use of NoSQL in industry, SQL versus NoSQL, Comparison of SQL NoSQL NewSQL.			

<b>Introduction to MongoDB :</b> What is MongoDB? Why MongoDB? Using JSON, Creating or generating unique key, Support for dynamic queries, Storing binary data, Terms used in RDMS and MongoDB, Data types in MongoDB, MongoDB Query Language: Insert method, Save method, Update method, Remove method, Find method, Dealing with Null values, Count, Limit, Sort, Skip, Arrays, Aggregate Functions.													<b>07 Hours</b>		
<b>Course Outcomes :</b> At the end of the course student will be able to															
1.	Get familiarize with fundamentals of database system, its terminologies and ER modeling.														
2.	Acquire knowledge on SQL and to be able to write SQL queries														
3.	Learn the syntax of procedural database language PL/SQL and to be able to write procedural programs														
4.	Learn database design guidelines and applying normalization at different levels to accomplish the same.														
5.	Understand the importance of NoSQL and the features of MongoDB to handle data.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>														1	2
<b>22MCA102.1</b>		3	3			3							3	3	
<b>22MCA102.2</b>		3	3			2							3	3	
<b>22MCA102.3</b>		3	2			2							3	3	
<b>22MCA102.4</b>		3	2			2							2	3	
<b>22MCA102.5</b>		3	3			3							3	3	
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	Elmasri and Navathe: Fundamentals of Database Systems, Seventh Edition 2016														
2.	Ivan Bayross : Commercial Application Development using Oracle Developer 2000														
3.	Seema Acharya, Subhashini Chellappan, “Big Data Analytics”, 1 <sup>st</sup> Edition, Wiley, 2015														
4.	Raghu Ramakrishnan and Johannes Gehrke : Database Management Systems, Sixth Edition, McGraw-Hill														
<b>REFERENCE BOOKS:</b>															
1.	Silberschatz, Korth and Sudarshan: Database Systems Concepts, Sixth Edition, McGraw-Hill														
2.	Alexis Leon, Mathews Leon: Database Management Systems, Vikas Publishing House														
3.	Connolly: Database Systems: A practical approach to design implementation and management, Third edition, Person Education														
<b>E Books / MOOCs/ NPTEL</b>															
1.	NOC : Fundamentals of Database Systems(Course sponsored by Aricent), IIT Kanpur, Dr. Arnab Bhattacharya <a href="https://nptel.ac.in/courses/106104135">https://nptel.ac.in/courses/106104135</a>														
2.	Oracle PL/SQL Language Pocket Reference, 5th Edition: A Guide to Oracle's PL/SQL Language Fundamentals  <a href="https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html">https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html</a>														

<b>Computer Organization and Architecture</b>			
<b>Course Code:</b>	<b>22MCA103</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students must have some basic knowledge of computer hardware and basic mathematics.			
<b>Course Objectives:</b>			
<b>1.</b>	To understand the basics of number systems, conversion and logic gates		
<b>2.</b>	To demonstrate proficiency in using Karnaugh maps for simplifying Boolean expressions and applying tabulation methods, as well as understanding the functionality and application of various data processing circuits.		
<b>3.</b>	To develop a thorough understanding of arithmetic circuits and the arithmetic unit.		
<b>4.</b>	To develop a comprehensive understanding of machine instructions, memory operations, addressing modes, and subroutines.		
<b>5.</b>	To understand the organization and functionality of Input/Output (I/O) devices, interrupts, and memory systems.		
<b>UNIT - I</b>			
<b>Number Systems and Digital Logic and Combinational Logic Gates</b>			<b>02 Hours</b>
<b>Number Systems:</b> Binary, Octal and Hexadecimal number systems. Conversion between Decimal, Binary and Hexadecimal number systems, Binary Coded Decimal.			
<b>Digital Logic</b>			<b>03 Hours</b>
Overview of Basic Gates and Universal Logic Gates, Realization of Boolean expressions using basic and universal gates, Exclusive OR Gate, Exclusive NOR Gate, Positive and Negative Logic.			
<b>Combinational Logic Gates</b>			<b>04 Hours</b>
Boolean Laws and Theorems, Demorgan's theorem, Simplifying Boolean Expression using Boolean postulates, Sum-of-Products Method, Product-of-sums method, Product-of-sums simplification.			
<b>UNIT - II</b>			
<b>Karnaugh Simplification</b>			<b>06 Hours</b>
Karnaugh Maps with Two, Three, Four, Five, Six Variables. Don't care conditions, Tabulation method.			
<b>Data Processing Circuits:</b>			<b>06 Hours</b>
Multiplexers, Demultiplexers, Decoders, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Parity Generators and Checkers, Magnitude Comparator.			
<b>UNIT - III</b>			
<b>Arithmetic Circuits and Arithmetic Unit</b>			<b>06 Hours</b>
Binary Addition, Binary Subtraction, Unsigned Binary Numbers, Sign-Magnitude Numbers, 2's Complement representation, Arithmetic building blocks, Parallel Adders/Subtractors, Adder-Subtractor, Fast Adder.			
			<b>06 Hours</b>
Binary Multiplication, Multiplication of Positive Numbers, Binary Multipliers, Signed-Operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers & Operations.			

<b>Unit - IV</b>															
<b>Machine Instruction and Programs</b>													<b>09 Hours</b>		
Basic operational concepts on machine instruction, Memory Location and Addresses, Memory Operations; Instructions & Instruction Sequencing; Addressing Modes, Stacks and Queues, Subroutines, Subroutine nesting and processor stack, parameter passing.															
<b>Unit - V</b>															
<b>Input/Output Organization</b>										Accessing I/O			<b>05 Hours</b>		
Devices, Interrupts, Interrupt Hardware, Enabling and Disabling Interrupts, Exceptions, Handling Multiple Devices, Controlling Device Requests, Buses, Direct Memory Access.															
<b>Memory System:</b>													<b>05 Hours</b>		
Semiconductor RAM Memories, Read-Only Memories, Cache Memories - Mapping Functions.															
<b>Course Outcomes:</b> At the end of the course student will be able to															
<b>1.</b>	Convert the number from one numbering system to another and realize the logic expression using Basic/ universal gates.														
<b>2.</b>	Demonstrate proficiency in using Karnaugh maps for simplifying Boolean expressions and applying tabulation methods, as well as understanding the functionality and application of various data processing circuits, such as multiplexers, decoders, encoders, and comparators.														
<b>3.</b>	To represent numbers in 2's complement and perform addition and subtraction of binary, binary multiplication, division, and analyze and design logic circuits for Adders, Subtractors and Fast Adders.														
<b>4.</b>	Analyze and interpret machine instructions, memory operations, addressing modes, and subroutines to effectively write the programs.														
<b>5.</b>	Demonstrate a comprehensive understanding of the organization and functionality of input/output (I/O) devices, interrupts, memory systems, and their interactions in a computer system.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes</b> →		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO1</b>	<b>PSO2</b>
↓ <b>Course Outcomes</b>															
<b>22MCA103.1</b>		3	2	3		2					2		2	3	
<b>22MCA103.2</b>		2	2	3		2					2		2	3	
<b>22MCA103.3</b>		2	2	3		2					2		2	3	
<b>22MCA103.4</b>		3	2	2		2					2		2	3	
<b>22MCA103.5</b>		2	2	3		2					2		2	3	
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
<b>1.</b>	Roger L Tokheim : Digital Electronics Principles and Applications, Sixth Edition, McGraw Hill, 2004														
<b>2.</b>	M Morris Mano, "Digital Logic and Computer Design", 10th Edition, Pearson, 2008														
<b>3.</b>	Carl Hamacher, Z Varnesic and S Zaky : Computer Organization, Fifth Edition, McGraw Hill, 2002														
<b>REFERENCE BOOKS:</b>															
<b>1.</b>	Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic Design with VHDL", 2 <sup>nd</sup> Edition, Tata McGraw Hill, 2005.														
<b>2.</b>	Donald P Leach, Albert Paul Malvino & Goutam Saha, "Digital Principles and Applications", 8 <sup>th</sup> Edition, Tata McGraw Hill, 2015														
<b>E Books / MOOCs/ NPTEL</b>															



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<b>Mathematical Foundation for Computer Applications</b>			
<b>Course Code:</b>	<b>22MCA104</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students should have knowledge of basic mathematics.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand operations on set theory, Solve example problems on set operations		
<b>2.</b>	Understand and solve problems on addition subtraction and multiplication of matrices.		
<b>3.</b>	Solve problems on eigen values and eigen vectors		
<b>4.</b>	Find mean, variance and covariance of two discrete and continuous random variable		
<b>5.</b>	Solve problems related to Graphs		
<b>UNIT - I</b>			
<b>Set theory and operations on sets :</b> Introduction, Venn Diagrams, subsets, The size of a set, power sets, cartesian products, Using set notations with quantifiers, Truth sets and quantifies Operations on sets : Introduction, set identities, generalizes unions and intersections, computer representations of sets			<b>05 Hours</b>
<b>Cardinality :</b> Introduction, countable sets, an uncountable set Inclusion-exclusion principle : Introduction, the principle of inclusion exclusion <b>Matrices :</b> Introduction, matrix arithmetic, transposes and powers of matrices, Zero-one matrices <b>eigen values and eigen vectors :</b> Finding Eigen values and Eigen vectors : Introduction, Procedure to find Eigen values, Procedure to find Eigen Vectors			<b>05 Hours</b>
<b>UNIT - II</b>			
<b>Propositional Logic :</b> Introduction, Propositions, Conditional statements, Converse, Contrapositive and Inverse statements, Biconditional statements, Truth tables of Compound propositions, Precedence of logical operators, logic and bit operations <b>Applications of Propositional Logic :</b> Introduction, Translating English sentences, System Specifications, Logic Circuits, Logic Puzzles			<b>05 Hours</b>
<b>Propositional Equivalences :</b> Introduction, Logical Equivalences, Using De Morgan's Laws, Constructing new logical equivalences, Propositional satisfiability, solving satisfiability problems <b>Predicates and Quantifiers :</b> Introduction, Predicates, Preconditions and post conditions, Quantifiers : Universal quantifier and existential quantifiers and uniqueness quantifiers			<b>05 Hours</b>

<b>UNIT - III</b>	
<b>Relations and their Properties :</b> Functions as relations, relations on a set, properties of relations, combining relations	<b>05 Hours</b>
<b>n-ary Relations and their Applications :</b> Introduction, n-ary relations, databases and relations, operations on n-ary relations, SQL	
<b>Representing Relations :</b> Introduction, representing relations using Matrices, representing using diagraphs	<b>05 Hours</b>
<b>Closures of Relations :</b> Introduction, closures, paths in directed graphs, transitive closures, Warshall's algorithm.	
<b>Equivalence relations :</b> Introduction, Equivalence relations, equivalence classes, equivalence classes and partitions	
<b>UNIT - IV</b>	
<b>The concept of probability :</b> Introduction, Sample space and events	<b>06 Hours</b>
<b>The axioms of probability :</b> Introduction, Properties of Probability, Bayes' Theorem, Basics of Probability, Concept of random variable	
<b>Discrete probability distributions :</b> Introduction, Probability distribution for discrete random variable, expected values, Mean, variance and co-variance	<b>06 Hours</b>
<b>Continuous probability distributions :</b> Introduction, Probability density function, expected values, Mean, variance and co-variance Binomial and normal distribution	
<b>UNIT - V</b>	
<b>Graph Models Graph Terminology and Special Types of Graphs :</b> Introduction, Basic Terminology, some special simple graphs, Bipartite Graphs, Bipartite Graphs and matchings, some applications of special types of graphs, new graphs from old	<b>05 Hours</b>
<b>Representing Graphs and Graph Isomorphism :</b> Introduction, Representing Graphs, Adjacency Matrices, Incidence Matrices, Isomorphism of graphs, Determining whether two simple graphs are isomorphic	<b>05 Hours</b>
<b>Euler and Hamilton Paths :</b> Introduction, Euler paths and circuits, Hamilton paths and circuits, Applications of Hamilton Circuits	
<b>Course Outcomes:</b> At the end of the course student will be able to	
<b>1.</b>	Able to solve problems effectively on set operations.
<b>2.</b>	Understand and solve problems on addition subtraction and multiplication of matrices.
<b>3.</b>	Translate sentences based on mathematical logic and solve problems related to applications of mathematical logic
<b>4.</b>	Should be able to find mean, variance and covariance of to discrete and continuous random variable
<b>5.</b>	Solve problems related to Graphs
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>	

<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA104.1</b>	3	3	3	3			3	3			3		3	2
<b>22MCA104.2</b>	3	3	3	3			3	3			3		3	3
<b>22MCA104.3</b>	3	3	3	3			3	3			3		3	3
<b>22MCA104.4</b>	3	3	3	3			3	3			3		3	3
<b>22MCA104.5</b>	3	3	3	3			3	3			3		3	2
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Kenneth H Rosen, “Discrete Mathematics and its Applications”, McGraw Hill Publications, 7 <sup>th</sup> Edition. (Chapters 2.1,2.2,2.5, 2.6,6.2,8.5,8.6,10.1 to 10.8)													
<b>2.</b>	Wolpole Myers Ye “Probability and Statistics for engineers and Scientist” Pearson Education, 8 <sup>th</sup> Edition													
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	Richard A Johnson and C.B Gupta “Probability and statistics for engineers” Pearson Education.													
<b>2.</b>	J.K Sharma “Discrete Mathematics”, Mac Millian Publishers India, 3 <sup>rd</sup> Edition, 2011.													
<b>E Books / MOOCs/ NPTEL</b>														
<b>1.</b>	H. Pishro-Nik, "Introduction to probability, statistics, and random processes", available at <a href="https://www.probabilitycourse.com">https://www.probabilitycourse.com</a> , Kappa Research LLC, 2014.													

<b>Software Engineering and Testing</b>			
<b>Course Code:</b>	<b>22MCA105</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b>Prerequisites :</b>			
Students should have knowledge of basic programming.			
<b>Course Objectives:</b>			
1.	To introduce and describe on outline process models for requirements engineering, software development, testing and evolution.		
2.	To describe Agile development techniques and to describe functional and non-functional requirements		
3.	To understand the different system models and software designs.		
4.	To understand the verification and validation testing methods.		
5.	To describe the Organizational approaches of testing.		
<b>UNIT - I</b>			
<b>Introduction:</b> Professional software development; Software Engineering and Testing.			<b>02 Hours</b>
<b>Software processes:</b> Software processes Models; The waterfall model, Incremental development, Integration and configuration.			<b>04 Hours</b>
<b>Process activities:</b> Software specification, Software design and implementation, Software validation, Software evolution.			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Agile Software development:</b> Agile methods, Agile development techniques.			<b>03 Hours</b>
<b>Software requirements:</b> Functional and non-functional requirements; Requirements engineering Process, Requirement elicitation, Requirement specification, Requirement Validation.			<b>07 Hours</b>
<b>UNIT-III</b>			
<b>System models:</b> Context models; Interaction models; sequence diagram Structured methods; class diagram, generalization, Aggregation. Behavioral Models-Data driven modeling; Event driven modeling, Model driven engineering.			<b>05 Hours</b>
<b>Software Design:</b> Object-oriented design using the UML-System context and interactions, Architecture design, Object class identification, Design models.			<b>05 Hours</b>
<b>UNIT - IV</b>			
<b>The Six Essentials of Software Testing:</b> The Six Essentials of Software Testing			<b>02 Hours</b>
<b>Testing Methods :</b> Verification testing: Basic verification methods, Verifying documents at different phases. Three critical success factors for implementing verification.			<b>05 Hours</b>
<b>Validation testing:</b> Validation overview, Validation methods-Black box methods, White box methods.			<b>05 Hours</b>
<b>UNIT - V</b>			
<b>Validation activities:</b> Low level Testing, High level Testing.			<b>02 Hours</b>
<b>Software testing tools :</b> Categorizing test tools, tool acquisition.			<b>03 Hours</b>
<b>Organizational approaches to testing :</b> Organizing and reorganizing testing, Structural design elements, Approaches to organizing the test function.			<b>05 Hours</b>
<b>Course Outcomes:</b> At the end of the course students will be able to			
1.	Understand what is Software Engineering and Testing and its importance.		

2.	Understand the phases and activities of the software development process
3.	Apply several Software Engineering and Testing techniques.
4.	Understand the relevance of validation and verification in the Software Engineering and Testing process.
5.	Create meaningful test plans and other critical test deliverables

**Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes**

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	PSO
↓ Course Outcomes													1	2
22MCA105.1	3	2	2	2	3		3		2				3	2
22MCA105.2	3	3	3	3			2		3	2	3		3	2
22MCA105.3	3			3	2	2	1				2		3	2
22MCA105.4		3	3	3	2			2			3	1	3	2
22MCA105.5	3	3	3	3	3	2			1	1		1	3	2

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1. Ian Somerville: Software Engineering, 10<sup>th</sup> edition, Pearson Education Ltd
2. Edward Kit: Software Testing in the Real World, Addison – Wesley

**REFERENCE BOOKS:**

1. William Perry: Effective Methods for Software Testing, Second Edition, John Wiley.
2. Bezier B: Software Testing Techniques, Second Edition, Wan Nostrand Reinluold.
3. Myers G J: The Art of Software Testing, John Wiley.
4. Roger S. Pressman: Software Engineering – A practitioners approach, 7<sup>th</sup> edition, McGraw-Hill

## Syllabus of I Semester MCA (Master of Computer Applications)

<b>Research Methodology and Publication Ethics</b>			
<b>Course Code:</b>	<b>22MCA106</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>2:0:0:0</b>	<b>Credits</b>	<b>02</b>
<b>Total Teaching Hours</b>	<b>26</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
1. Essential qualifications for understanding research. 2. Intellectual curiosity, personal ambition to gain recognition, to serve the society.			
<b>Course Objectives:</b>			
<b>1.</b>	To understand the Meaning, Objectives and Characteristics of research		
<b>2.</b>	To understand how to select and define the research problem.		
<b>3.</b>	To understand Research design and methods		
<b>4.</b>	To understand Philosophy, Ethics and Scientific Conduct in research		
<b>5.</b>	To understand Intellectual Property Rights		
<b>UNIT - I</b>			
Meaning, Objectives and Characteristics of research - Research methods Vs Methodology –Types of research –Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical – Research process – Criteria of good research.			<b>04 Hours</b>
<b>UNIT - II</b>			
Developing a research plan. Defining the research problem - Selecting the problem - Necessity of defining the problem -Techniques involved in defining the problem - Importance of literature review in defining a problem - Survey of literature - Primary and secondary sources			<b>05 Hours</b>
<b>UNIT - III</b>			
Research design and methods – Research design – Basic Principles- Need of research design – Features of good design– Important concepts relating to research design. Sampling design - Steps in sampling design - Characteristics of a good sample design - Types of sample designs – Measurement and scaling techniques – Methods of data collection – Collection of primary data – Data collection instruments			<b>06 Hours</b>
<b>Unit - IV</b>			
Philosophy and Ethics, Scientific Conduct: Ethics: definition, moral philosophy, nature of moral judgments and reactions. Scientific Conduct Ethics with respect to science and research. Intellectual honesty and research integrity.			<b>06 Hours</b>
<b>Unit - V</b>			
Intellectual Property Rights : The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957			<b>05 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to			

1.	Understand and explain the Meaning, Objectives and Characteristics of research
2.	Understand and explain how to select and define a research problem.
3.	Understand and explain research design and methods
4.	Understand and explain the philosophy, ethics and scientific conduct in research
5.	Understand and explain intellectual property rights

**Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes**

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	PSO
↓ Course Outcomes													1	2
<b>22MCA106.1</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>22MCA106.2</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>22MCA106.3</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>22MCA106.4</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>22MCA106.5</b>	3	3	3	2	3	3	3	3	3	3	3	3	3	3

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An Introduction to Research Methodology, RBSA Publishers.
2. Kothari, C. R., 1990. Research Methodology : Methods and Techniques. New Age International. 418 p.
3. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi

**REFERENCE BOOKS:**

1. Sinha, S. C. and Dhiman, A. K., 2002. Research Methodology, EssEss Publications. 2 volumes.
2. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
4. Coley, S. M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
5. Intellectual Property Rights in the Global Economy : Keith Eugene Maskus, Institute for International Economics, Washington, DC, 2000
6. Subbarau N R – Handbook on Intellectual Property Law and Practice-S Viswanathan Printers and Publishing Private Limited. 1998



<b>Data Structures with Algorithms Lab</b>	
<b>Course Code:</b>	<b>22MCA107</b>
<b>Teaching Hours/Week (L:T:P:S):</b>	<b>0:0:4:0</b>
<b>Total Teaching Hours:</b>	<b>26</b>
<b>Course Type:</b>	<b>PCC</b>
<b>Credits:</b>	<b>02</b>
<b>CIE + SEE Marks:</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>	
<b>Prerequisites :</b>	
Students must have basic knowledge of C programming.	
<b>Course Objectives:</b>	
<b>1.</b>	Implement the primitive data structures such as arrays and structures.
<b>2.</b>	Implement Stack, Queue data structures statically.
<b>3.</b>	Implement the non linear data structures such as Linked list, Binary Trees, Graphs.
<b>4.</b>	Implement different sorting methods and searching methods
<b>List of Experiments</b>	
<b>1.</b>	C programs to demonstrate the operations of stack. (using arrays and structures).
<b>2.</b>	C programs to convert the valid infix arithmetic expression to postfix and prefix form.
<b>3.</b>	Evaluate postfix expression.
<b>4.</b>	Recursive C programs to <ul style="list-style-type: none"> <li>i) Find the Factorial of a number.</li> <li>ii) Find Fibonacci of a number.</li> <li>iii) Solve Towers of Hanoi Problem.</li> <li>iv) Find the GCD of two numbers.</li> <li>v) Find the multiplication of two numbers.</li> </ul>
<b>5.</b>	C programs using pointers.
<b>6.</b>	C programs to simulate the working of simple queue, circular queue and priority queue using arrays and structures.
<b>7.</b>	C programs to demonstrate the operations of singly & doubly linked list. (operations like insert a node at the front, at the back, at the specified position; delete a node from the front end, from the back end, from the specified position; search a node, if the info field is specified; display all the nodes in the list).
<b>8.</b>	Implement stack and queues using singly linked list.
<b>9.</b>	C programs on binary trees. (Construct a binary search tree and Traverse the tree using all the methods i.e., inorder, preorder, postorder).
<b>10.</b>	C programs to demonstrate the different searching techniques over a list of integers. (Linear search, Binary search).
<b>11.</b>	C programs to sort a list using different sorting techniques. (Bubble sort selection sort, quick sort, simple insertion sort, shell sort, merge sort, Heap sort, Binary tree sort).
<b>Course Outcomes:</b> At the end of the course student will be able to	
<b>1.</b>	Static implementation of Stack and Queue data structures. Understand the concept of Recursive programs. Understand the implementation details of linked lists. Dynamic Implementation of Stack and Queue data structures.
<b>2.</b>	Understand the implementation details of Binary tree and Graph data structures. Implement and Illustrate various Sorting and Searching Techniques

<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>													<b>1</b>	<b>2</b>
<b>22MCA107.1</b>	3	3	3	3	2		3	3	2	3	3		3	2
<b>22MCA107.2</b>	3	3	2	2	3		3	3	3	3	2		3	2
<b>1: Low 2: Medium 3: High</b>														
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	Yediyah Langsam and Moshe J Augenstein and Aaron M Tenenbaum: Data Structures using C and C++, Second Edition, Pearson Education Asia, 2002.													
<b>2.</b>	Jean-Paul Tremblay: An Introduction to Data Structures with Applications, Tata McGraw Hill													
<b>3.</b>	Introduction to the Design and Analysis of Algorithms. Anany Levitin, Pearson Education, 2nd Edition.													
<b>4.</b>	Horowitz E., Sahani S., Rajashekharan S: Computer Algorithm, Galgotia Publications.													

<b>Advanced Database Systems Lab</b>														
<b>Course Code: 22MCA108</b>						<b>Course Type: PCC</b>								
<b>Teaching Hours/Week (L: T: P: S): 0:0:4:0</b>						<b>Credits: 02</b>								
<b>Total Teaching Hours: 30</b>						<b>CIE + SEE Marks: 50+50</b>								
<b>Teaching Department: Master of Computer Applications</b>														
<b><u>Prerequisites :</u></b>														
Student must have basic knowledge of computer system- hardware/software and File Programming.														
<b>Course Objectives:</b>														
1.	Populate and query a database using SQL DML/DDDL commands													
2.	Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS													
3.	Programming PL/SQL including stored procedures, Cursors and triggers.													
4.	Perform MongoDB CRUD operations.													
<b>List of Experiments</b>														
1.	Exercise on creating tables.													
2.	Exercise on altering tables, dropping tables.													
3.	Exercise on giving table level constraints, field level constraints.													
4.	Exercise on insertion, retrieval, deletion and modification of data values.													
5.	Exercise on ORDER BY, GROUP BY, HAVING clauses.													
6.	Exercise on Aggregate functions in SQL.													
7.	Exercise on Joins, Unions, Sub queries, Nested Sub queries, Co-related sub-queries.													
8.	Exercise on creating views, dropping views.													
9.	Exercise on PL/SQL : control structures, connecting tables.													
10.	Exercise on PL/SQL : Cursors, Triggers, Exception handling.													
11.	Exercise on MongoDB.													
12.	Design & Implementation of a Database.													
<b>Course Outcomes:</b> At the end of the course students will be able to														
1.	Understand and use database language statements to query, update, and manage a database using SQL and PL/SQL.													
2.	Understand the concepts used in performing CRUD operations using NoSQL database like MongoDB.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>													1	2
<b>22MCA108.1</b>	3	3			3							3	3	
<b>22MCA108.2</b>	2	3			2							3	3	
<b>1: Low 2: Medium 3: High</b>														
<b>REFERENCE BOOKS:</b>														
1.	Elmasri and Navathe: Fundamentals of Database Systems, Seventh Edition 2016													
2.	Ivan Bayross : Commercial Application Development using Oracle Developer 2000													

<b>3.</b>	Seema Acharya, Subhashini Chellappan, “Big Data Analytics”, 1st Edition, Wiley, 2015
<b>E Resources</b>	
<b>1.</b>	NOC: Fundamentals of Database Systems (Course sponsored by Aricent), IIT Kanpur, Dr. Arnab Bhattacharya <a href="https://nptel.ac.in/courses/106104135">https://nptel.ac.in/courses/106104135</a>
<b>2.</b>	<b>Oracle PL/SQL Language Pocket Reference, 5th Edition: A Guide to Oracle's PL/SQL Language Fundamentals</b> <a href="https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html">https://www.pdfdrive.com/oracle-plsql-language-pocket-reference-5th-edition-a-guide-to-oracles-plsql-language-fundamentals-d167357800.html</a>

## Syllabus of I Semester MCA (Master of Computer Applications)

<b>Fundamentals of Programming – Bridge Course</b>															
<b>Course Code: 22MCA109</b>							<b>Course Type: PCC</b>								
<b>Teaching Hours/Week (L:T:P:S): 0:0:4:0</b>							<b>Credits: 00</b>								
<b>Total Teaching Hours: 26</b>							<b>CIE + SEE Marks: 50+50</b>								
<b>Teaching Department: Master of Computer Applications</b>															
<b>Course Objectives:</b>															
1.	Learn the basics of programming structure and module.														
2.	Study the concept of decision making statements, loop controlling structures.														
3.	Learn and execute programs on arrays and structures.														
4.	Gain knowledge about pointers and execute the programs using pointers.														
<b>List of Experiments</b>															
1.	Simple C programs with input – output statements.														
2.	C programs with decision making statements.														
3.	C programs using loop control structures.														
4.	C programs using arrays.														
5.	C programs using structures.														
6.	C programs using pointers.														
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Understand the basics of programming structure and module. Demonstrate the concept of decision making statements, loop controlling structures. Execute simple programs, programs using arrays and structures.														
2.	Understand the concepts of functions and subroutine, execute the programs. Understand the pointer concepts and execute the programs using pointers.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>														1	2
<b>22MCA109.1</b>		3	3	3	3	2		3	3	3	3	3		3	2
<b>22MCA109.2</b>		3	3	2	2	3		2	3	3	3	2		3	2
<b>1: Low 2: Medium 3: High</b>															

<b>Data Communication and Computer Networks</b>			
<b>Course Code:</b>	<b>22MCA201</b>	<b>Course Type:</b>	<b>PCC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:0:0:0</b>	<b>Credits:</b>	<b>03</b>
<b>Total Teaching Hours:</b>	<b>39</b>	<b>CIE + SEE Marks:</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students must have some basic knowledge of computer system hardware and software.			
<b>Course Objectives: This Course will enable students to</b>			
<b>1.</b>	To Understand the fundamental concepts of computer networks and familiarize with the Transmission Media, Error Detection & Correction methods.		
<b>2.</b>	To understand and apply protocols, technologies, and design principles of the application layer and the data link layer in network communication.		
<b>3.</b>	To Understand the purpose and functionality of the transport layer, learn about transport layer protocols, mechanisms, and services, and explore the impact of transport layer on network communication.		
<b>4.</b>	To Understand the network layer's role in routing, addressing, and forwarding, learn about network layer protocols and algorithms,		
<b>5.</b>	To Understand the concept of congestion control in network communication, learn about different congestion control algorithms and mechanisms		
<b>UNIT-I</b>			
Introduction: Data Communications, computer Networks			<b>01 Hours</b>
<b>Networks Protocols and Architecture:</b> OSI: The model, The OSI Layers; TCP/IP Protocol Architecture : The TCP/IP layers.			<b>03 Hours</b>
<b>Data Encoding and Communication Interfaces:</b> Digital Data Digital Signals: None turn to zero(NRZ), Multilevel Binary, Biphasic, Modulation Rate, scrambling techniques, Digital Data Analog Signals: Encoding Techniques; Analog Data Digital Signals: Pulse Code Modulation, Asynchronous & Synchronous Transmission; Types of Errors; Error Detection: Parity Check, Cyclic Redundancy Check(CRC): arithmetic modulo, polynomial, digital logic, Error Correction: Block Code Principles.			<b>05 Hours</b>
<b>UNIT-II</b>			
<b>Data Link Control:</b> Flow Control: Stop and Wait & Sliding Window Flow Controls; Error Control: Stop and Wait ARQ, GO-Back-N ARQ, Selective-Reject ARQ; High-level Data Link Control: Basic Characteristics, Frame Structure.			<b>03 Hours</b>
<b>Application Layer:</b> DNS- The Domain Name System: The DNS Name Space, Resource Records, Name Servers; Electronic mail: Architecture and Services, The User Agent, Message Formats:			<b>04 Hours</b>

MIME, Message Transfer: SMTP, Final Delivery:POP3,IMAP, HTTP.															
<b>UNIT-III</b>															
<b>The Transport Layer:</b> The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives, Berkley Sockets; Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release. The Internet Transport Protocols: UDP: Introduction to UDP, Remote Procedure Call; The Internet Transport Protocols: TCP: Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header													<b>07 Hours</b>		
<b>UNIT-IV</b>															
<b>Network layer:</b> Network layer design issues: Store and Forward packet Switching, Services Provided to the Transport Layer, Implementation of Connection less Service, Implementation of Connection-Oriented Service, Comparison of Virtual Circuit and Datagram Subnets; Routing algorithms: The Optimality Principal, Shortest Path Routing, Flooding, Distance Vector Routing, Link state Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing.													<b>08 Hours</b>		
<b>UNIT-V</b>															
<b>Congestion Control:</b> Congestion Control Algorithms: General Principles of Congestion Control, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control; Quality of Service: Requirements, Techniques for Achieving Good Quality of Service, Integrated Services, Differentiated Services; Inter-networking: How networks differ, How Networks Can Be Connected, Concatenated Virtual Circuits, Tunneling, Fragmentation,Ipv6.													<b>08 Hours</b>		
<b>Course Outcomes:</b> At the end of the course student will be able to															
<b>1.</b>	<b>Understand</b> the concepts of computer networks, Data Transmission and Data Encoding Techniques. how the data is transmitted in the Physical Layer and usage of the different Layers in the Data Transmission.														
<b>2.</b>	<b>Demonstrate</b> proficiency in developing and deploying network applications, implementing data link layer protocols.														
<b>3.</b>	<b>Apply</b> transport layer protocols and mechanisms to ensure reliable and efficient data transmission and understand the relationship between the transport layer and other layers in the network architecture.														
<b>4.</b>	<b>Apply</b> network layer protocols and algorithms to enable efficient routing and forwarding of data packets.														
<b>5.</b>	<b>Apply</b> congestion control algorithms and mechanisms to regulate and optimize network traffic flow, analyze and design and implement effective congestion control solutions in network environments.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
	<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
	↓ <b>Course Outcomes</b>														
	<b>22MCA201.1</b>	3	3	3	3	3					3	3	3	3	
	<b>22MCA201.2</b>	2	3	2	2	3					2	2	2	2	
	<b>22MCA201.3</b>	3	3	2	3	2					2	3	3	3	

<b>22MCA201.4</b>	3	2	3	3	3					3	3	3	3	
<b>22MCA201.5</b>	3	3	3	3	3					3	3	3	3	
<b>1: Low 2: Medium 3: High</b>														
<b>TEXTBOOKS:</b>														
1.	William Stallings: Data and Computer Communication, Eighth Edition, Pearson Education													
2.	Alberto Leon - Garcia and Indra Widjaja, Communication Networks - Fundamental Concepts and Key architectures, Tata McGraw-Hill, 2000.													
3.	Andrew S. Tanenbaum: Computer Networks, Fourth Edition, Pearson Education, Asia, 2008.													
<b>REFERENCE BOOKS:</b>														
1.	Behrouz A. Forouzan: Data Communications and Networking, Tata McGraw-Hill													
2.	Achyut S Godbole: Data Communications and Networks, Tata McGraw-Hill.													
<b>E Books / MOOCs/ NPTEL:</b>														
1.	<a href="https://open.umn.edu/opentextbooks/textbooks/353">https://open.umn.edu/opentextbooks/textbooks/353</a>													
2.	<a href="https://freecomputerbooks.com/An-Introduction-to-Computer-Networks-by-Peter-Dordal.html">https://freecomputerbooks.com/An-Introduction-to-Computer-Networks-by-Peter-Dordal.html</a>													
3.	<a href="https://onlinecourses.swayam2http://nptel.ac.in/courses/106105081/.ac.in/cec22_cs05/preview">https://onlinecourses.swayam2http://nptel.ac.in/courses/106105081/.ac.in/cec22_cs05/preview</a>													
4	<a href="http://nptel.ac.in/courses/106105081/">http://nptel.ac.in/courses/106105081/</a>													



<b>Enterprise Java</b>			
<b>Course Code:</b>	<b>22MCA202</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have basic knowledge of Object-Oriented Programming concepts.			
<b>Course Objectives:</b>			
<b>1.</b>	To understand Input/Output using Java and use Class fundamentals, Objects, Methods, Polymorphism,		
<b>2.</b>	To understand Inheritance, Abstraction, Package creation and Exceptions handling in Java		
<b>3.</b>	To understand Multithreaded Programming concepts using Java, develop GUI Applications in Java using Swing packages and Event handling.		
<b>4.</b>	To understand and use Networking concepts, Distributed computing using RMI, JDBC for Database connectivity and Component development using Java Beans.		
<b>5.</b>	To understand Web application development, Using Servlets, Spring Boot.		
<b>UNIT - I</b>			
<b>Introduction to JAVA :</b>			<b>10 Hours</b>
<b>Introducing classes:</b> Class fundamentals; Declaring objects; Assigning object reference variables; Introducing methods; Constructors; The this keyword; Overloading methods; Introducing access control; Understanding static: Introducing final; introducing nested and inner classes; String class, StringBuilder class. <b>Stream Classes:</b> Reading and writing files; Stream classes; Byte Streams (InputStream; OutputStream; FileInputStream; FileOutputStream; DataInputStream, DataOutputStream); Character streams(Reader; Writer, FileReader, FileWriter, BufferedReader, BufferedWriter); Serialization: Serializable, ObjectOutputStream, ObjectInputStream.			
<b>UNIT -II</b>			
<b>Object Oriented Fundamentals and Exception Handling</b>			<b>06 Hours</b>
<b>Inheritance :</b> Inheritance basics; Using super; Creating a multilevel hierarchy; Method overriding; Dynamic method dispatch; Using Abstract class; Using final with inheritance, Aggregation. <b>Packages and Interfaces :</b> Packages; Access protection; Importing packages; Interfaces. <b>Exception handling :</b> Exception- handling fundamentals; Exception types; Uncaught exceptions; Using try and catch; Multiple catch clauses; Nested try statements; throw; throws; finally; Java's built-in exceptions; Creating your own exception sub-classes;			
<b>UNIT - III</b>			
<b>The Collection Framework, Multithreaded Programming and Event Handling, AWT and Swings:</b>			<b>08 Hours</b>
<b>The Collection Framework:</b> The Collection interfaces: The Collection interface, The List interface, The Set interface;			

<p>The collection classes: The ArrayList class, The LinkedList class, The HashSet class, The LinkedHashMap class</p> <p><b>Multithreaded programming:</b>          Java Thread model; Main thread; Creating a thread; Creating multiple threads; Using isAlive() and join(); Synchronization; Interthread communication;</p> <p><b>Event Handling, AWT and Swings :</b>  <b>Event Handling:</b>          Two event handling mechanisms; Delegation event model; Event classes; Sources of events; EventListener interfaces; Using the Delegation Event Model;</p> <p><b>Swings :</b>          JApplet; JFrame; Labels; Text fields; Buttons; Check boxes; RadioButtons; Adapter classes</p>	
<b>Unit - IV</b>	
<p><b>Networking, RMI, JDBC and Java Beans :</b>          Networking basics: Java and the net; InetAddress; TCP/IP client sockets; URL: URLConnection; TCP/IP server sockets; Datagrams.</p> <p><b>RMI :</b>          Remote Method Invocation (RMI): Remote Method Invocation concept; Server side; Client side.</p> <p><b>JDBC :</b>          JDBC objects: Concept of JDBC; JDBC driver types; JDBC packages; Brief overview of the JDBC process; Database connection; Associating the JDBC/ODBC bridge with the database; Statement objects; ResultSet; Transaction Processing.</p> <p><b>Java Beans :</b>          Introduction to Java Beans; Advantages of Java Beans; JAR files; Introspection; Developing a simple Bean; Using bound properties; Using BeanInfo Interface; Constrained properties.</p>	<b>08 Hours</b>
<b>Unit - V</b>	
<p><b>Servlets and Spring Boot :</b>  <b>Servlets :</b>          Background; Life cycle of a Servlet; Simple Servlet; Servlet API; javax.servlet package; Reading Servlet parameter; javax.servlet.http package; Handling HTTP requests and responses; Using Cookies, Session Objects.</p> <p><b>Spring Boot :</b>          What is Spring Boot?, Advantages of Spring Boot, Spring Boot Features, Spring Boot Architecture, Spring Initializer, Creating a Spring Boot Project, Spring Boot Project Components, Spring Boot Database, Spring Boot View.</p>	<b>07 Hours</b>
<p><b>Course Outcomes:</b> At the end of the course student will be able to</p>	
1.	Create Java applications based on Object Oriented Programming concepts.
2.	Handle Exceptions and implement Multithreaded Programming concepts using Java
3.	Create applications that employ Swing for GUI development, package hierarchies that may be deployed as executable JARs as well as understand the use of various Input/Output packages.
4.	Understand and implement Networking concepts, Distributed computing using RMI, JDBC for Database connectivity and Component development using Java Beans.
5.	Understand and implement Web application development Using Servlets, Spring Boot.
<p><b>Course Outcomes Mapping with Program Outcomes &amp; PSO</b></p>	

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
↓ Course Outcomes													1	2
22MCA202.1	3		3	3	3				3		3		3	
22MCA202.2	3		3	3	3				3		3		3	
22MCA202.3	3		3	3	3				3		3		3	
22MCA202.4	3		3	3	3				3		3		3	
22MCA202.5	3		3	3	3				3		3		3	

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1.	Herbert Schildt : Java: The Complete Reference, Eleventh Edition, Tata McGraw Hill., 2019
2.	Java Server Programming Java EE 7 (J2EE 1.7), Black Book, Dreamtech press 2014
3.	Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot, Dinesh Rajput, Pack Publishing Ltd., 2018

**REFERENCE BOOKS:**

1.	Dr. Donald Doherty and Rick Leinecker : JavaBeans Unleashed
2.	James Goodwill : Developing Java Servlets
3.	Karl Avedal, Danny Ayers : Professional JSP
4.	Steven Holzner : Java 2 Black Book
5.	Ed Roman : Mastering Enterprise JavaBeans
6.	Jim Keogh : The Complete Reference J2EE, Tata McGraw Hill, 2008.

<b>Operating Systems with UNIX</b>			
<b>Course Code:</b>	<b>22MCA203</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students should have knowledge about computer organization, different parts of computer system and also high level languages like C.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the principles and services of operating systems		
<b>2.</b>	Analyse fundamental operating system abstractions like process, threads, files, semaphores and IPC		
<b>3.</b>	Know the benefits of concurrency and synchronization and apply them to write concurrent programs.		
<b>4.</b>	Learn the philosophy behind Unix Operating System along with its architecture.		
<b>5.</b>	Write Shell scripts and Use Unix commands appropriately.		
<b>UNIT - I</b>			
<b>Introduction to Operating Systems :</b> System Structure What operating systems do; Computer System Organization; Computer System Architecture; Operating System Operations; Operating System Services; System Calls; Types of System Calls; System Programs;			<b>04 Hours</b>
<b>Operating System Structure :</b> Virtual Machines; System boot. Overview of Process, Process Concept; Process Scheduling; Operations on Processes; Inter – Process Communication; Multi – Threaded Programming; Overview: Multithreading Models.			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Process Management Process Scheduling:</b> Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling			<b>04 Hours</b>
<b>Process Synchronization:</b> The Critical Section Problem: Peterson’s Solution; Semaphores; Classical Problems of Synchronization.			<b>03 Hours</b>
<b>UNIT - III</b>			
<b>Deadlocks:</b> System model; Deadlock Characterization, Methods for handling deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from deadlock.			<b>04 Hours</b>
<b>Memory Management Memory Management Strategies:</b> Background, Swapping; Contiguous Memory Allocation; Paging; Segmentation; Virtual Memory Management; Background; Demand Paging; Page Replacement.			<b>04 Hours</b>

<b>UNIT - IV</b>														
<b>The File System:</b> The File, What's in a File name? The Parent-Child Relationship, The HOME Variable: The Home Directory, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The Unix File System. Basic File Attributes: ls options, File Ownership, File Permissions, chmod, Directory Permissions, Changing the File Ownership More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links, The Directory, umask, Modification and Access Times, find. The Shell: The Shell's Interpretive Cycle, Shell Offerings												<b>04 Hours</b>		
<b>Pattern Matching-The Wild-cards, Escaping and Quoting, Redirection:</b> The Three Standard Files, Two Special Files: /dev/null and /dev/tty, pipes, tee: Creating a Tee, Command Substitution.												<b>04 Hours</b>		
<b>UNIT - V</b>														
<b>The Process:</b> Process Basics, ps: Process Status, System Processes, Mechanism of Process Creation, Internal and External Commands, Running Jobs in Background, Killing Processes with Signals, Job Control, at and batch, cron.												<b>04 Hours</b>		
<b>Essential Shell Programming:</b> Shell Variables, Environment Variables, Shell Scripts, read, Using Command Line Arguments, exit and exit status of command, The Logical Operators, The if Conditional, using test and [] to Evaluate Expression, The case Conditional, expr, while: looping, for: looping with a list, set and shift.												<b>04 Hours</b>		
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	Understand the principles and services of operating systems													
<b>2.</b>	Identify fundamental operating system abstractions like process, threads, files, semaphores and IPC													
<b>3.</b>	Assess the benefits of concurrency and synchronization and apply them to write concurrent programs.													
<b>4.</b>	Learn the philosophy behind Unix Operating System along with its architecture.													
<b>5.</b>	Understand the philosophy behind Unix Operating System along with its architecture. Write Shell scripts and Use Unix commands appropriately.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	PSO
↓ Course Outcomes													1	2
<b>22MCA203.1</b>	3	3	3	3			3	3	3				3	3
<b>22MCA203.2</b>	3	3	3	3			3	3	3				3	2
<b>22MCA203.3</b>	3	3	3	3			3	3	3				3	2
<b>22MCA203.4</b>	3	3	3	3			3	3	3				3	2
<b>22MCA203.5</b>	3	3	3	3			3	3	3				3	2
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Sumitabha Das: UNIX Concepts and Applications, 4 <sup>th</sup> Edition, Tata McGraw Hill, 2006													
<b>2.</b>	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 8 <sup>th</sup> Edition, Wiley – India													
<b>REFERENCE BOOKS:</b>														

1.	UNIX: The Complete Reference: Kenneth Roson et al, Osborne/McGraw Hill, 2000
2.	Using UNIX: Steve Montsugu, 2 <sup>nd</sup> Edition, Prentice Hall India, 1999
3.	UNIX and Shell Programming: M G Venkatesh Murthy, Pearson Education Asia, 2005 Behrouz A Forouzan and Richard F Gilberg
4.	D M Dhamdhare: Operating Systems – A Concept Based Approach, 2nd Edition, Tata McGraw – Hill, 2002
<b>E Books / MOOCs/ NPTEL</b>	
1.	<a href="https://www.oreilly.com/library/view/learning-the-unix/1565923901/">https://www.oreilly.com/library/view/learning-the-unix/1565923901/</a>

<b>Data Warehousing and Data Mining</b>			
<b>Course Code:</b>	<b>22MCA204</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students must possess basic knowledge of computer system - hardware and software, Database Management Systems and Statistics			
<b>Course Objectives:</b>			
<b>1.</b>	Provide the student with an understanding of the concepts of data warehousing, its architecture and modelling		
<b>2.</b>	Explain the Knowledge Discovery Process and get notion of Data Mining		
<b>3.</b>	Learn the Preprocessing techniques required for Data Mining		
<b>4.</b>	Describe the data mining tasks of Association Analysis, Classification and Clustering and also study their well-known techniques		
<b>5.</b>	Test real data sets using popular data mining tools		
<b>UNIT - I</b>			
<b>Data Warehousing &amp; modeling:</b> Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations			<b>12 Hours</b>
<b>UNIT - II</b>			
<b>Data warehouse implementation:</b> Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP			<b>06 Hours</b>
<b>Introduction to Data mining:</b> Introduction- What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.			<b>04 Hours</b>
<b>UNIT - III</b>			
<b>Association Analysis :</b> Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.			<b>10 Hours</b>
<b>UNIT - IV</b>			
<b>Classification :</b> Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers			<b>10 Hours</b>

<b>UNIT - V</b>														
<b>Clustering Analysis :</b> Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.													<b>10 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Describe the architecture of Data Warehouses and compare design schemas													
2.	Apply various preprocessing tasks and define Data Mining													
3.	Explain Association rule mining and apply association algorithms													
4.	Apply various classification techniques and algorithms and evaluate them													
5.	Describe various clustering techniques and apply algorithms													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA204.1</b>	3	3	2	2	1							1	1	3
<b>22MCA204.2</b>	3	2		1	1								1	3
<b>22MCA204.3</b>	2	3	3		2								1	3
<b>22MCA204.4</b>	2	2	2	3	3								1	3
<b>22MCA204.5</b>	3	2	3	1	2								1	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression, 2014.													
2.	Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.													
<b>REFERENCE BOOKS:</b>														
1.	Arun K. Pujari : Data Mining Techniques, 2nd Edition, Universities Press, 2009.													
2.	Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression, 2012.													
3.	Michael J. Berry, Gordon S. Linoff: Mastering Data Mining, Wiley Edition, second edition, 2012													
<b>E Books / MOOCs/ NPTEL</b>														
1.	<a href="#">NPTEL Course on Data Mining</a> , IIT Kharagpur													



## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Professional Communication Skills</b>			
<b>Course Code:</b>	<b>22MCA205</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>1:1:0:0</b>	<b>Credits</b>	<b>02</b>
<b>Total Teaching Hours</b>	<b>26</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Learners must have essential knowledge of English language communication.			
<b>Course Objectives:</b>			
<b>1.</b>	To comprehend the process of Communication, and the basics of technical communication and develop good Presentation skills		
<b>2.</b>	To enhance personality development in social and professional context and to possess knowledge of the Concept of leadership		
<b>3.</b>	To impart better writing skills by sensitizing the learners to the dynamics of effective writing		
<b>4.</b>	To recognize the importance of time management and stress management		
<b>5.</b>	To be aware of ethics in engineering practice and professional responsibilities		
<b>UNIT - I</b>			
<b>Communication Skills :</b> The Concept and Process of Communication, Methods of Communication, Communication Cycle & Feedback			<b>10 Hours</b>
<b>Organizational Communication :</b> Importance and Types of Organizational Communication Effective Communication and Barriers to Communication			
<b>Effective Presentation Strategies :</b> Defining the purpose of presentation, preparation and understanding nuances of delivery			
<b>UNIT - II</b>			
<b>Basic Language Skills and Language through Literature :</b> Grammar and Usage: correct errors, choose correct forms out of alternative choices, join clauses, rewrite sentences as directed.			<b>12 Hours</b>
<b>Listening and Writing Skills :</b> Types of listening and Barriers to effective listening, Application letters and Resume writing and Email etiquettes			
<b>Self-Enhancement :</b> Self-Assessment, Types of Personality, Johari window and SWOT Analysis and Interpersonal Skills Perceptions and Attitudes, Values and Belief Systems and General Etiquettes, Theories of leadership.			
<b>UNIT - III</b>			
<b>Engineering Practice Ethics and Professional responsibilities :</b>			<b>04 Hours</b>

Rights and responsibilities regarding intellectual property, Workplace rights and responsibilities, Responsibilities for environment and society  
**Stress and Time Management :**  
 Identifying the Stress Source, Signs of Stress, Healthier ways to deal with Stress, Time Management, Four Ds of Decision Taking

**Course Outcomes:** At the end of the course student will be able to

- |  |   |
|--|---|
|  | <ol style="list-style-type: none"> <li>1. Understand the concept of communication in everyday process and at organizations</li> <li>2. Improved communication, interaction and presentation of ideas</li> <li>3. Develop progressive attitude at workplace and in society at large and apprehend Leadership styles</li> <li>4. Identify ethics and professional skills effectively</li> <li>5. Recognize the importance of time management and stress management</li> </ol> |
|--|---|

**Course Outcomes Mapping with Program Outcomes & PSO**

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	PSO
↓ Course Outcomes													1	2
<b>22MCA205.1</b>								2	3	3		3	1	3
<b>22MCA205.2</b>									3	3		3	1	3
<b>22MCA205.3</b>								2	3	3		2	1	3
<b>22MCA205.4</b>									3	3		2	1	3
<b>22MCA205.5</b>						3	2		2	3		3	1	3

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1. Meenakshi Raman and Sangeeta Sharma: Technical Communication - Principles and Practices, Oxford University Press 2004.
2. George Reynolds: Ethics in Information Technology, Thomson Course Technology, 2003.
3. Ray French: Cross Culture Management, Universities Press
4. Urmila Rai: Business Communication, Himalaya Publishing House

**REFERENCE BOOKS:**

1. M. Ashraf Rizvi: Effective Technical Communication by, 1<sup>st</sup> Edition, Tata McGraw Hill.
2. Mike W Martin and Ronald Scherzinger: Ethics in Engineering, 3<sup>rd</sup> Edition Tata McGraw Hill.
3. C.S Rayudu: Communication, Himalaya Publishing House
4. "Communicating at work – Principles and Practices for Business and the Professions" - Ronald B Adler & Jeanne Marquardt Elmhurst; McGraw-Hill College; Sixth Edition.
5. "Organizational Behaviour", - Stephen P Robbins; Prentice Hall, India.
6. "Organizational Behaviour", - Fred Luthans; McGraw Hill International Edition.

<b>Digital Image Processing &amp; Pattern Recognition</b>			
<b>Course Code:</b>	<b>22MCA211</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b>Prerequisites:</b>			
Linear Algebra, Differential Equations, Probability and Statistics, Calculus, Signals and systems, Digital Electronics (just basic), Basic Programming skills, Basic of Computer Graphics.			
<b>Course Objectives:</b>			
1.	Understand the fundamental concepts in Digital image processing. To study different types of image acquisition methods and basics of intensity transformations and histogram processing		
2.	Compare Spatial domain concept and Frequency domain concepts. To compare and contrast Correlation and convolution techniques.		
3.	Learn different types of noise models, Compression methods and filtering techniques. To study different basic morphological algorithms and operations and fundamentals of Image Segmentation.		
4.	Study the basics of Pattern Recognition.		
5.	Compare and contrast Clustering and Classification. And to study different types of classification algorithms.		
<b>UNIT-I</b>			
<b>Introduction, Digital Image Fundamentals:</b> Elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, some basic relationship between pixels.			<b>05 Hours</b>
<b>Intensity Transformations:</b> Basics of intensity transformations, histogram processing			<b>03 Hours</b>
<b>UNIT-II</b>			
<b>Spatial Filtering:</b> Fundamentals of spatial filtering, smoothing and sharpening filters.			<b>04 Hours</b>
<b>Frequency domain Filtering :</b> Background, preliminary concepts, sampling, Fourier transforms and DFT, 2-D DFT and properties, frequency domain filtering, low pass filters, high pass filters.			<b>04 Hours</b>
<b>UNIT-III</b>			
<b>Image restoration and Reconstruction</b> Noise models, restoration in the presence of noise, inverse filtering.			<b>03 Hours</b>
<b>Image Compression :</b> Fundamentals, basic compression methods.			<b>02 Hours</b>
<b>Morphological Image Processing :</b> Preliminaries, erosion and dilation, opening and closing, basic morphological algorithms.			<b>02 Hours</b>

<b>Image Segmentation :</b> Fundamentals, point, line and edge detection, thresholding, region based segmentation.													<b>03 Hours</b>		
<b>UNIT – IV</b>															
<b>Pattern Recognition :</b> Introduction - What is Pattern Recognition?, Clustering vs Classification; Applications;													<b>03 Hours</b>		
<b>Clustering :</b> Overview of clustering; Different distance functions and similarity measures, K-means clustering.													<b>03 Hours</b>		
<b>UNIT – V</b>															
<b>Classification :</b> Bayes decision rule, Minimum distance classifier, K-NN Classifier, Single and Multilayer perceptron, training set and test sets, standardization and normalization.													<b>07 Hours</b>		
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Understand the fundamental concepts in Digital image processing. Explain different types of image acquisition methods and basics of intensity transformations and histogram processing.														
2.	Compare Spatial domain concept and Frequency domain concepts. Compare and contrast Correlation and convolution techniques.														
3.	Describe different types of noise models, different types of filtering techniques and basic compression methods. Discuss the different basic morphological algorithms and operations. Understand the basics of segmentation.														
4.	Understand the basics of Pattern Recognition														
5.	Compare and contrast Clustering and Classification. Explain different types of classification algorithms.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>														1	2
<b>22MCA211.1</b>		3	3	3	3	2		3	3	3	3	3		3	3
<b>22MCA211.2</b>		3	3	2	2	3		2	3	3	3	2		3	3
<b>22MCA211.3</b>		3	3	2	2	3		2	3	3	3	2		3	3
<b>22MCA211.4</b>		3	3	3	3	2		2	3	3	3	3		3	3
<b>22MCA211.5</b>		3	3	3	3	2		3	3	3	3	3		3	3
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	Rafael C. Gonzalez & Richard E. Woods : Digital Image Processing, 3rd edition, PHI 2008														
2.	R.O. Duda, P.E. Hartand D.G. Stork, Pattern Classification, John Wiley. 2010														
<b>REFERENCE BOOKS:</b>															
1.	Anil K. Jain : Fundamentals of Digital Image Processing, Prentice Hall, 1995														
2.	William K. Pratt, John Wiley & Sons Inc : Digital Image Processing, 3rd edition, 2001														
3.	Statistical Pattern Recognition; K. Fukunaga; Academic Press, 2000														
4.	S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009														
5.	Robert Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons, Inc.1992														

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Environmental Studies and Green IT</b>			
<b>Course Code:</b>	<b>22MCA212</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the importance of the environment.		
<b>2.</b>	Understand the concepts of Green IT.		
<b>3.</b>	Understand the best practices of Green IT.		
<b>4.</b>	Understand tools related to Green IT.		
<b>5.</b>	Create digital documents related to Green IT.		
<b>UNIT - I</b>			
Environmental studies: Scope and importance of environmental studies, environment and its components, ecosystem, environmental pollution; Air, water, soil, Thermal, nuclear and solid waste management, e-waste management			<b>07 Hours</b>
<b>UNIT - II</b>			
Winning with Green IT- Basic Green Concepts, Green and IT, IT Ecosystem, Why Green IT now, Do's and Don'ts of Green IT, Making business case for Green IT, Policies for change, balancing carbon Foot print, Standards and Metrics, Emerging standards with IT practices, reviewing Established and emerging Standards Assessing organization's current energy and needs, Understanding energy terms and terminology, Building Audit for energy requirement, policy based management, Efficiency factors, Carbon reduction options, putting a master plan for go green			<b>10 Hours</b>
<b>UNIT - III</b>			
Greening the data center, foundation for Green data management, formalizing best practices for Green IT, Information life cycle management, Tired storage architecture, Going greener with Hosted Data Center Services, maximizing data center efficiency- proper site selection, consolidating physical infrastructure, usage of green servers, managing servers for energy efficiency, planning data center cooling factors- basics of cooling system, bench marking cooling system's efficiency , managing the storage system from green perspective, managing the network to become green			<b>10 Hours</b>
<b>UNIT - IV</b>			
Virtualization, understanding virtualization, building virtual infrastructure, enabling virtual, using energy efficient machines, desktop virtualization, usage of thin client, collaboration tools – text, voice, video, Video conference, Tele Presence Paperless office, changing printing habits,			<b>06 Hours</b>
<b>UNIT - V</b>			
Using digital documents, evaluating green gadgetry, powering gadgets intelligently, greening the facility, lighting for less, landscaping in a sustainable way, Improving the indoor environment, recycling throughout the office, usage of renewable energy, safe disposal policy			<b>06 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to			
1. Implement projects on solid and e-waste management.			
2. Understand emerging standards related to Green IT.			
3. Identify best practices related to Green IT.			

4. Apply tools related to Green IT.

5. Analyse digital documents related to Green IT.

**Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes**

<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
<b>↓ Course Outcomes</b>													1	
<b>22MCA212.1</b>	2	2	2				2						1	
<b>22MCA212.2</b>	2	2	2				2						1	
<b>22MCA212.3</b>	2	2	2		1		2						1	
<b>22MCA212.4</b>	2	2	2		1		2						1	
<b>22MCA212.5</b>	2	2	2		1		2						1	

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1. Brain W. Kernighan and Rob Pike: The Practice of Programming, Addison – Wesley; 1999

**REFERENCE BOOKS:**

1. Carol Baroudi, Jeffrey Hill, Arnold Reinhold, JhanaSenxian : Green IT For Dummies, For Dummies
2. BabakAkhgar; Colin Pattinson; Mohammad Dastbaz : Green Cloud Computing and Risk Management, Morgan Kaufmann
3. Xiaodong Liu; Yang Li : Green Services Engineering, Optimization, and Modeling in the Technological Age, IGI Global
4. Basak : Environmental Studies, Pearson

**E Books / MOOCs/ NPTEL**

1. <https://nptel.ac.in/courses/120108004>

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Soft Computing</b>			
<b>Course Code:</b>	<b>22MCA213</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P:S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
1. Critical thinking and problem-solving skills.			
2. A strong mathematical background.			
<b>Course Objectives:</b>			
<b>1.</b>	Comprehend soft computing techniques and its applications.		
<b>2.</b>	Understand the artificial neural networks and its applications		
<b>3.</b>	Analyze the single-objective optimization problems using GAs		
<b>4.</b>	Develop the fuzzy logic sets and membership function and defuzzification techniques.		
<b>5.</b>	Design of Hybrid system for solving the real life problems		
<b>UNIT - I</b>			
<b>Neural Networks:</b> History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.			<b>08 Hours</b>
<b>UNIT - II</b>			
<b>Fuzzy Logic:</b> Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.			<b>07 Hours</b>
<b>UNIT - III</b>			
<b>Operations on Fuzzy Sets, Fuzzy Arithmetic, Fuzzy Logic, Uncertainty based Information:</b> Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations .Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Classical Logic, Multivalve Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Information & Uncertainty, Non specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.			<b>10 Hours</b>
<b>UNIT - IV</b>			
<b>Introduction of Neuro-Fuzzy Systems:</b> Architecture of Neuro Fuzzy Networks, Applications of Fuzzy Logic: Medicine, Economics etc.			<b>08 Hours</b>
<b>Unit - V</b>			
<b>Genetic Algorithms:</b> An Overview, GA in problem solving, Implementation of GA.			<b>06 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to			
<b>1.</b>	To understand the soft computing technique's correlation with mathematical models.		
<b>2.</b>	To learn fuzzy logic and applications		

<b>3.</b>	To solve single-objective optimization and its applications using GAs.													
<b>4.</b>	To understand the Artificial neural network and its applications													
<b>5.</b>	To Implement genetic algorithms													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA213.1</b>	1	2	3	3	2			2		1	3	2	1	1
<b>22MCA213.2</b>	2	1	3		1		2		1				1	2
<b>22MCA213.3</b>	2	1		2		1		3		2	1		3	1
<b>22MCA213.4</b>	3						2			3		3	1	1
<b>22MCA213.5</b>	2			2		3			3			2	2	1
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS :</b>														
<b>1.</b>	Anderson J.A.: An Introduction to Neural Networks, PHI, 1999													
<b>2.</b>	Hertz J. Krogh, R.G. Palmer: Introduction to the Theory of Neural Computation, Addison - Wesley, 1991													
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	G.J. Klir & B. Yuan: Fuzzy Sets & Fuzzy Logic, PHI, 1995													
<b>2.</b>	Melanie Mitchell: An Introduction to Genetic Algorithm, PHI, 1998													
<b>E Books / MOOCs/ NPTEL</b>														
<b>1.</b>	Soft Computing, Samir Roy, Udit Chakraborty, Pearson Education India, 2013.													
<b>2.</b>	<b>NPTEL Course: Introduction To Soft Computing, By Prof. Debasis Samanta   IIT Kharagpur</b>													



## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Parallel Processing</b>			
<b>Course Code:</b>	<b>22MCA214</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites:</u></b>			
Fundamentals of Computer Organization.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand how to write and execute parallel programs		
<b>2.</b>	Study the concept of Distributed Memory Programming with MPI		
<b>3.</b>	Learn about Shared Memory Programming with Pthreads		
<b>4.</b>	Compare and contrast Shared Memory Programming with Pthreads and Shared Memory Programming with OpenMP		
<b>5.</b>	Gain knowledge about Parallel Program Development and Parallel Algorithms		
<b>UNIT - I</b>			
<b>Introduction to Parallel Processing :</b> Computing Need of Performance, Building Parallel Systems, Why to Write Parallel Programs? How to Write Parallel Programs? Approach: Concurrent, Parallel, Distributed.			<b>04 Hours</b>
<b>Parallel Hardware and Parallel Software :</b> Background, Modifications to the von Neumann Model, Parallel Hardware, Parallel Software, Input and Output, Performance, Parallel Program Design and Writing and Running Parallel Programs.			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Distributed Memory Programming with MPI :</b> Getting Started, The Trapezoidal Rule in MPI, Dealing with I/O, Collective Communication, MPI Derived Data types, A Parallel Sorting Algorithm.			<b>07 Hours</b>
<b>UNIT - III</b>			
<b>Shared Memory Programming with Pthreads :</b> Processes, Threads and Pthreads, Hello, World program ,Matrix-Vector Multiplication, Critical Sections Busy-Waiting, Mutexes, Producer-Consumer Synchronization and Semaphores, Barriers and Condition Variables, Read-Write Locks, Caches, Cache-Coherence, and False Sharing and Thread-Safety.			<b>08 Hours</b>
<b>UNIT - IV</b>			

<b>Shared Memory Programming with OpenMP :</b>													<b>08 Hours</b>		
Introduction to OpenMP, The Trapezoidal Rule Scope of Variables, The Reduction Clause, The Parallel For Directive, More About Loops in OpenMP: Sorting, Scheduling Loops, Producers and Consumers, Caches, Cache-Coherence, and False Sharing and Thread-Safety.															
<b>UNIT - V</b>															
<b>Parallel Program Development and Parallel Algorithms :</b>													<b>08 Hours</b>		
Two N-Body Solvers, Tree Search and Case Studies.															
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Explain how to write and execute parallel programs and why to write parallel programs														
2.	Demonstrate the concept of Distributed Memory Programming with MPI														
3.	Discuss about Shared Memory Programming with Pthreads														
4.	Compare and contrast Shared Memory Programming with Pthreads and Shared Memory Programming with OpenMP														
5.	Explain about Parallel Program Development and Parallel Algorithms														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>														1	2
<b>22MCA214.1</b>		3	3	3	3	2		3	3	3	3	3		3	2
<b>22MCA214.2</b>		3	3	2	2	3		2	3	3	3	2		3	2
<b>22MCA214.3</b>		3	3	2	2	3		2	3	3	3	2		3	2
<b>22MCA214.4</b>		3	3	3	3	2		2	3	3	3	3		3	2
<b>22MCA214.5</b>		3	3	3	3	2		3	3	3	3	3		3	2
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	An Introduction to Parallel Programming by Peter s. Pacheco. 2011. I Edition, Morgan Kaufmann publishers														
<b>REFERENCE BOOKS:</b>															
1.	Using OpenMP: Portable Shared Memory Parallel Programming, Gabriele Jost and Ruudvander Pas The MIT Press (October 12, 2007)														
2.	Using MPI - 2nd Edition: Portable Parallel Programming with the Message Passing Interface, William Group and Ewing Lusk, 1999, 2nd edition, MIT Press														
3.	Pthreads Programming: A Posix Standard for Better Multiprocessing, Dick Buttlar, Jacqueline Farrell & Bradford Nichols .1996, I Edition , Oreilly														
4.	Introduction to Parallel Computing, by Niranjana N. Chiplunkar, Raju K., Wiley, 2020														

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Distributed Computing</b>			
<b>Course Code:</b>	<b>22MCA216</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students must have basic knowledge of the Basics of Operating System, Unix System, System Programming.			
<b>Course Objectives:</b>			
<b>1.</b>	To learn issues related to clock Synchronization and the need for global state in distributed systems.		
<b>2.</b>	To learn distributed Scheduling and Load Balancing and RPC algorithms.		
<b>3.</b>	To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems		
<b>4.</b>	To learn the characteristics of Distributed File Systems		
<b>5.</b>	To understand the security issues, access control and fault tolerance in Distributed Computing		
<b>UNIT - I</b>			
<b>Distributed System, Communication :</b> Introduction to Distributed System: Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems. Communication: Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream-oriented communication. Scheduling and Load Balancing: List Scheduling, Static Load Balancing, Dynamic Load Balancing, Moore's Algorithm.			<b>08 Hours</b>
<b>UNIT - II</b>			
<b>Processes, Naming, Synchronization :</b> Processes : Threads, Clients, Servers, Code Migration, Software agent. Naming: Naming entities, Locating mobile entities, Removing un-referenced entities. Synchronization : Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Consistency and Replication, Fault Tolerance, Security :</b> Consistency and Replication: Introduction, Data centric consistency models, Client centric consistency models, Replica management, Distribution protocols, Consistency protocols			<b>07 Hours</b>
<b>UNIT - IV</b>			
<b>Fault Tolerance, Security :</b> Fault Tolerance: Introduction, Process resilience, Reliable client server communication, Reliable group communication. Distributed commit, Recovery.			<b>08 Hours</b>

Security: Introduction, Secure channels, Access control, Security management.														
<b>UNIT - V</b>														
<b>Distributed File Systems :</b> Distributed File System: Architecture, Processes, Communication, Naming, Synchronization, Consistency and replication, Fault tolerance, Security, Sun network file system, CODA files system. Case Study: CORBA, Distributed COM, Globe, Comparison of CORBA and DCOM, Globe.													<b>08 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies													
2.	Analyze the various techniques used for clock synchronization and mutual exclusion													
3.	Demonstrate the concepts of Resource and Process management and synchronization algorithms													
4.	Understand the concepts of Replication, Fault Tolerance and Security													
5.	Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
↓ <b>Course Outcomes</b>													1	2
<b>22MCA216.1</b>	3	2	3			2		2			2	3	3	2
<b>22MCA216.2</b>	2	3		3						3	2		2	3
<b>22MCA216.3</b>		2			2			3			2	2	3	2
<b>22MCA216.4</b>	2			2		2			2	2			3	2
<b>22MCA216.5</b>		3				2				2	2		2	2
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, 2016													
2.	G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts and Design, Pearson Education, Fifth Edition, 2011													
<b>REFERENCE BOOKS:</b>														
1.	M. Singhal, N. Shivaratri, Advanced Concepts in Operating Systems, TMH													
2.	M. L. Liu, Distributed Computing Principles and Applications, Pearson Addison Wesley, 2004													
<b>E Books / MOOCs/ NPTEL</b>														
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs87/preview">https://onlinecourses.nptel.ac.in/noc21_cs87/preview</a>													

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>E-Commerce</b>			
<b>Course Code:</b>	<b>22MCA221</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Advanced Web Technologies			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the importance of E-Commerce.		
<b>2.</b>	Understand the services of E-Commerce.		
<b>3.</b>	Understand the importance of EDI technology.		
<b>4.</b>	Apply tools related to the security of E-commerce.		
<b>5.</b>	Understand threats related to E-commerce.		
<b>UNIT - I</b>			
<b>E-commerce and its Technological Aspects Overview of developments in Information Technology and Defining E-Commerce:</b> The scope of E-commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E-Commerce Architecture.			<b>06 Hours</b>
<b>UNIT - II</b>			
<b>Consumer Oriented E-Commerce E-Retailing:</b> Traditional retailing and e- Retailing, Benefits of e-retailing, Key success factors, Models of e-retailing, Features of e retailing. E-services: Categories of e-services, Web-enabled services, matchmaking services, Information-selling on the web, e-entertainment, Auctions and other specialized services. Business to Business Electronic Commerce			<b>07 Hours</b>
<b>UNIT - III</b>			
<b>Electronic Data Interchange:</b> Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, and EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net. Electronic Cash, cheques and credit cards on the Internet.			<b>10 Hours</b>
<b>UNIT - IV</b>			
<b>Security in E Commerce Threats in Computer Systems:</b> Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall: Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.			<b>08 Hours</b>

<b>UNIT - V</b>														
<b>Threats in e-Ecommerce :</b> Basic Ethical Concepts, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection													<b>08 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to														
1. Understand the overall framework of E-commerce														
2. Compare different e-retailing techniques.														
3. Apply tools related to EDI technology.														
4. Protect E-commerce from threats														
5. Identify threats related to E-commerce.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
<b>↓ Course Outcomes</b>													1	2
<b>22MCA221.1</b>	2	2	2		1								1	
<b>22MCA221.2</b>	1	1	2		1								1	
<b>22MCA221.3</b>	2	2	2		1								1	
<b>22MCA221.4</b>	1	2	2		1								1	
<b>22MCA221.5</b>	1	2	2		1								1	
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Elias. M. Awad, Electronic Commerce & quot;, Prentice-Hall of India Pvt Ltd.													
<b>2.</b>	Ravi Kalakota, Andrew B. Whinston, Electronic Commerce-A Manager's guide Addison-Wesley.													
<b>3.</b>	Efraim Turban, Jae Lee, David King, H. Michael Chung, "Electronic Commerce A Managerial Perspective", Addison-Wesley.													
<b>4.</b>	Elias M Award, "Electronic Commerce from Vision to Fulfillment", 3rd Edition, PHI, Judy Strauss, Adel El-Ansary, Raymond Frost, "E-Marketing", 3RDEdition, Pearson Education.													
<b>E Books / MOOCs/ NPTEL</b>														
<b>1.</b>	<a href="https://onlinecourses.swayam2.ac.in/cec19_cm01/preview">https://onlinecourses.swayam2.ac.in/cec19_cm01/preview</a>													

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Health Care Analytics</b>			
<b>Course Code: 23MCA222</b>	<b>22MCA222</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P:S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Knowledge of mathematics and statistics. Ability to learn with data storage, data warehousing, and mining.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the role that data analytics plays in healthcare operations		
<b>2.</b>	Be familiar with the characteristics of healthcare data, associated data systems, and analytics tools		
<b>3.</b>	Understand the organizational needs and process to enact healthcare data analytics		
<b>4.</b>	Understand the Biomedical Information Mining and clinical applications		
<b>5.</b>	Mining of statistical model and visual analytics for health care		
<b>UNIT - I</b>			
<b>Fundamentals of Healthcare Analytics :</b> Components of healthcare analytics, Data and information – Measurement, Metrics, and Indicators. From data to knowledge. Analytics building blocks. Descriptive, predictive, and prescriptive analytics. Healthcare analytics applications – an introduction			<b>06 Hours</b>
<b>Medical Images and Analytics :</b> Overview of Digital Imaging and Communications in Medicine (DICOM) standards. Biomedical image analysis – biomedical Imaging modalities, object detection, image segmentation, image registration, feature extraction.			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Mining of sensor data in healthcare :</b> Challenges of healthcare data analysis. Biomedical signal analysis – types of biomedical signals, correlation analysis.			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Genomic Data and Analytics :</b> Genomic data analysis for personalized medicine – genomic data generation - Microarray data, Next-Generation Sequencing, Public Database, Predictive models for integrating clinical and genomic data – introduction, issues and challenges in integrating clinical and genomic data, different types of integration.			<b>06 Hours</b>
<b>UNIT - IV</b>			
<b>Biomedical Information Mining and Social Media Analytics :</b> Electronic Health Records(EHR)-components of EHR, coding systems, benefits and challenges of EHR. Natural language processing – core NLP Components – Morphological Analysis, Lexical Analysis, Syntactic Analysis, Semantic Analysis, Data Encoding, mining information from clinical text, challenges of processing clinical reports, clinical applications.			<b>09 Hours</b>
<b>Social media analysis for healthcare</b> Social media analysis for detection and tracking of infectious disease. Social Media			

Analysis for Public Health Research.														
<b>Unit - V</b>														
<b>Advanced Healthcare Data Analytics :</b> Basic statistical prediction models, Alternative clinical prediction models, Survival models, Evaluation and validation. Temporal data mining for healthcare data – Association analysis, Temporal pattern mining.													<b>06 Hours</b>	
<b>Visual analytics for healthcare</b> – Visual analytics for clinical workflow, visual analytics for clinicians and patients.														
<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	To understand fundamentals of Healthcare Analytics													
2.	To create biomedical analytics													
3.	To perform genomic data and analytics													
4.	To understand social media analytics													
5.	Understand health care Analysis													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA222.1</b>	1	2	3	3	2			2		1	3	2	2	3
<b>22MCA222.2</b>	2	1	3		3		1		1				1	3
<b>22MCA222.3</b>	2	1		2		1		3		2	1		3	3
<b>22MCA222.4</b>	3						2			3		3	1	3
<b>22MCA222.5</b>	2			2		3			3			2	1	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS :</b>														
1.	C.K. Reddy and C.C. Aggarwal, Healthcare Data Analytics 2015													
2.	Christo ElMorr and Hossam Ali-Hassan, Analytics in Healthcare A Practical Introduction, 2019													
<b>REFERENCE BOOKS:</b>														
1.	Adam Bohr and Kaveh Memarzadeh, “Artificial Intelligence in Healthcare”, Academic Press, 2020.													
2.	H. Yang and E.K. Lee, Health care Analytics: From Data to Knowledge to Healthcare Improvement, 2016													
3.	Richard Bibb, Dominic Egg beer and Abby Paterson, Medical Modelling, “The Application of Advanced Design and Rapid Prototyping Techniques in Medicine”, 2 <sup>nd</sup> Edition, 2015													
<b>E Books / MOOCs/ NPTEL</b>														
1.	<b>E-Book: Healthcare Analytics Made Simple</b>													
2.	BIG DATA ANALYTICS FOR HEALTHCARE-source: Source: <a href="http://www.coursera.org">www.coursera.org</a>													



## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Accountancy and Financial Management</b>			
<b>Course Code:</b>	<b>22MCA223</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b>Course Objectives:</b>			
<b>1.</b>	To understand the fundamentals of accounting.		
<b>2.</b>	To understand the Fundamentals of Cost Accounting		
<b>3.</b>	To understand Ratio Analysis		
<b>4.</b>	To understand Funds Flow Analysis and Cash Flow Analysis		
<b>5.</b>	To understand Budgeting		
<b>UNIT – I</b>			
<b>Accounting:</b> Meaning and Definition of Accounting, Features, Objectives/Functions of Accounting. Accounting concepts and conventions. Classification of accounts and rules of debit and credit. Journal: Meaning uses and problems on Journal Entries. Ledger : Meaning, uses and problems on preparation of Ledger accounts. Trial Balance: Meaning, objectives and problems on preparation of Trial Balance.			<b>08 Hours</b>
<b>UNIT - II</b>			
<b>Fundamentals of Cost Accounting:</b> Fundamentals of Cost Accounting: Meaning and Definition of Cost, Costing and Cost Accounting: Objectives, Advantages and Disadvantages of Cost Accounting. Methods of costing (Meaning Only). Classification of Cost: On the basis of elements, functions and variability. Cost Sheet : Meaning, Uses and simple problems on preparation of statement of cost (Preparation of Estimated Cost Sheet is excluded) <b>Marginal Costing:</b> Marginal Costing : Meaning and Definition of Marginal Cost and Marginal Costing. Break-even-analysis: Meaning and significance. Break-even-chart: Meaning, assumptions and uses contribution, P/V ratio, Margin of safety, Angle of Incidence. Problems on Marginal Costing.			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Ratio Analysis:</b> Ratio Analysis: Meaning of Ratio Analysis, Advantages of Ratio Analysis, Limitations of Ratio Analysis, Classification of Accounting Ratios-Liquidity Ratios, Leverage Ratios, Activity Ratios, Probability Ratios. Simple problems on Computation of ratios			<b>08 Hours</b>

<b>Unit – IV</b>														
<b>Funds:</b> Funds Flow Analysis and Cash Flow Analysis: Meaning, Uses and Limitations of Funds Flow and Cash Flow Statement. Differences between Cash Flow Analysis and Funds Flow Analysis. Preparation of Funds Flow statements and cash Flow statements, simple problems.												<b>08 Hours</b>		
<b>Unit – V</b>														
<b>Budgetary Control:</b> Budgetary Control: Meaning of Budget and Budgetary control-Budgetary control as a Management Tool-Limitations of budgetary control. Classification of budgets, Problems on preparation of Flexible budget only.												<b>07 Hours</b>		
<b>Capital Budgeting:</b> Capital Budgeting Decisions: Meaning and Definition of Capital Budgeting, Objectives of Capital Budgeting, Role of Capital Budgeting and Limitations of Capital Budgeting-Factors affecting Capital Budgeting Decisions.														
<b>Course Outcomes:</b> At the end of the course students will be able to														
<b>1.</b>	Understand and explain the fundamentals of Accounting.													
<b>2.</b>	Understand and explain cost accounting and its types													
<b>3.</b>	Understand and explain ratio analysis													
<b>4.</b>	Understand and analyse funds flow cash flow													
<b>5.</b>	Understand and implement budgeting													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	PSO
↓ Course Outcomes													1	2
<b>22MCA223.1</b>				2		1	2			2	2	2	2	
<b>22MCA223.2</b>				2		1	2			2	2	2	2	
<b>22MCA223.3</b>				2		1	2			2	2	2	2	
<b>22MCA223.4</b>				2		1	2			2	2	2	2	
<b>22MCA223.5</b>				2		1	2			2	2	2	2	
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Jawahar Lal : Accounting for Management, Fourth Edition, Himalaya Publishing, 2006.													
<b>2.</b>	I M Pandey : Financial Management, Ninth Edition, Vikas Publishing, 2005.													
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	S N Maheshwari, Sultan: Financial and Management Accounting, Chand & Sons													
<b>2.</b>	Richard M Lynch, and Robert W Williamson: Accounting for Management, Third Edition, Tata McGraw Hill.													
<b>3.</b>	Sukhla Grewal : Accountancy, First Edition, Sultan Chand & Sons													
<b>4.</b>	R L Gupta and Radha Swamy: Advanced Accounting, Tenth Edition, Sultan Chand & Sons.													

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Bioinformatics</b>			
<b>Course Code:</b>	<b>22MCA224</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P:S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Basic knowledge of Data Analytics and Biology			
<b>Course Objectives:</b>			
<b>1.</b>	Adapt basic knowledge of various techniques and areas of applications in bioinformatics.		
<b>2.</b>	Analyze common problems in bioinformatics, alignment techniques, ethical issues, public data sources, and evolutionary modeling.		
<b>3.</b>	Evaluate the main databases at the NCBI resources.		
<b>4.</b>	Discover the practical use of tools for specific bioinformatics areas		
<b>5.</b>	Adopt important parameters for drug discovery		
<b>UNIT - I</b>			
<b>Introduction to Bioinformatics :</b> What is bioinformatics: overview, major databases in bioinformatics, molecular biology, Central DogmaData retrieval tools, gene structure Prokaryotic and Eukaryotic genomes, sequence assembly, Gene mapping, networking and hardware fundamentals, Internet and world wide web.			<b>07 Hours</b>
<b>Unit - II</b>			
<b>Sequence Alignment :</b> Alignment of Pairs of Sequences: Introduction, biological motivation of alignment problems. Methods of Sequence Alignments-Dot Matrix Method, Using Scoring Matrices. Measuring sequence detection efficiency, Dynamic Programming, Pair wise database searching.			<b>08 Hours</b>
<b>Unit - III</b>			
<b>Gene Prediction :</b> Gene Identification and Prediction: Introduction, Basis of Gene Prediction, gene prediction Methods: Feature based approach, other gene prediction tools, Conventional determination of Open Reading Frames (ORF), Multiple Sequence Alignment : Definition And Goal, The Consensus, Computational Complexity, Manual Methods, Simultaneous Methods, Progressive Methods, Databases of Multiple Alignments And Searching			<b>09 Hours</b>
<b>Unit - IV</b>			
<b>Secondary database Searching :</b> Secondary Database Searching: Importance And Need of Secondary Database Searches, Secondary Database Structure and Building a Sequence Search Protocol, structural and functional interpretation.			<b>07 Hours</b>

<b>Unit - V</b>															
<b>Drug Discovery :</b> Analysis Packages : Analysis Package Structure, Commercial Databases, Commercial Software, Comprehensive Packages, Packages Specializing in DNA Analysis, Intranet Packages, Internet Packages. Introduction: Areas influencing drug discovery, important parameters in drug discovery, drug discovery technologies, target discovery strategy, Strategy to identify possible drug targets.													<b>08 Hours</b>		
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Adapt the biological knowledge about molecular biology, gene mapping and networking.														
2.	Analyse methods of Sequence Alignments														
3.	Build gene prediction Methods: Feature based approach, other gene prediction tools														
4.	Demonstrate building a Sequence Search Protocol														
5.	Explain drug discovery technologies, strategy to identify possible drug targets														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
	<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
	<b>↓ Course Outcomes</b>													1	2
	<b>22MCA224.1</b>	2	3	2	3			3		2			3	2	2
	<b>22MCA224.2</b>		3				2				2		2	1	2
	<b>22MCA224.3</b>	2		2	3				3	3			2	1	1
	<b>22MCA224.4</b>	1	2		3		2						2	1	1
	<b>22MCA224.5</b>	1	2	2	3			1		1		2	3	3	1
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	T. K. Attwood, D. J. Parry-Smith, and S. Phukan, "Introduction to Bioinformatics", Pearson Education, 2001														
2.	S.C Rostogi, Mendiratta, P. Rasogi, "Bio Informatics: Methods and Applications", Second edition, PHI 2006														
<b>REFERENCE BOOKS:</b>															
1.	Arthur M. Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005														
2.	Vittal R. Srinivas, "Bioinformatics – A Modern Approach", Prentice-Hall of India Pvt. Ltd., 2005														
3.	Jean Mickel Clavere & Cadrienotredom "Bio Informatics– A beginners guide" Wiley Dream Tech, 2003														
<b>E Books / MOOCs/ NPTEL</b>															
1.	<b>Bioinformatics: Tools and Applications 2009th Edition, Kindle Edition</b>														
2.	Bioinformatics –Algorithms and Applications														

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>.NET Framework and C#</b>			
<b>Course Code:</b>	<b>22MCA226</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P:S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have some basic knowledge of computer system hardware and software			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the .NET framework.		
<b>2.</b>	Understand the concept of class hierarchy, method overloading. Overriding abstract classes and interfaces, exception handling, I/O stream classes.		
<b>3.</b>	Understand the use of events and delegates, Use of multi-threading.		
<b>4.</b>	Understanding multithreading and I/O stream concepts.		
<b>5.</b>	Data access with ADO.NET		
<b>UNIT - I</b>			
<b>Introduction to the .NET Platform :</b> Benefits of .NET Framework, Architecture of .NET Framework 4.0, Components of .NET Framework 4.0: CLR, CTS, Metadata and Assemblies, .NET Framework Class Library, Windows Forms.			<b>03 Hours</b>
<b>Introducing C# :</b> Need of C#, C# Pre-processor Directives, Creating a Simple C# Console Application, Identifiers and Keywords. Data Types, Variables and Constants: Value Types, Reference Types, Type Conversions, Boxing and Unboxing, Variables and Constants. Operator Precedence, Using the ?? (Null Coalescing) Operator, Using the :: (Scope Resolution) Operator and Using the is and as Operators.			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Classes, Objects and Structures :</b> Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and methods, Static Classes and Static Class Members, Structures: Syntax of a struct and Access Modifiers for structs, Enumerations.			<b>02 Hours</b>
<b>Arrays and Strings :</b> Arrays, Multidimensional arrays, jagged arrays, Assigning array references, Foreach loop, Strings of operator overloading			<b>01 Hours</b>
<b>Methods :</b> Controlling access to class members, Pass objects to methods, Using ref and out parameters, Using a variable number of arguments, Returning objects, Method			<b>01 Hours</b>

overloading, Constructors, Garbage collection and destructors, Overloading constructors.	
<p><b>Properties, Object- Oriented Programming Concepts :</b>  Read-only Property, Static Property, Accessibility of accessors and Anonymous types. Indexers, Encapsulation: Encapsulation using accessors and mutators, Encapsulation using Properties.  Inheritance: Inheritance and Constructors, Sealed Classes and Sealed Methods, Extension methods. Polymorphism: Compile time Polymorphism/ Overloading, Runtime Polymorphism/ Overriding. Abstraction: Abstract classes, Abstract methods.  Interfaces: Syntax of Interfaces, Implementation of Interfaces, Interfaces and Inheritance.</p>	<b>03 Hours</b>
<b>UNIT - III</b>	
<p><b>Delegates, Events and Exception Handling :</b>  Delegates: Creating and using Delegates, Multicasting with Delegates.  Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers. Exception Handling: System exception class, Exception handling fundamentals, Consequences of an uncaught exception, Using multiple catch statements, Catching all exceptions, Nested try blocks, Throwing an exception, Using finally, Commonly used exceptions.</p>	<b>05 Hours</b>
<p><b>Namespaces, the Preprocessor and Assemblies :</b>  Namespaces, Preprocessor, Assemblies and the internal access modifier; Runtime Type ID, Reflection and Attributes: Runtime type definition, Reflection, Using Reflection, Attributes, Using the built-in attributes</p>	<b>03 Hours</b>
<b>UNIT - IV</b>	
<p><b>Multithreaded Programming :</b>  Multithreading Fundamentals, Thread class, Determining the end of Thread, IsBackground property, Thread priorities, Synchronization, Thread communication using Wait(), Pulse(), PulseAll(), UsingMethodImplAttribute, Suspending resuming stopping threads, Determining threads state, Using the Main thread, Starting a separate task</p>	<b>03 Hours</b>
<p><b>Working with Collections, Building Components :</b>  Collections overview, Collection interfaces, Dictionary entry structure, General-purpose collection class, Storing bits and BitArray, Specialized collections, Accessing a collection using an enumerator.  Introduction to components, Overview of C# component, IComponent, Simple component, Overriding Dispose(), Employing the using statement, Containers.</p>	<b>02 Hours</b>
<p><b>Using I/O :</b>  C#'s I/O built in streams, Stream classes, Console I/O, FileStream and Byte-Oriented file I/O, Character based file I/O, Redirecting the standard streams, Reading and writing binary data, Using memory stream, Using StreamReader and StringWriter.</p>	<b>02 Hours</b>
<b>UNIT - V</b>	
<p><b>Graphical User Interface with Windows Forms :</b>  Introduction, Windows Forms, Event Handling: A Simple Event- Driven GUI, Visual Studio Generated GUI Code, Delegates and Event- Handling Mechanism, Another Way to Create Event Handlers, Locating Event Information. Control Properties and Layout, Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, ToolTips, Mouse-Event Handling, Keyboard-Event Handling.</p>	<b>03 Hours</b>

<b>Data Access with ADO.NET :</b> Data Access with ADO.NET: The need for ADO.NET, Faces of ADO.NET, Role of ADO.NET Data Providers, Understanding the ADO.NET Namespaces, Types of System.Data, Examining the DataColumn type, Examining the DataRow Type, Details of the DataTable, Building a complete DataTable, Understanding the DataView type Understanding the role of the DataSet, Expressing relations using the DataRelation type, Building a simple Test Database, Selecting a Data Provider, Types of the System.Data.OleDb Namespace, Working with the Connected Layer of ADO.NET, Working with the OleDbDataReader, Inserting, updating, and deleting records using OleDbCommand, Executing a stored Procedure using OleDbCommand, Disconnected layer and the OleDbDataAdapter type, Working with the SQL Data Provider.													<b>05 Hours</b>	
<b>Web Development Using .Net :</b> Introduction to MVC AND Razor.: Defining MVC, Basics of routing. Client Solutions : JavaScript JQuery													<b>02 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	To understand .net framework and c# program structure													
<b>2.</b>	To perform polymorphism and to use abstract classes													
<b>3.</b>	Use memory stream string reader and string writer, delegates and events.													
<b>4.</b>	To create multiple threads communication													
<b>5.</b>	Access and store data into backend databases using ADO.NET													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA226.1</b>	3	3	3	1	2	1	1	1	2				3	2
<b>22MCA226.2</b>	1	1	3	3	2	1	1	1	1	1	1	1	3	3
<b>22MCA226.3</b>	1	1	1	1	1	1	1	1	2	3	1	1	3	3
<b>22MCA226.4</b>	1	1	1	1	3	1	1	1	1	1	1	1	3	2
<b>22MCA226.5</b>	1	3	1	2	1	1	1	1	1	1	1	1	3	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Herbert Schildt, The Complete Reference C#, TATA McGraw-Hill edition Chapters: 1 – 25													
<b>2.</b>	Andrew Troelsen, C# and .NET Platform, Apress, 1st edition,2001. Chapter 17													
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	Ben Albahari, Peter Drayton and Brad Merril, "C# Essentials", SPD, 2001													
<b>2.</b>	"Microsoft C# Language Specifications", WP Publishers and Distributors Pvt. Ltd., 2001													
<b>E Books / MOOCs/ NPTEL</b>														
<b>1.</b>	Object Oriented Programming using c#													
<b>2.</b>	C# 7.0 in a Nutshell: The Definitive Reference													

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Data Communication and Networks Lab</b>														
<b>Course Code:</b>	<b>22MCA206</b>				<b>Course Type:</b>	<b>PCC</b>								
<b>Teaching Hours/Week (L: T: P: S):</b>	<b>0:0:4:0</b>				<b>Credits:</b>	<b>02</b>								
<b>Total Teaching Hours:</b>	<b>48</b>				<b>CIE + SEE Marks:</b>	<b>50+50</b>								
<b>Teaching Department: Master of Computer Applications</b>														
<b><u>Prerequisites :</u></b>														
Student must have some basic knowledge of computer system hardware and software.														
<b><u>Course Objectives:</u></b>														
<b>1.</b>	To get practical knowledge of working principles of various communication protocols													
<b>2.</b>	To analyze the various routing algorithms and To know the concept of data/packet transfer between nodes.													
<b>3.</b>	Analyse structure and formats of TCP/IP layer protocols using network tools like network simulators.													
<b>4.</b>	Implementing various network algorithms such as error control, error detection, routing and security related algorithms.													
<b>List of Experiments</b>														
<b>1.</b>	Implementation of error detection mechanisms													
<b>2.</b>	Implementation of the congestion control algorithms.													
<b>3.</b>	Implementation of routing algorithms.													
<b>4.</b>	Implementation of client / server programs using TCP and UDP.													
<b>5.</b>	Implementation of RSA algorithm for encryption/Decryption of message between client & server.													
<b>6.</b>	Implementation of frame sorting logic, to order frames received from multiple senders.													
<b>7.</b>	Implementation of TELNET.													
<b>8.</b>	Simulation of Networking components using any Network Simulation software													
<b>9.</b>	Implementation of wireless technology													
<b>10.</b>	Use of Open NMS and TCL tool.													
<b><u>Course Outcomes:</u></b> At the end of the course student will be able to														
<b>1.</b>	Understand the practical approach to network communication protocols.													
<b>2.</b>	Understand the various Routing Protocols/Algorithms and Internetworking.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>													1	2
<b>22MCA206.1</b>	3	3	3	3	2		3	3	2	3	3		3	1
<b>22MCA206.2</b>	3	3	2	2	3		3	3	3	3	2		3	1
<b>1: Low 2: Medium 3: High</b>														



<b>REFERENCE BOOKS:</b>	
1.	Cisco CCNA Study Guide v2.71, Aaron Balchunas
2.	CCNA, Study Guide, 6th Edition, TodLammle
<b>E Resources</b>	
1.	<a href="https://www.isi.edu/nsnam/ns/">https://www.isi.edu/nsnam/ns/</a>
2.	<a href="https://www.geeksforgeeks.org/network-simulator-3/">https://www.geeksforgeeks.org/network-simulator-3/</a>

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Enterprise Java Lab</b>														
<b>Course Code:</b>	<b>22MCA207</b>	<b>Course Type:</b>	<b>PCC</b>											
<b>Teaching Hours/Week (L:T:P: S):</b>	<b>0:0:4:0</b>	<b>Credits:</b>	<b>02</b>											
<b>Total Teaching Hours:</b>	<b>48</b>	<b>CIE + SEE Marks:</b>	<b>50+50</b>											
<b>Teaching Department: Master of Computer Applications</b>														
<b><u>Prerequisites :</u></b>														
Students must have basic knowledge of Object Oriented Programming concepts.														
<b>Course Objectives:</b>														
1.	To understand and implement Object Oriented Programming in Java, handling of exceptions and multithreaded programs.													
2.	To understand and implement network and distributed programming in Java													
3.	To understand Java APIs to connect to a backend database and development of Graphic User Interface for Java Applications.													
4.	To understand and implement Java components as well as develop web applications in Java.													
<b>List of Experiments</b>														
1.	Programs to implement encapsulation, abstraction, inheritance and polymorphism													
2.	Programs to handle Exceptions													
3.	Implementation of Multithreading Programs.													
4.	Implementation of Stream classes.													
5.	Network programming using Sockets and Datagrams													
6.	Implementation of RMI													
7.	Implementation of Swing components													
8.	Programs to connect to backend databases using JDBC													
9.	Component development using BDK													
10.	Development of Server sided programs using servlets													
11.	Implementation of Spring Boot 2.0													
<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Develop Java applications using Object Oriented Programming features, exception handling, multithreading, networking and distributed computing features.													
2.	Develop Java applications that connect to a backend database, provide Graphic User Interface, develop Custom components as well as web applications.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes</b> →	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
↓ <b>Course Outcomes</b>													1	2
<b>22MCA207.1</b>	3		3	3	3				3		3		3	
<b>22MCA207.2</b>	3		3	3	3				3		3		3	
<b>1: Low 2: Medium 3: High</b>														

**REFERENCE BOOKS:**

1.	Herbert Schildt : Java: The Complete Reference, Eleventh Edition, Tata McGraw Hill., 2019
2.	Java Server Programming Java EE 7 (J2EE 1.7), Black Book, Dreamtech press 2014
3.	Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot, Dinesh Rajput, Pack Publishing Ltd., 2018
4.	Dr. Donald Doherty and Rick Leinecker : JavaBeans Unleashed
5.	James Goodwill : Developing Java Servlets
6.	Karl Avedal, Danny Ayers : Professional JSP
7.	Ed Roman : Mastering Enterprise JavaBeans

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Operating Systems with UNIX Lab</b>	
<b>Course Code: 22MCA208      Course Type: PCC</b>	
<b>Teaching Hours/Week (L:T:P: S): 0:0:4:0      Credits: 02</b>	
<b>Total Teaching Hours: 48      CIE + SEE Marks: 50+50</b>	
<b>Teaching Department : Master of Computer Applications</b>	
<b><u>Prerequisites</u></b>	
Students should have knowledge about computer organization, different parts of computer systems and also high-level languages like C.	
<b>Course Objectives:</b>	
<b>1.</b>	Should be able to implement all scheduling algorithms.
<b>2.</b>	Should be able to implement Bankers algorithm.
<b>3.</b>	Implement page replacement algorithm
<b>4.</b>	Develop shell scripts and implement basic commands
<b>List of Experiments</b>	
<b>1.</b>	Write a program to create five child processes using system call fork() and display their ids.
<b>2.</b>	Write a program to implement FCFS scheduling algorithm to determine the average waiting time and average turnaround time.
<b>3.</b>	Write a program to implement SJF scheduling algorithm (pre-emptive and non-pre-emptive) to determine average waiting time and average turnaround time.
<b>4.</b>	Write a program to implement Round Robin scheduling algorithm to determine average waiting time and average turnaround time.
<b>5.</b>	Write a program to implement priority scheduling algorithm to determine average waiting time and average turnaround time.
<b>6.</b>	Implement Banker's algorithm to determine whether the given system of 'n' number of processes is in safe state and also implement the Resource request algorithm
<b>7.</b>	Simulate the memory management page replacement algorithm FIFO and Calculate the number of page faults for the given reference string.
<b>8.</b>	Write a program to demonstrate Optimal page replacement algorithm to determine number of page faults.
<b>9.</b>	Simulate the memory management page replacement algorithm LRU. Calculate the number of page faults for the given reference string.
<b>10.</b>	Develop shell scripts to demonstrate the utility of basic Unix commands like echo, pwd, who, grep, sort, cut, paste, pipe, tee, cat, more, tty, stty, spell and such other simple commands/filters using appropriate Unix/Linux platform.

<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Understand and implement fork system call and implement scheduling algorithms.													
2.	Implement bankers algorithm, page replacement algorithms, shell scripts and execute basic UNIX commands													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA208.1</b>	3	3	3	3		3	3	3		3			3	2
<b>22MCA208.2</b>	3	3	3	3		3	3	3		3			3	2
<b>1: Low 2: Medium 3: High</b>														
<b>REFERENCE BOOKS:</b>														
1.	Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.													
2.	UNIX: The Complete Reference: Kenneth Roson et al, Osborne/McGraw Hill, 2000.													
<b>E Resources</b>														
1.	<a href="https://www.oreilly.com/library/view/learning-the-unix/1565923901/">https://www.oreilly.com/library/view/learning-the-unix/1565923901/</a>													

## Syllabus of II Semester MCA (Master of Computer Applications)

<b>Technical Seminar and Report Writing</b>														
<b>Course Code: 22MCA209</b>							<b>Course Type: Seminar</b>							
<b>Teaching Hours/Week (L:T:P: S): 0:0:0:2</b>							<b>Credits: 01</b>							
<b>Total Teaching Hours: 24</b>							<b>CIE Marks: 50</b>							
<b>Teaching Department: Master of Computer Applications</b>														
<b>Course Objectives:</b>														
<b>1.</b>	To learn to prepare for a seminar on a technical topic and present it effectively using overhead projectors and presentation software.													
<b>2.</b>	To learn to prepare a well formatted and well-organized report with appropriate content using report preparation software.													
<p>The student will prepare for a seminar on a technical topic and present it. A panel consisting of faculty members will evaluate the presentation and marks will be provided. The student will submit a report on the same. For the preparation of the presentation the student will refer technical papers from journals. The presentation will be prepared using LaTeX tool.</p>														
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	Review a technical topic													
<b>2.</b>	Present effectively													
<b>3.</b>	help the students face placement interviews.													
<b>4.</b>	Prepare a well organized report with appropriate content													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA209.1</b>	3	1		2			3	2	2	3	3	3	3	2
<b>22MCA209.2</b>	3	1						2	3	3		3	3	2
<b>22MCA209.3</b>	1	1		1			3	1	3	3			3	2
<b>22MCA209.4</b>													3	2
<b>1: Low 2: Medium 3: High</b>														
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	<b>Naomi Karten, “Presentation Skills for Technical Professionals: Achieving Excellence (Soft Skills for It Professionals)” – 23 Sept. 2010</b>													
<b>2.</b>	Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications													
<b>3.</b>	Day, R .A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.													

<b>Artificial Intelligence and Machine Learning</b>			
<b>Course Code:</b>	<b>22MCA301</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:1:0:0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>52</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have an understanding of statistics, probability, calculus, linear algebra and knowledge of programming.			
<b>Course Objectives:</b>			
<b>1.</b>	To understand the advantages and types of Artificial Intelligence		
<b>2.</b>	To understand machine learning, the need for machine learning, its types and data preprocessing		
<b>3.</b>	To understand Regression Models, Decision Trees, Support Vector Machines, Naive Bayesian Learning and Evaluating Regression model performance.		
<b>4.</b>	To understand Clustering Techniques, K-NN, Dimensionality Reduction using Principal Component Analysis and Reinforcement Learning algorithms.		
<b>5.</b>	To learn deep learning concepts, Neural network, Gradient descent, Back Propagation, and Convolutional Neural Networks.		
<b>UNIT - I</b>			
<b>Artificial Intelligence:</b> What is AI; Why Artificial Intelligence; Goals of AI; Advantages and disadvantages of AI; Applications of AI, Types of AI			<b>10 Hours</b>
<b>UNIT - II</b>			
<b>Machine learning:</b> What is ML; Need for ML; Challenges and applications of ML; classification: Supervised, Unsupervised, Reinforcement learning, AI vs Machine learning, Data Preprocessing.			<b>10 Hours</b>
<b>UNIT - III</b>			
<b>Regression:</b> Simple, Linear Regression, Multiple Regression, Polynomial Regression, Logistic Regression, Decision Trees, Support Vector Machines, Naive Bayesian Learning, Evaluating Regression model performance.			<b>12 Hours</b>
<b>Unit - IV</b>			
<b>Clustering:</b> K-Means Clustering, Hierarchical Clustering, K-NN, Principal Component Analysis, Reinforcement Learning			<b>08 Hours</b>
<b>Unit - V</b>			
<b>Deep Learning and Artificial Neural Networks:</b> Introduction to deep learning, The Neuron, How do Neural network learn and work? Gradient descent, Back Propagation, ANN in python, Convolutional Neural Networks.			<b>12 Hours</b>

<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Understand the concepts of Artificial Intelligence and its types.														
2.	Understand machine learning, the need for machine learning, its types and data preprocessing														
3.	Understand Regression Models, Decision Trees, Support Vector Machines, Naive Bayesian Learning and Evaluating Regression model performance.														
4.	Understand Clustering Techniques, K-NN, Dimensionality Reduction using Principal Component Analysis and Reinforcement Learning algorithms.														
5.	Understand deep learning concepts, Neural network, Gradient descent, Back Propagation, and Convolutional Neural Networks.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	
↓ Course Outcomes															
<b>22MCA301.1</b>	3	3	3	3	3	3	3	3	2	3	3	3	3	3	
<b>22MCA301.2</b>	3	3	3	3	3	3	3	3	2	3	3	3	3	3	
<b>22MCA301.3</b>	3	3	3	3	3	3	3	3	2	3	3	3	3	3	
<b>22MCA301.4</b>	3	3	3	3	3	3	3	3	2	3	3	3	3	3	
<b>22MCA301.5</b>	3	3	3	3	3	3	3	3	2	3	3	3	3	3	
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015														
2.	Tom M Mitchell, “Machine Learning”, 1st Edition, McGraw Hill Education, 2017.														
3.	Elaine Rich, Kevin K and S B Nair, “Artificial Intelligence”, 3 <sup>rd</sup> Edition, McGraw Hill Education, 2017														
4.	Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014														
<b>REFERENCE BOOKS:</b>															
1.	Introduction to Machine Learning with Python - A Guide for Data Scientists (Muller Andreas)														
2.	Data Science: Concepts and Practice - By Vijay Kotu, Bala Deshpande 2nd edition, Publisher -Morgan Kaufmann, 2018														
3.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2 <sup>nd</sup> Edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016														
4.	<b>Data Science For Dummies</b> , Lillian Pierson, John Wiley & Sons, 21-Feb-2017														



<b>Advanced Web Technologies</b>			
<b>Course Code:</b>	<b>22MCA302</b>	<b>Course Type</b>	<b>PCC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3-1-0</b>	<b>Credits</b>	<b>04</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have some basic knowledge of HTML, CSS, web browsers, development tools, scripting language, front-end and back-end development.			
<b>Course Objectives:</b>			
<b>1.</b>	To understand and apply the principles of XHTML, CSS, HTML5, and Bootstrap, and develop the skills to create structured web pages, implement effective styling, leverage the features of HTML5 for modern web development, and utilize Bootstrap for responsive and visually appealing designs.		
<b>2.</b>	To understand PHP scripting language and its applications in web development.		
<b>3.</b>	To understand JavaScript and its programming concepts, and overview of XML key components.		
<b>4</b>	To understand JavaScript execution environment and different event handler techniques.		
<b>5.</b>	To understand jQuery concept and its effects and provide an introduction to AngularJS.		
<b>UNIT - I</b>			
<b>XHTML, CSS, HTML5, BOOTSTRAP</b>			<b>02 Hours</b>
<b>XHTML:</b> Standard Structure, Basic Text Markup, Lists, Tables, Forms, Frames.			
<b>CSS:</b> Introduction, Levels of Style Sheets, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, The Box Model, The <span> and <div> tags.			<b>03 Hours</b>
<b>HTML5 :</b> Introduction of html5, iframes, layout, responsive web design(view port),computer code, new semantics elements in HTML5, Migration, canvas, svg, input types, new form elements and attribute, google map, media(audio, video)			<b>03 Hours</b>
<b>BOOTSTRAP:</b> Introduction of Bootstrap, First Web Page with Bootstrap, Bootstrap Grid system, CDN, Tables, Images, Jumbotron and Page Header, Wells, Alerts, Buttons, Badges and Labels, Progress Bars, List Groups, Navigation Bar, Forms, Form Inputs, Media Objects, Carousel Plug-in			<b>04 Hours</b>
<b>UNIT -II</b>			
<b>PHP</b>			<b>08 Hours</b>
Overview of PHP and uses of PHP, General Syntactic Characteristics, Primitives, Operations and expressions, Control Statements, Arrays, Functions, Pattern Matching, Form Handling, Files,			
<b>Advanced PHP:</b>			<b>04 Hours</b>
Cookies, Session tracking, Database Access with PHP and MySQL.			
<b>UNIT - III</b>			
<b>JavaScript, XML</b>			<b>06 Hours</b>
<b>JavaScript</b>			
Overview of JavaScript, Object Orientation and JavaScript, Syntactic Characteristics, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern Matching.			
<b>XML</b>			<b>04 Hours</b>

Introduction, Syntax, Document Structure, Document Type Definitions, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS.														
<b>Unit - IV</b>														
<b>Dynamic Documents with JavaScript</b>													<b>08 Hours</b>	
JavaScript Execution Environment, The Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from the Body Elements, Button Elements, Text Box and Password Elements, The Navigator Object.														
Introduction to dynamic documents, Positioning Element, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements.														
<b>Unit - V</b>														
<b>JQUERY</b>													<b>05 Hours</b>	
Introduction, Syntax, selectors, events, JQuery HTML, Effects.														
<b>Introduction to Angular JS:</b>													<b>05 Hours</b>	
What is AngularJS? Angular Directives, AngularJS Expression, Angular Expression, AngularJS Module, AngularJS Controller, AngularJS Filter.														
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	Create well-structured web pages using XHTML, apply CSS styling techniques, utilize HTML5 features for modern web development, and design responsive websites using Bootstrap, demonstrating proficiency in web development with these technologies.													
<b>2.</b>	Develop proficiency in PHP programming by demonstrating knowledge of its manipulate arrays, create functions, handle form data, manage files, utilize cookies and session tracking, and interact with MySQL databases.													
<b>3.</b>	Develop proficiency in JavaScript programming as well as gain a solid understanding of XML.													
<b>4.</b>	Develop proficiency in JavaScript for creating dynamic web documents.													
<b>5.</b>	Effectively use jQuery to manipulate HTML elements and enabling to apply jQuery for dynamic web development and explore further possibilities with AngularJS.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO1</b>	<b>PSO2</b>
<b>↓ Course Outcomes</b>														
<b>22MCA302.1</b>	3	2	3		3	3	3	3	3	3	3	3	3	
<b>22MCA302.2</b>	3	2	3		3	3	3	3	3	3	3	3	3	
<b>22MCA302.3</b>	2	2	3		3	3	3	3	3	3	3	3	3	
<b>22MCA302.4</b>	3	2	3		3	2	2	2	2	2	2	3	3	
<b>22MCA302.5</b>	3	2	3		3	2	2	2	2	2	2	3	3	
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Robert W. Sebesta: Programming with World Wide Web, IV Edition, Pearson Education, 2008.													
<b>2.</b>	Snig Bhaumik: Bootstrap Essentials, PACKT publishing, open source													
<b>3.</b>	Bear Bibeault: JQuery in Action, Manning Publications.													
<b>4</b>	Nicholas C Zakas et al: Professional AJAX, Wrox publications, 2006.													

5	Francis Shanahan: Mashups, Wrox, 2007.
<b>REFERENCE BOOKS:</b>	
1.	M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web, How to Program, 5 <sup>th</sup> Edition, Pearson Education, 2008
2	Chris Bates: Web Programming Building Internet Applications, 3 <sup>rd</sup> Edition, Wiley India, 2007.
3	Xue Bai et al: The Web Warrior Guide to Web Programming, Cengage Learning, 2001
4	Thomas A. Powel: Ajax The Complete reference, McGraw Hill, 2008.
5	Gottfried Vossen, Stephan Hagemann: Unleashing Web 2.0 From Concepts to Creativity, Elsevier, 2007.
6	Steven Holzner : Ajax Bible Wiley India , 2007.
7	Justin Gehtland et al: A Web 2.0 primer Pragmatic Ajax, SPD Publications, 2006.
8	Eric Van derVlist et al: Professional Web 2.0 Programming, Wiley India, 2007.
9	Jake Spurlock: Bootstrap- Responsive Web Development, O'Reilly Media, 2014.

<b>Mobile Computing and Application Development</b>			
<b>Course Code:</b>	<b>22MCA331</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students should have basic knowledge of Computer networking and programming.			
<b>Course Objectives:</b>			
<b>1.</b>	Introduce the student with concept of Mobile Computing and its architecture		
<b>2.</b>	Discuss the evolution of Mobile Communication system over different generations		
<b>3.</b>	Describe various components of Android Mobile Apps and use them in app development		
<b>4.</b>	Design applications using various UI controls supported by Android		
<b>5.</b>	Learn to work with data from various sources for Mobile Applications		
<b>UNIT - I</b>			
<b>Introduction to Mobile Computing :</b> Introduction, Architecture for Mobile Computing			<b>02 Hours</b>
<b>Evolution of Wireless Cellular Networks :</b> GSM: GSM Architecture, Entities, Call routing in GSM, GSM Addresses and Identities, GPRS: Introduction, GPRS Network Architecture, GPRS Network Operations, Third Generation Networks and features, Fourth Generation Networks and features, Fifth Generation technology and benefits.			<b>06 Hours</b>
<b>UNIT - II</b>			
<b>Basics of Android :</b> Introduction to Android, Build your first app, Layouts, Views and Resources, Text and Scrolling Views			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Activities and Intents :</b> Activities: Activity Life cycle and states, Intents: Implicit intents and Explicit intents			<b>08 Hours</b>
<b>UNIT - IV</b>			
<b>User Experience :</b> User Interaction: input controls, Menus, Screen navigation, Recycler View; Delightful user experience: drawables, styles and themes.			<b>08 Hours</b>
<b>UNIT - V</b>			
<b>Working in the background :</b> Broadcasts, Services, Notifications			<b>03 Hours</b>
<b>Working with data :</b> Storing data, Working with SQLite database, Content Providers			<b>04 Hours</b>

<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Understand the architecture of Mobile Computing and evolution of Mobile Communication technologies													
2.	Install and run basic Android applications on Mobile device and emulator													
3.	Summarize Activity Life cycle and develop apps with intents													
4.	Design Android applications with different Android user interface elements to give a delightful experience to the user													
5.	Develop Android applications incorporating databases													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA331.1</b>	3	3	2	2	1							1	1	1
<b>22MCA331.2</b>	3	2		1	1								1	2
<b>22MCA331.3</b>	2	3	3		2								1	2
<b>22MCA331.4</b>	2	2	2	3	3								1	2
<b>22MCA331.5</b>	3	2	3	1	2								1	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	Dr. Ashok Talukder, Ms. Roopa Yavagal, Mr. Hasan Ahmed: Mobile Computing Technology, Applications and Service Creation, 2 <sup>nd</sup> Edition, Tata McGraw Hill, 2010													
2.	Alexander Kukushkin-Introduction to Mobile Network Engineering, 1 <sup>st</sup> Edition, Wiley 2018													
3.	Erik Hellman, “Android Programming – Pushing the Limits”, 1 <sup>st</sup> Edition, Wiley India Pvt. Ltd, 2014													
<b>REFERENCE BOOKS:</b>														
1.	Dawn Griffiths and David Griffiths, “Head First Android Development”, 1 <sup>st</sup> Edition, O’Reilly SPD Publishers, 2015													
2.	J F DiMarzio, “Beginning Android Programming with Android Studio”, 4 <sup>th</sup> Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580													
3.	Anubhav Pradhan, Anil V Deshpande, “Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2													
<b>E Books / MOOCs/ NPTEL</b>														
1.	Google Developer Training Material <a href="https://google-developer-training.github.io/android-developer-fundamentals-course-concepts-v2/">https://google-developer-training.github.io/android-developer-fundamentals-course-concepts-v2/</a>													

<b>Digital and Social Media Marketing</b>			
<b>Course Code:</b>	<b>22MCA332</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have basic knowledge about management and Ideas on social media			
<b><u>Course Objectives:</u></b>			
<b>1.</b>	To learn about basics of digital marketing		
<b>2.</b>	To learn concepts on Ad campaigns and internet marketing		
<b>3.</b>	To understand the significance of Social media marketing		
<b>4.</b>	To learn about SEO, SEM, Web Analytics, Mobile Marketing, Trends in Digital Advertising		
<b>5.</b>	To understand the social media strategies and channels.		
<b>UNIT - I</b>			
<b>Introduction to Digital Marketing :</b> Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.			<b>08 Hours</b>
<b>UNIT - II</b>			
<b>Internet Marketing and Digital Marketing :</b> Mix – Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC; Search Engine Advertising: - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation Display marketing: - Types of Display Ads - Buying Models - Programmable Digital Marketing - Analytical Tools - YouTube marketing.			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Social Media Marketing :</b> Role of Influencer Marketing, Tools & Plan– Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy Facebook Marketing: - Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools LinkedIn Marketing: - Introduction and Importance of LinkedIn Marketing, Framing LinkedIn Strategy, Lead Generation through LinkedIn, Content Strategy, Analytics and Targeting Twitter Marketing : Introduction to Twitter Marketing, how twitter Marketing is different than other forms of digital marketing, framing content strategy, Twitter Advertising Campaigns Instagram and Snapchat: - Digital Marketing Strategies through Instagram and Snapchat Mobile Marketing: Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics Introduction to social mediometrics			<b>07 Hours</b>
<b>UNIT - IV</b>			
<b>Introduction to SEO, SEM, Web Analytics, Mobile Marketing, Trends in Digital Advertising :</b> Introduction and need for SEO, How to use internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - Introduction to SEM Web Analytics: - Google Analytics & Google AdWords; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code Trends in digital advertising			<b>08 Hours</b>

<b>UNIT - V</b>															
<b>Social Media Channels:</b> Introduction, Key terms and concepts, Traditional media vs Social media. Social media channels: Social networking. Content creation, Bookmarking & aggregating and Location & social media. Tracking social media campaigns. Social media marketing: Rules of engagement. Advantages and challenges. Social Media Strategy: Introduction, Key terms and concepts. Using social media to solve business challenges. Step-by-step guide to creating a social media strategy. Documents and processes. Dealing with opportunities and threats. Step-by-step guide for recovering from an online brand attack. Social media risks and challenges													<b>08 Hours</b>		
<b>Course Outcomes:</b> At the end of the course student will be able to															
<b>1.</b>	Recognize appropriate e-marketing objectives														
<b>2.</b>	Appreciate the e-commerce framework and technology.														
<b>3.</b>	Illustrate the use of search engine marketing, online advertising and marketing strategies.														
<b>4.</b>	Use social media & create templates.														
<b>5.</b>	Develop social media strategy's to solve business problems.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>														1	2
<b>22MCA332.1</b>		3	2	3			2		2			2	3	3	2
<b>22MCA332.2</b>		2	3		3						3	2		2	1
<b>22MCA332.3</b>			2			2			3			2	2	3	2
<b>22MCA332.4</b>		2			3		2			2	2			3	2
<b>22MCA332.5</b>			3				2		3		2	2		2	2
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
<b>1.</b>	Seema Gupta "Digital Marketing" Mc-Graw Hill 1 <sup>st</sup> Edition – 2017														
<b>2.</b>	Internet Marketing: Integrating Online and Offline Strategies. M. L. Roberts and Debra Zahay, 3 <sup>rd</sup> edition, Cengage Publishing, 2013														
<b>REFERENCE BOOKS:</b>															
<b>1.</b>	Digital Marketing: Strategy, Implementation and Practice, Chaffey D., Ellis-Chadwick, 5 <sup>th</sup> Edition, F., Pearson, 2012														
<b>2.</b>	Puneet Singh Bhatia "Fundamentals of Digital Marketing" Pearson 1 <sup>st</sup> Edition–2017														
<b>E Books / MOOCs/ NPTEL</b>															
<b>1.</b>	<a href="https://www.udemy.com/topic/social-media-marketing/">https://www.udemy.com/topic/social-media-marketing/</a>														

## Syllabus of III Semester MCA (Master of Computer Applications)

<b>Software Risk Identification and Management</b>			
<b>Course Code:</b>	<b>22MCA335</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have basic knowledge on software engineering and its development.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the concepts and principles of Risk Management		
<b>2.</b>	Apply the concepts and principles of Continuous Risk Management		
<b>3.</b>	To learn about the activity planning and risk management principles.		
<b>4.</b>	To develop skills to manage the various supporting practices.		
<b>5.</b>	To Deploy Risk management and various environmental classes		
<b>UNIT - I</b>			
Introduction, risk items, risk resolution techniques, and heuristics risk list risk-action list, risk-strategy model, risk-strategy, analysis.			<b>08 Hours</b>
<b>UNIT - II</b>			
A Holistic Vision of Software Risk Management, Temporal Dimension, Methodological Dimension, Human Dimension, Graphic Representation of the Holistic Vision of Software Risk Management			<b>08 Hours</b>
<b>UNIT - III</b>			
Software Risk Management Methodologies, Basic constructs to Risk Management, Risk Management Paradigm, Risk Taxonomy, Risk Clinic			<b>07 Hours</b>
<b>UNIT - IV</b>			
Supporting practices, Software Risk Evaluation (SRE) practice, Continuous Risk Management (CRM), Team Risk Management (TRM), Methodological framework for Software Risk Management (SRM), Software Capability Maturity Model (SW-CMMSM), Software Acquisition-Capability Maturity Model (SA-CMMSM)			<b>08 Hours</b>
<b>UNIT - V</b>			
Deployment of the SEI Risk Management program, Major classes within the Hierarchy, Major elements of Risk within each class, Major attributes within each element and class, Product engineering class, Development environment class, Program constraints class			<b>08 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to			
<b>1.</b>	Understand Risk Management principles		
<b>2.</b>	Estimate the risks involved in various project activities		
<b>3.</b>	Gain extensive knowledge about activity planning in Risk management		
<b>4.</b>	Be able to use key methods and tools		
<b>5.</b>	Be able to tailor Continuous Risk Management to a project.		



<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓Course Outcomes</b>													1	2
<b>22MCA335.1</b>	3	2	3			2		2			2	3	3	2
<b>22MCA335.2</b>	2	3		3			3			3	2		2	1
<b>22MCA335.3</b>		2			2			3			2	2	3	2
<b>22MCA335.4</b>	2			3		2			2	2			3	2
<b>22MCA335.5</b>		3				2		3		2	2	2	2	2
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	Barry W. Boehm, “Software risk: management principles and practices”, reprinted from vol-8.													
2.	Implementing Enterprise Risk Management, John Wiley & Son, Inc., Hoboken, New Jersey. John R.S. Fraser, Betty J. Simkins, Kristina Narvaev, 2015													
<b>REFERENCE BOOKS:</b>														
1.	Robert K. Wysocki —Effective Software Project Management— Wiley Publication, 2011.													
2.	Risk management notes [Online]. Available: <a href="http://agile.csc.ncsu.edu/SEMaterials/RiskManagement.pdf">http://agile.csc.ncsu.edu/SEMaterials/RiskManagement.pdf</a>													
<b>E Books / MOOCs/ NPTEL</b>														
1.	<a href="https://www.udemy.com/course/introduction-to-software-project-risk-management/">https://www.udemy.com/course/introduction-to-software-project-risk-management/</a>													

<b>Industrial and Medical IOT</b>			
<b>Course Code:</b>	<b>22MCA336</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department : Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have a basic computer skills.			
<b>Course Objectives:</b>			
1.	Introduce evolution of internet technology and need for IoT with its characteristics.		
2.	Discuss on IoT reference layer and various protocols and software with its application.		
3,	Train the students to build IoT systems using arduino, Raspberry Pi and open source IoT platforms.		
4.	Make the students to apply IoT data for business solution in industrial IoT.		
5.	Understand the applications of medical IoT in various domain in secured manner.		
<b>UNIT - I</b>			
<b>Introduction to IoT:</b> Defining IoT, Characteristics of IoT, Sensors, types of sensors, actuator and smart object			<b>04 Hours</b>
<b>Physical design of IoT :</b> Things in IoT, IoT protocol.			
<b>Logical design of IoT :</b> Functional blocks of IoT, Communication models & APIs.			<b>04 Hours</b>
<b>IoT &amp; M2M :</b> Machine to Machine, Difference between IoT and M2M			
<b>UNIT - II</b>			
<b>IoT levels &amp; Deployment templates</b> <b>Developing IoTs :</b> IoT design methodology, Case study on IoT system for weather monitoring.			<b>04 Hours</b>
<b>Applications of IoT :</b> Case study of home automation, Case study of smart parking and Case study of smart irrigation.			<b>04 Hours</b>
<b>UNIT - III</b>			
<b>IoT Physical device &amp; Endpoint :</b> Basic building blocks of an IoT device, Introduction to Raspberry Pi, About board, Programming raspberry Pi with python, Introduction to arduino board, Programming arduino device.			<b>08 Hours</b>
<b>UNIT - IV</b>			
<b>Industrial IoT :</b> What is IIOT? IOT Vs. IIOT, History of IIOT, Benefits of IIoT			<b>07 Hours</b>

IIoT-An analysis framework-review of existing IoT taxonomies, industry sector, location, connectivity. Case Study															
<b>UNIT - V</b>															
<b>Internet of Medical Things :</b> IoMT and Telehealth, Relation of IoMT with Telehealth and Telemedicine, Benefits of IoMT, IoMT Provider Benefits, Challenges of implementing IoMT, IoMT Devices, Importance of security for IoMT, IoMT Vs IoT.														<b>08 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Able to learn and understand the characteristics and protocols of Internet of Things.														
2.	Able to understand the design methodology of IoT with its application.														
3.	Able to understand the working of Raspberry Pi and Arduino board.														
4.	Able to know the functionality of industrial IoT.														
5.	Able to understand the functionalities of medical IoT.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes</b> →	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>	
↓ <b>Course Outcomes</b>													1	2	
<b>22MCA336.1</b>	3	3	3			2	1		3				3	3	
<b>22MCA336.2</b>	3	3	3	3	3	2			1	1	2		3	3	
<b>22MCA336.3</b>	3	3	2	3	3	2			1		2		3	3	
<b>22MCA336.4</b>	2	3	2	2	3								3	3	
<b>22MCA336.5</b>	3	3	2	2	3								3	3	
<b>1: Low 2: Medium 3: High</b>															
<b>TEXT BOOKS:</b>															
1.	Vijay Madiseti, Arshdeep Bahga, “Internet of Things: A Hands -On Approach”														
2.	David Hanes, Gonzalo Salgueiro, Rob Barton "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things", 2019														
<b>REFERENCE BOOKS:</b>															
1.	Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 <sup>st</sup> Edition, Apress Publications, 2013														
2.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"														
3.	Hugh Boyes*, Bil Hallaq, Joe Cunningham, Tim Watson “The industrial internet of things (IIoT): An analysis framework”. Published by Elsevier														
<b>E Books / MOOCs/ NPTEL</b>															
1.	<a href="https://www.splunk.com/en_us/data-insider/what-is-the-internet-of-medical-things-iomt.html#iomt-and-telehealth">https://www.splunk.com/en_us/data-insider/what-is-the-internet-of-medical-things-iomt.html#iomt-and-telehealth</a>														

<b>Block Chain Technology</b>			
<b>Course Code:</b>	<b>22MCA343</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students must possess basic knowledge of the internet, have Interest in learning Blockchain and Computer with Mac, Windows, or Linux OS			
<b>Course Objectives:</b>			
<b>1.</b>	To understand Block Chain, Blockchain Architecture and its Applications		
<b>2.</b>	To understand crypto currencies, Types and Applications		
<b>3.</b>	To understand Concept of Double Spending, Hashing, Mining, payment verification, Resolving Conflicts and Creation of Blocks		
<b>4.</b>	To understand Crypto currency wallets and conversion to Fiat Currency.		
<b>5.</b>	To Understand Smart contracts, usage, application, working principle, Law and Regulations		
<b>UNIT - I</b>			
Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin.			<b>07 Hours</b>
<b>UNIT - II</b>			
Blockchain : Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to crypto currencies, Types, Applications.			<b>08 Hours</b>
<b>UNIT - III</b>			
Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks			<b>08 Hours</b>
<b>Unit - IV</b>			
Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.			<b>08 Hours</b>
<b>Unit - V</b>			
Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study.			<b>08 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to			
<b>1.</b>	Understand and explain Block Chain, blockchain architecture and its applications		
<b>2.</b>	Understand and explain crypto currencies, types and applications		
<b>3.</b>	Understand and explain the concept of double spending, hashing, mining, payment verification, resolving conflicts and creation of blocks		
<b>4.</b>	Understand crypto currency wallets and conversion of crypto currency to fiat currency.		

5.	Understand and explain smart contracts, usage, application, working principle, law and regulations in relation to crypto currency.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA343.1</b>	3	2		3	3				3			3	3	1
<b>22MCA343.2</b>	2	3		2	2				2			3	3	1
<b>22MCA343.3</b>	3	3		3	3				2			3	3	1
<b>22MCA343.4</b>	2	2		3	2				3			3	3	1
<b>22MCA343.5</b>	2	3		2	3				2			3	3	1
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	Arshdeep Bikramaditya Signal, Gautam Dhameja, “Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions”, APress													
2.	<b>Bahga, Vijay Madiseti, “Blockchain Applications: A Hands-On Approach”. 31 January 2017</b>													
3.	Melanie Swan, “Blockchain”, OReilly													
<b>REFERENCE BOOKS:</b>														
1.	Aravind Narayan. Joseph Bonneau, “Bitcoin and Crypto currency Technologies”, Princeton													
2.	Arthu.T Books, “Bitcoin and Blockchain Basics: A non-technical introduction for beginners”													

<b>Network and Cyber Security</b>			
<b>Course Code:</b>	<b>22MCA344</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have basic knowledge of Computer Networks			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the concepts of network and cyber security.		
<b>2.</b>	Apply key principles of cryptography.		
<b>3.</b>	Understand the concept of authentication.		
<b>4.</b>	Understand basic principles of cybercrime.		
<b>5.</b>	Apply tools to achieve security in cybercrime.		
<b>UNIT - I</b>			
<b>Introduction to network and cyber security :</b> What is network security, Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. What is cyber security, Substitution Techniques: Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad, rotor machines, Steganography			<b>09 Hours</b>
<b>UNIT - II</b>			
<b>Public Key Cryptography :</b> Prime Numbers, Fermats and Eulers theorem, testing to Primality: Millar-Rabin algorithm, Principles of Public Key Cryptosystem, RSA algorithm, Diffie-Hellman, Key exchange. <b>Hash Functions :</b> Applications, Requirements and Security, Hash functions based on Cipher Block chaining			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Authentication of Systems :</b> Remote user-authentication principles, Kerberos Version 4, Kerberos Version 5: Environmental Shortcomings, X.509 Authentication Service: certificates, X.509 version3.			<b>07 Hours</b>
<b>UNIT-IV</b>			
<b>Introduction to Cybercrime :</b> Cybercrime: Definition and Origins of the Word Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.			<b>07 Hours</b>
<b>UNIT - V</b>			
<b>Tools and Methods Used in Cybercrime :</b> Introduction , Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares , Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Digital Signatures and the Indian IT Act, Cybercrime and			<b>08 Hours</b>

Punishment, Cyberlaw, Technology and Students: Indian Scenario														
<b>Course Outcomes:</b> At the end of the course student will be able to														
1. Provide security for the data over the network.														
2. Implement algorithms related to cryptography.														
3. Explain basic authentication principles.														
4. Discuss various cybercrimes.														
5. Identify cybercrime threats using tools.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA344.1</b>	2	2	2	1	1								3	2
<b>22MCA344.2</b>	2	2	2	1									3	2
<b>22MCA344.3</b>	2	2	2	1	3								3	2
<b>22MCA344.4</b>	2	2	2	1	1								3	2
<b>22MCA344.5</b>	2	2	2	1	2								3	2
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, Sixth Edition													
2.	Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791 Publish Date 2013													
3.	Cryptography and Network Security, AtulKahate, TMH, 2003													
<b>REFERENCE BOOKS:</b>														
1.	Charlie Kaufman, Radia Perlman, Mike Speciner: Network Security-Private Communication in Public World, 2 <sup>nd</sup> Edition Pearson Education,2003													
<b>E Books / MOOCs/ NPTEL</b>														
1.	<a href="https://nptel.ac.in/courses/106106129">https://nptel.ac.in/courses/106106129</a>													

<b>Cyber Forensics</b>			
<b>Course Code:</b>	<b>22MCA345</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L: T: P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Data Communication and Computer Networks, Artificial Intelligence and Machine Learning			
<b>Course Objectives:</b>			
<b>1.</b>	To study the fundamentals of Computer Forensics.		
<b>2.</b>	To learn to analyze and validate forensics data.		
<b>3.</b>	To study the tools and tactics associated with Cyber Forensics.		
<b>4.</b>	Understand the principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.		
<b>5.</b>	To learn technical aspects & legal aspects related to cyber crime.		
<b>UNIT - I</b>			
<b>INTRODUCTION TO COMPUTER FORENSICS :</b> Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.			<b>08 Hours</b>
<b>UNIT - II</b>			
<b>EVIDENCE COLLECTION AND FORENSICS TOOLS :</b> Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>ANALYSIS AND VALIDATION :</b> Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics			<b>08 Hours</b>
<b>UNIT - IV</b>			
<b>ETHICAL HACKING :</b> Introduction to Ethical Hacking – Foot printing and Reconnaissance - Scanning Networks - Enumeration – System ETHICAL HACKING IN WEB Hacking - Malware Threats - Sniffing			<b>08 Hours</b>
<b>UNIT - V</b>			
<b>ETHICAL HACKING IN WEB :</b> Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.			<b>07 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to			
<b>1.</b>	Understand the basics of computer forensics		
<b>2.</b>	Apply a number of different computer forensic tools to a given scenario		



3.	Analyze and validate forensics data
4.	Identify the vulnerabilities in a given network infrastructure
5.	Implement real-world hacking techniques to test system security

**Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes**

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
↓Course Outcomes														
<b>22MCA345.1</b>	3	3			3					3		3	3	2
<b>22MCA345.2</b>	3	3			2					3		3	3	2
<b>22MCA345.3</b>	3	2			2					3		3	3	2
<b>22MCA345.4</b>	3	2			2					2		2	3	2
<b>22MCA345.5</b>	3	3			3					3		3	3	2

**1: Low 2: Medium 3: High**

**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, — Computer Forensics and Investigations, Cengage Learning, India Edition, 2016
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015

**REFERENCE BOOKS:**

1. John R.Vacca, —Computer Forensics, Cengage Learning, 2005
2. Marjie T.Britz, —Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013
3. Ankit Fadia — Ethical Hacking Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik —Insider Computer Fraud Auerbach Publications Taylor & Francis Group–2008

**E Books / MOOCs/ NPTEL**

1. **Digital Forensics With Open Source Tools: Using Open Source Platform Tools for Performing Computer Forensics on Target Systems: Windows, MAC, Linux**  
<https://www.pdfdrive.com/digital-forensics-with-open-source-tools-using-open-source-platform-tools-for-performing-computer-forensics-on-target-systems-windows-mac-linux-unix-etc-d156711094.html>

<b>Quantum Information and Cryptography</b>			
<b>Course Code:</b>	<b>22MCA346</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Students must have basic knowledge on quantum mechanics, linear algebra, group theory and about the analysis of algorithms.			
<b>Course Objectives:</b>			
<b>1.</b>	To understand basics of Cryptography with encryption techniques.		
<b>2.</b>	To be able to secure a message over insecure channel by various means.		
<b>3.</b>	To provide an in-depth understanding of cryptography theories, algorithms and systems.		
<b>4.</b>	To defend the security attacks on information systems with secure algorithms		
<b>5.</b>	To understand the fundamental concepts on quantum computing.		
<b>UNIT - I</b>			
<b>Foundations of Cryptography :</b> Information Security-Confidentiality, Integrity and Availability-Authentication, Authorization and Non repudiation-Introduction to Plain Text, Cipher Text, Encryption and Decryption Techniques, Secure Key, Hashing, Digital signature.			<b>04 Hours</b>
<b>Classical Encryption techniques :</b> Symmetric cipher model, substitution techniques, transposition techniques.			<b>03 Hours</b>
<b>UNIT - II</b>			
<b>Conventional Symmetric Encryption Algorithms :</b> Block cipher principles, Feistel Cipher Network Structures, Data Encryption Standard, Modes of Operation (ECB, CBC, OFB, CFB), Strength of DES.			<b>04 Hours</b>
<b>Modern Symmetric Encryption Algorithms :</b> Blowfish, Key Distribution: Scenario, Hierarchical Key control, Session Key lifetime, Transparent Key control, Decentralized key control.			<b>04 Hours</b>
<b>UNIT - III</b>			
<b>Public Key Cryptography :</b> Prime Numbers, Principles of public key Cryptosystems, RSA algorithm.			<b>04 Hours</b>
<b>Other public key Cryptosystems:</b> Diffie-Hellman Key exchange Algorithms, Elgamal Cryptographic system, Elliptic curve cryptography.			<b>04 Hours</b>
<b>UNIT - IV</b>			
<b>Message Authentication and Message Digest :</b> Authentication Requirements, Authentication Functions: Message Encryption, Message Authentication Code, Hash Function, MD5: logic, Compression function			<b>04 Hours</b>

<b>Digital Signatures :</b> Requirements, Direct digital signature, Arbitrated digital signature, Digital Signature Standard (DSS and DSA)													<b>04 Hours</b>	
<b>UNIT - V</b>														
<b>Quantum Information and Computing</b> What is Quantum computing, Superposition and Entanglement, Quantum Computer, What are Quantum Bits, History of Quantum Computing, Applications of Quantum Computing, Classical Computing Vs. Quantum Computing, Future of Quantum Computing													<b>08 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Provide security of the data over the network.													
2.	Do research in the emerging areas of cryptography and network security.													
3.	Develop cryptographic algorithms for information security													
4.	Protect any network from the threats in the world.													
5.	Understand the basic concepts on quantum computing.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA346.1</b>	3	3		3	3								3	2
<b>22MCA346.2</b>	3	3	3	3	3						3		3	2
<b>22MCA346.3</b>	3	3	3	3	2						3		3	2
<b>22MCA346.4</b>	3	2	2	3							2		3	2
<b>22MCA346.5</b>	3	3	3										3	2
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, 7 <sup>th</sup> Edition, 2017 (ISBNNo.:978-0-13-44446-11)													
2.	D.R. Stinson, Cryptography: Theory and Practice, 3 <sup>rd</sup> Edition, Boca Raton, FL: Chapman & Hall/CRC, 2005. (ISBNNo.:978-1-58-488508-5)													
<b>REFERENCE BOOKS:</b>														
1.	Charlie Kaufman, Radia Perlman, Mike Speciner : Network Security-Private Communication in Public World, 2 <sup>nd</sup> Edition Pearson Education													
2.	Atul Kahate, Cryptography and Network Security, Tata McGraw Hill													
<b>E Books / MOOCs/ NPTEL</b>														
1.	<a href="https://www.javatpoint.com/what-is-quantum-computing">https://www.javatpoint.com/what-is-quantum-computing</a>													

<b>Cloud Computing and Big Data Analytics</b>			
<b>Course Code:</b>	<b>22MCA351</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P:S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites :</u></b>			
Student must have some basic knowledge of Core Java, database concepts, and any of the Linux operating system flavors.			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the types, characteristics and challenges with digital data		
<b>2.</b>	Understand the concept of Big data Analytics and technology landscape		
<b>3.</b>	Understand the use of open source software framework called Hadoop		
<b>4.</b>	Understand different cloud computing service models and cloud security		
<b>5.</b>	Learn about multicloud computing and Cloud Computing in Business		
<b>UNIT - I</b>			
<b>Types of Digital Data :</b> Classification of Digital Data, Structured Data, Sources of Structured Data, Ease of Working with Structured Data, Semi-Structured Data, Sources of Semi-Structured Data, Unstructured Data, Issues with “Unstructured” Data, How to Deal with Unstructured Data.			<b>04 Hours</b>
<b>Introduction to Big Data:</b> Characteristics of Data, Evolution of Big Data, Definition of Big Data, Volume, Velocity, Variety, Challenges of Big Data, Other Characteristics of Data Which are Not Definitional Traits of Big Data, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, Coexistence of Big Data and Data Warehouse.			<b>04 Hours</b>
<b>Unit - II</b>			
<b>Introduction to Big Data Analytics :</b> Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Importance of Big Data Analytics, Terminologies Used in Big Data Environment, In Memory Analytics, In Database Processing, Symmetric Multiprocessor System, Massively Parallel Processing, Difference between Parallel versus Distributed Systems, Shared Nothing Architecture, Consistency, Availability, Partition Tolerance (CAP), Basically Available Soft State Eventual Consistency (BASE)			<b>08 Hours</b>
<b>Unit - III</b>			
<b>Hadoop Techniques: :</b> Introducing Hadoop, RDBMS versus Hadoop, Hadoop versus SQL, Distributed Computing Challenges, Key Aspects of Hadoop, Hadoop Components. Features of Hadoop, Key Advantages of Hadoop, Versions of Hadoop, Hadoop 1.0, Hadoop 2.0, Overview of Hadoop Ecosystems, High Level Architecture of Hadoop, Hadoop Distributed File System, HDFS Daemons, Anatomy of File Read, Anatomy of File Write, Processing Data with Hadoop, MapReduce Daemons, MapReduce Example,			<b>07 Hours</b>

Managing Resources and Application with Hadoop YARN, Limitations of Hadoop 1.0 Architecture, HDFS Limitation, Hadoop 2: HDFS, Hadoop 2 YARN: Taking Hadoop Beyond Batch, Hadoop Ecosystem.														
<b>Unit - IV</b>														
<b>Cloud Computing definition, Cloud service models (IaaS, PaaS &amp; SaaS) :</b> Cloud deployment models (Public, Private, Hybrid and Community Cloud), Private & Public Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Building blocks namely Physical Layer, Virtualization Layer, Cloud Management Layer, When to opt for Public Cloud, Public Cloud Service Models.														<b>08 Hours</b>
<b>Unit - V</b>														
Cloud Computing in terms of Application Security, Server Security, and Network Security, multi-cloud management, Management System (e.g. RightScale Cloud Management System), Cloud Computing in Business.														<b>08 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to														
1.	Classify the digital data													
2.	Understand the top challenges facing big database													
3.	Study components and advantages of Hadoop													
4.	Understand Cloud deployment models													
5.	Understand Server Security, and Network Security, application security.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA351.1</b>	2	3	2	3			3					3	1	1
<b>22MCA351.2</b>	3	3				2						2	2	2
<b>22MCA351.3</b>	2		3		1				1			2	3	3
<b>22MCA351.4</b>	1	2		3		2	1					2	2	3
<b>22MCA351.5</b>	2		2	3				3				2	3	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
1.	Seema Acharya and Subhashini C: Big Data and Analytics, First Edition, Wiley India Pvt. Ltd, 2015													
2.	Cloud Computing: Principles and paradigms By Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, 2011													
<b>REFERENCE BOOKS:</b>														
1.	Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman: Big data for dummies													
2.	Tom White: Hadoop – The Definitive Guide													
3.	Chuck Lam: Hadoop in action													
4.	Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown: Hadoop for dummies													
<b>E Books / MOOCs/ NPTEL</b>														
1.	Big Data computing-nptel													
2.	Cloud Computing and Big Data, C. Catlett, W. Gentsch, L. Grandinetti, IOS Press, 2013													

## Syllabus of III Semester MCA (Master of Computer Applications)

<b>Natural Language Processing</b>			
<b>Course Code:</b>	<b>22MCA352</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P:S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b>Course Objectives:</b>			
<b>1.</b>	To learn the basics of Natural Language Processing		
<b>2.</b>	Learn the finite-state morphological parsing process		
<b>3.</b>	To know about Syntactic Parsing		
<b>4.</b>	Understand the basic feature systems for English		
<b>5.</b>	To know the concept of Named entity recognition		
<b>UNIT - I</b>			
<b>Introduction to Natural Language Processing :</b> The study of Language, Applications of NLA, Different levels of language analysis			<b>04 Hours</b>
<b>Linguistic Background :</b> An outline of English syntax, The elements of simple noun phrases, verb phrases and simple sentences, Particles, adjective phrases, adverbial phrases			<b>04 Hours</b>
<b>UNIT - II</b>			
<b>Finite-state morphological parsing :</b> Detecting and correcting spelling errors, Minimum edit distance, N-Grams - Counting words in corpora, Simple(un-smoothed) n-grams;			<b>04 Hours</b>
<b>Part – of - Speech Tagging - English word classes :</b> Tagsets for English, Hidden Markov Models - Markov chains, The Hidden Markov Model.			<b>04 Hours</b>
<b>UNIT - III</b>			
<b>Syntactic Parsing:</b> Grammars and syntax structure, A top down parser			<b>04 Hours</b>
<b>Depth first strategy vs Breadth first strategy :</b> Bottom up chart parser, Efficiency considerations, Transition Network Grammars, Top down chart parser.			<b>04 Hours</b>
<b>UNIT - IV</b>			
<b>Features and Augmented Grammars :</b> Feature systems and augmented grammars			<b>04 Hours</b>
<b>Basic feature systems for English :</b> person and number features; Binary features; Morphological analysis and the lexicon; A simple grammar using features			<b>04 Hours</b>
<b>UNIT - V</b>			
<b>Applications:</b>			<b>04 Hours</b>

Information Extraction – Named entity recognition, Relation detection and classification														
<b>Temporal and event processing, Template filling :</b> Temporal and event processing, Template filling.														<b>03 Hours</b>
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	Basics of Natural Language Processing													
<b>2.</b>	Knows the concept of finite-state morphological parsing													
<b>3.</b>	Solves problems related to Syntactic Parsing													
<b>4.</b>	Learns the basic feature systems for English													
<b>5.</b>	Learns the basics of Named entity recognition													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA352.1</b>	3	3	3	3			3	3				3	3	3
<b>22MCA352.2</b>	3	3	3	3			3	3				3	3	3
<b>22MCA352.3</b>	3	3	3	3			3	3				3	3	3
<b>22MCA352.4</b>	3	3	3	3			3	3				3	3	3
<b>22MCA352.5</b>	3	3	3	3			3	3				3	3	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Jurafsky, D. and J. H. Martin, "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2 <sup>nd</sup> Edition, Prentice Hall, 2008													
<b>2.</b>	Allen, James, "Natural Language Understanding", 2 <sup>nd</sup> Edition, Benjamin/Cumming, 1995													
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	Steven Bird, S., Klein, E., Loper, E, "Natural Language Processing with Python-Analyzing Text with the Natural Language Toolkit", O'Reilly Media, 2010													
<b>2.</b>	Grant S Ingersoll, Thomas S. Morton, and Andrew L. Farris," Taming text: how to find, organize, and manipulate it" Manning Publications Co., 2013													
<b>3.</b>	Feldman Ronen, and James Sanger," The text mining handbook: advanced approaches in analyzing unstructured data", Cambridge university press,2007													
<b>4.</b>	Christopher D Manning, and Hinrich Schütze," Foundations of statistical natural language processing", MIT press, 1999													
<b>E Books / MOOCs/ NPTEL</b>														
<b>1.</b>	<a href="http://tamingtext.com/2013/01/11/taming-text-print-copies-now-available/">http://tamingtext.com/2013/01/11/taming-text-print-copies-now-available/</a>													

## Syllabus of III Semester MCA (Master of Computer Applications)

<b>Management Information Systems</b>			
<b>Course Code:</b>	<b>22MCA355</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Mater of Computer Applications</b>			
<b>Course Objectives:</b>			
<b>1.</b>	Describe the role of information technology and decision support systems in business		
<b>2.</b>	Introduce the fundamental principles of computer-based information systems and design and develop an understanding of the principles and techniques used		
<b>3.</b>	Enable students understand the various knowledge representation methods and different expert system structures		
<b>4.</b>	Introduce the various E-business models used by organizations		
<b>5.</b>	Enable the students to use information to assess the impact of the Internet and Internet technology on electronic commerce and electronic business		
<b>UNIT - I</b>			
<b>Systems Engineering :</b> System concepts, System control, Types of systems, Handling system complexity, Classes of systems, General model of MIS, Need for system analysis			<b>02 Hours</b>
<b>Information and Knowledge :</b> Information concepts, Classification of information, Methods of data and information collection, Value of information			<b>03 Hours</b>
<b>Introduction of MIS :</b> MIS: Concept, Definition, Role of the MIS, Impact of MIS, MIS and the user, Management as a control system, MIS support to the management, Management effectiveness and MIS, Organization as system. MIS: organization effectiveness			<b>03 Hours</b>
<b>UNIT - II</b>			
<b>Strategic Management of Business :</b> Concept of corporate planning, Essentiality of strategic planning, Development of the business strategies, Type of strategies, Short-range planning, Tools of planning, MIS: Strategic business planning			<b>04 Hours</b>
<b>Development of MIS :</b> Development of long range plans of the MIS, Ascertaining the class of information, Determining the information requirement, Development and implementation of the MIS, Management of information quality in the MIS, Organization for development of MIS, MIS development process model			<b>04 Hours</b>
<b>UNIT - III</b>			
<b>Role of ICT / IT Strategies /IT Solutions :</b>			<b>04 Hours</b>



Planning fundamentals (real world cases), Organizational planning, planning for competitive advantage (SWOT Analysis), Business models and planning. Business/IT planning, identifying business/IT strategies, Implementation Challenges, Change management, Developing business systems (real world case)															
<b>Business Process Re-Engineering :</b> Introduction, Business process, Process model of the organization, Value stream model of the organization, what delay the business process, Relevance of information technology, MIS and BPR														<b>04 Hours</b>	
<b>UNIT - IV</b>															
<b>Technology of Information Systems :</b> Introduction, Data processing, Transaction processing, Application processing, information system processing, TQM of information systems, Human factors & user interface, Strategic nature of IT decision, MIS choice of information technology														<b>04 Hours</b>	
<b>Decision Making and DSS :</b> Decision making concepts; Decision making process, Decision-making by analytical modeling, Behavioral concepts in decision making, Organizational decision-making, Decision structure, DSS components, Management reporting alternatives														<b>04 Hours</b>	
<b>UNIT - V</b>															
<b>Electronic Business Systems :</b> Enterprise business system – Introduction, cross-functional enterprises applications, real world case, Functional business system, Introduction, marketing systems, sales force automation, CIM, HRM, online accounting system, Customer relationship management, ERP, Supply chain management (real world cases for the above)														<b>04 Hours</b>	
<b>Client Server Architecture and E-business Technology :</b> Client server architecture, implementation strategies, Introduction to E-business, model of E-business, internet and World Wide Web, Intranet/Extranet, electronic, Impact of Web on Strategic management, Web enables business management, MIS in Web environment														<b>03 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to															
<b>1.</b>	Define MIS and analyze its significance in business organizations														
<b>2.</b>	Develop corporate planning and strategies using MIS														
<b>3.</b>	Apply SWOT Analysis and apply business														
<b>4.</b>	Summarize organizational decision-making process and also apply decision support systems														
<b>5.</b>	Analyze the role of various Electronic Business systems such CRM,ERP,SCM in organizations														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
	<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
	<b>↓ Course Outcomes</b>														
	<b>22MCA355.1</b>	3	3	2	2	1							1	1	1
	<b>22MCA355.2</b>	3	2		1	1								1	1

<b>22MCA355.3</b>	2	3	3		2								1	1
<b>22MCA355.4</b>	2	2	2	3	3								1	1
<b>22MCA355.5</b>	3	2	3	1	2								1	1
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS:</b>														
<b>1.</b>	Waman S Jawadekar : Management Information Systems , TataMcGraw Hill, 2009													
<b>2.</b>	James A O'Brien and George M Marakas : Management Information Systems, 7 <sup>th</sup> Edition, Tata McGraw Hill, 2006													
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	Ralph M Stair and George W Reynolds : Principles of Information Systems, 7 <sup>th</sup> Edition, Cengage Learning, 2010													
<b>2.</b>	Steven Alter: Information Systems - The Foundation of E-Business, 4 <sup>th</sup> Edition, Pearson Education Asia, 2011													
<b>3.</b>	Mahadeo Jaiswal and Monika Mital : Management Information System, 3 <sup>rd</sup> Edition, Oxford University Press													
<b>4.</b>	Effy Oz : Management Information Systems, 5 <sup>th</sup> Edition, Cengage Learning, 2006													
<b>E Books / MOOCs/ NPTEL</b>														
<b>1.</b>	<a href="#">NPTEL course on Management Information Systems</a> , IIT Kharagpur													

## Syllabus of III Semester MCA (Master of Computer Applications)

<b>Time Series Analysis and Prediction</b>			
<b>Course Code:</b>	<b>22MCA356</b>	<b>Course Type</b>	<b>PEC</b>
<b>Teaching Hours/Week (L:T:P: S)</b>	<b>3:0:0:0</b>	<b>Credits</b>	<b>03</b>
<b>Total Teaching Hours</b>	<b>39</b>	<b>CIE + SEE Marks</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b>Prerequisites :</b>			
Mathematical Foundation for Computer Applications			
<b>Course Objectives:</b>			
<b>1.</b>	Understand the fundamental advantage and necessity of forecasting in various situations.		
<b>2.</b>	Derive the properties of ARMA Models		
<b>3.</b>	Choose an appropriate ARIMA model for a given set of data and fit the model using an appropriate package		
<b>4.</b>	Derive the properties of ARIMA and state-space models		
<b>5.</b>	Compute forecasts for a variety of linear methods and models		
<b>UNIT - I</b>			
<b>Introduction :</b> Examples of Time Series, Objectives of Time Series Analysis , Some Simple Time Series Models, Some Zero-Mean Models, Models with Trend and Seasonality, A General Approach to Time Series Modeling, Stationary Models and the Auto-correlation Function, The Sample Auto-correlation Function, A Model for the Lake Huron Data, Estimation and Elimination of Trend and Seasonal Components, Estimation and Elimination of Trend in the Absence of Seasonality, Estimation and Elimination of Both Trend and Seasonality, Testing the Estimated Noise Sequence.  Stationary Processes, Basic Properties, Linear Processes, Introduction to ARMA Processes, Properties of the Sample Mean and Autocorrelation Function, Estimation of $\mu$ , Estimation of $\gamma(\cdot)$ and $\rho(\cdot)$ , Forecasting Stationary Time Series, The Durbin–Levinson.			<b>08 Hours</b>
<b>UNIT - II</b>			
<b>ARMA Model :</b> ARMA(p, q) Processes, The ACF and PACF of an ARMA(p, q) Process, Calculation of the ACVF, The Autocorrelation Function, The Partial Autocorrelation Function, Forecasting ARMA Processes. Spectral Analysis, Spectral Densities, The Periodogram, Time-Invariant Linear Filters, The Spectral Density of an ARMA Process.			<b>08 Hours</b>
<b>UNIT - III</b>			
<b>Modelling and Forecasting with ARMA Processes :</b> Preliminary Estimation, Yule–Walker Estimation, Burg’s Algorithm, The Innovations Algorithm, The Hannan–Rissanen Algorithm, Maximum Likelihood Estimation, Diagnostic Checking, Graph, The Sample ACF of the Residuals, Tests for Randomness of the Residuals, Forecasting, Order Selection, The FPE Criterion, The AICC Criterion. Nonstationary and Seasonal Time Series Models, ARIMA Models for Nonstationary Time Series, Identification Techniques, Unit Roots in Time Series Models.			<b>08 Hours</b>

<b>Unit - IV</b>														
<b>State-Space Models:</b> State-Space Representations, The Basic Structural Model, State-Space Representation of ARIMA Models , The Kalman Recursions, Estimation For State-Space Models, State-Space Models with Missing Observations, The EM Algorithm, Generalized State-Space Models, Parameter-Driven Models, Observation-Driven Models. Forecasting: Introduction, Minimum Mean Square Error Forecasts, computation of Forecasts, The ARIMA forecast as a Weighted Average of Previous Observations, Updating Forecasts, Eventual Forecast Functions.													<b>08 Hours</b>	
<b>Unit - V</b>														
<b>Seasonal Time Series Models :</b> General Concepts, Traditional Methods, Regression Method, Moving Average Method, Seasonal ARIMA Models, Empirical Examples. Exponential smoothing methods: Introduction, First-Order Exponential smoothing, Modeling Time Series Data, Second-Order Exponential Smoothing, Higher-Order Exponential Smoothing, Forecasting, Constant Process, Linear Trend Process, Exponential Smoothing for Seasonal Data, Additive Seasonal Model, Multiplicative Seasonal Model, Exponential Smoothers and Arima Models.													<b>07 Hours</b>	
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	Differentiate between models with trend and Seasonal Components.													
<b>2.</b>	Interpret properties of ARMA models.													
<b>3.</b>	Apply ARIMA model for the data.													
<b>4.</b>	Interpret properties of State-Space Models.													
<b>5.</b>	Implement linear models.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes</b> →	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
↓ <b>Course Outcomes</b>													1	2
<b>22MCA356.1</b>	3	3	3										2	3
<b>22MCA356.2</b>	3	3	3										2	3
<b>22MCA356.3</b>	3	3	3										2	3
<b>23MCA356.4</b>	3	3	3										2	3
<b>22MCA356.5</b>	2	2	2		2								2	3
<b>1: Low 2: Medium 3: High</b>														
<b>TEXT BOOKS :</b>														
<b>1.</b>	Peter J. Brockwell, Richard A. Davis “Introduction to Time Series and Forecasting “, 2 <sup>nd</sup> Edition, Springer Publishers													
<b>2.</b>	William W. S. Wei, “Time Series Analysis: Univariate and Multivariate Methods “, 2 <sup>nd</sup> Edition, 2006, Pearson Addison Wesley													
<b>3.</b>	Douglas C. Montgomery, Cheryl L. Jennings, “Introduction to Time Series Analysis and Forecasting”, 2 <sup>nd</sup> Edition, WILEY Publishers													
<b>REFERENCE BOOKS :</b>														
<b>1.</b>	T M J A Cooray, “Applied Time Series: Analysis and Forecasting”, 2 <sup>nd</sup> Edition, 2016, Narosa Publishers.													
<b>2.</b>	Dr. Avishek Pal, Dr. PKS Prakash, “Practical Time Series Analysis”, 2nd Edition, 2017, PACKT Publishers.													
<b>3.</b>	Robert H. Shumway, David S. Stoffer, “Time Series Analysis and Its Applications: With R Examples”, 2nd Edition, 2015, Springer Publishers.													

<b>4.</b>	Chris Chatfield, “The Analysis of Time Series: An Introduction“, 6 <sup>th</sup> Edition, 2016, CRC Press Publishers.
<b>E Books / MOOCs/ NPTEL</b>	
<b>1.</b>	<a href="https://nptel.ac.in/courses/103106123">https://nptel.ac.in/courses/103106123</a>
<b>2.</b>	<a href="https://onlinecourses.nptel.ac.in/noc21_ch28/preview">https://onlinecourses.nptel.ac.in/noc21_ch28/preview</a>
<b>3.</b>	<a href="https://www.coursera.org/learn/practical-time-series-analysis#syllabus">https://www.coursera.org/learn/practical-time-series-analysis#syllabus</a>

## Syllabus of III Semester MCA (Master of Computer Applications)

<b>Artificial Intelligence and Machine Learning Lab</b>	
<b>Course Code: 22MCA303</b>	<b>Course Type: PCC</b>
<b>Teaching Hours/Week (L:T:P: S): 0:0:4:0</b>	<b>Credits: 02</b>
<b>Total Teaching Hours: 48</b>	<b>CIE + SEE Marks: 50+50</b>
<b>Teaching Department: Master of Computer Applications</b>	
<b><u>Prerequisites :</u></b>	
Students must have an understanding of statistics, probability, calculus, linear algebra and knowledge of programming.	
<b>Course Objectives:</b>	
<b>1.</b>	To understand and implement data preprocessing techniques.
<b>2.</b>	To understand and implement Supervised and Unsupervised Machine Learning Algorithms.
<b>3.</b>	To understand and implement Deep Learning Algorithms.
<b>4.</b>	To understand and implement performance evaluation techniques for the model built.
<b>List of Experiments</b>	
<b>1.</b>	Write basic programs (Conditional, branching, looping, Methods and modules, classes and objects, numpy, pandas, sklearn) using Python
<b>2.</b>	Write Programs to demonstrate supervised and unsupervised learning
<b>3.</b>	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
<b>4.</b>	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
<b>5.</b>	Write a program to implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
<b>6.</b>	Assuming a set of documents that need to be classified, use the Naive Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
<b>7.</b>	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
<b>8.</b>	Apply k-Means algorithm to cluster a set of data stored in a .CSV file. You can add Java/Python ML library classes/API in the program.
<b>9.</b>	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
<b>10.</b>	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
<b>Course Outcomes:</b> At the end of the course student will be able to	
<b>1.</b>	Apply data preprocessing techniques, supervised and unsupervised machine learning algorithms.
<b>2.</b>	Apply deep learning algorithms and implement performance evaluation techniques.
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>	

<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO1</b>	<b>PSO2</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA303.1</b>	3	1		3	3					2	2	3	3	3
<b>22MCA303.2</b>	3	1		3	3					2	2	3	3	3

**1: Low 2: Medium 3: High**

**REFERENCE BOOKS:**

<b>1.</b>	Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015
<b>2.</b>	Tom M Mitchell, “Machine Learning”, 1 <sup>st</sup> Edition, McGraw Hill Education, 2017.
<b>3.</b>	Elaine Rich, Kevin K and S B Nair, “Artificial Intelligence”, 3 <sup>rd</sup> Edition, McGraw Hill Education, 2017
<b>4.</b>	Introduction to Machine Learning with Python - A Guide for Data Scientists (Muller Andreas)
<b>5.</b>	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2 <sup>nd</sup> Edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016

## Syllabus of III Semester MCA (Master of Computer Applications)

<b>Advanced Web Technologies and Applications Lab</b>			
<b>Course Code:</b>	<b>22MCA304</b>	<b>Course Type:</b>	<b>PCC</b>
<b>Teaching Hours/Week (L: T: P: S):</b>	<b>0:0:4:0</b>	<b>Credits:</b>	<b>02</b>
<b>Total Teaching Hours:</b>	<b>48</b>	<b>CIE + SEE Marks:</b>	<b>50+50</b>
<b>Teaching Department: Master of Computer Applications</b>			
<b><u>Prerequisites</u></b>			
Students must have some basic knowledge of computer system hardware and software.			
<b>Course Objectives:</b>			
<b>1.</b>	To develop an ability to design and implement static and dynamic website		
<b>2.</b>	Use appropriate client-side or Server-side applications		
<b>3.</b>	Develop basic programming skills using Javascript and JQuery		
<b>4.</b>	Learn the language of web : HTML,CSS, Bootstrap, PHP, JSON		
<b>List of Experiments</b>			
<b>1.</b>	Develop and demonstrate XHTML document that illustrate the use of images, tables, links, formatting tools, lists, forms, frames and style sheets		
<b>2.</b>	Develop and demonstrate HTML5 document that illustrate the use of new semantics elements, Migration, canvas, svg, input types, new form elements and attribute, google map, media(audio, video).		
<b>3.</b>	Develop and demonstrate XHTML document that includes javascript for the following <ol style="list-style-type: none"> <li>a. I/O statements</li> <li>b. Control statements</li> <li>c. Arrays</li> <li>d. Objects</li> <li>e. Functions</li> <li>f. Constructors</li> <li>g. Event Handling through...                             <ul style="list-style-type: none"> <li>Body elements</li> <li>Button elements</li> <li>Text box and password elements</li> </ul> </li> <li>h. Element accessing, positioning and moving</li> <li>i. Stacking and slow movements to elements</li> <li>j. Dragging and dropping the elements</li> <li>k. Element visibility</li> </ol>		
<b>4.</b>	Develop and Demonstrate XHTML document that includes javascript for Pattern Matching Using Regular Expressions		
<b>5.</b>	Design a XML document to store information and display the XML document.		
<b>6.</b>	Execute simple programs using PHP		
<b>7.</b>	Create a Web Application using PHP		
<b>8.</b>	Database programs using PHP		
<b>9.</b>	Simple programs using JQuery, JSON and AJAX		
<b>10.</b>	AJAX applications using various GUI components		
<b>11.</b>	Implementation of "Shopping cart" application using AJAX		
<b>12.</b>	AJAX application to keep track of user data and retrieve the session data		
<b>13.</b>	AJAX application to verify client side and server side data		



<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Design and implement static and dynamic websites with good aesthetic sense of designing and latest technical know-how's														
2.	Understand, analyze and apply the role of languages like HTML, Bootstrap, CSS, XML, JavaScript, PHP and protocols in the workings of the web and web applications														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes</b> →		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
↓ <b>Course Outcomes</b>														1	2
22MCA304-1.1		3	3	3	3	2		3	3	2	3	3		3	
22MCA304-1.2		3	3	2	2	3		3	3	3	3	2		3	
<b>1: Low 2: Medium 3: High</b>															
<b>REFERENCE BOOKS:</b>															
1.	Robert W. Sebesta: Programming with World Wide Web, 4 <sup>th</sup> Edition, Pearson Education, 2008														
2.	M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web, How to Program, 5 <sup>th</sup> Edition, Pearson Education, 2008														
<b>E Resources</b>															
1.	<a href="https://onlinecourses.swayam2.ac.in/nou22_cs03/preview">https://onlinecourses.swayam2.ac.in/nou22_cs03/preview</a>														
2.	<a href="https://onlinecourses.swayam2.ac.in/aic20_sp32/preview">https://onlinecourses.swayam2.ac.in/aic20_sp32/preview</a>														

<b>Mini Project</b>															
<b>Course Code: 22MCA305</b>					<b>Course Type: PCC</b>										
<b>Teaching Hours/Week (L:T:P: S*): 0:0:4:9</b>					<b>Credits: 04</b>										
* Self Learning															
<b>Total Teaching Hours: 48</b>					<b>CIE + SEE Marks: 50+50</b>										
<b>Teaching Department: Master of Computer Applications</b>															
<b>Course Objectives:</b>															
1.	To provide the student the experience of developing quality software solutions by involving in all the stages of the software development life cycle.														
2.	To learn to work in a team and present the work effectively.														
<p>The objective of the MCA mini project work is to provide the student with the experience of developing quality software solutions by involving in all the stages of the software development life cycle like requirements engineering, systems analysis, systems design, software development, testing strategies and documentation with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices.</p> <p>Mini project can be assigned to an individual student or to a group having not more than 3 students. The mini project has to be carried out during the third semester of the MCA program. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of the work done in every stage of the software development life cycle. A student has to submit a project report at the end of the semester. Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department</p>															
<b>Course Outcomes:</b> At the end of the course student will be able to															
1.	Understand and gain the knowledge of the principles of software engineering practices and develop a correct software for a real world problem.														
2.	Work in a team, contribute to the project and present the work effectively.														
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>															
<b>Program Outcomes→</b>		1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>														1	2
<b>22MCA305.1</b>		3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>22MCA305.2</b>		3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>1: Low 2: Medium 3: High</b>															
<b>REFERENCE BOOKS :</b>															
1.	Roger S. Pressman, —Software Engineering – A Practitioner’s Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010														
2.	Ali Bahrami, “Object oriented systems development using the unified modelling language”, 1st Edition, McGraw-Hill, 1998														
3.	<b>John Sonmez, “Soft Skills: The software developer's life manual”, 29 December 2014</b>														
4.	<b>Ian Sommerville, —Software Engineering, 9th Edition, Pearson Education Asia, 2011</b>														

## Syllabus of IV Semester MCA (Master of Computer Applications)

<b>Internship</b>														
<b>Course Code: 22MCA401</b>							<b>Course Type: PCC</b>							
<b>Teaching Hours/Week (L:T:P: S): 0:0:35:0</b>							<b>Credits: 03</b>							
<b>Total Teaching Hours: 140/4 Weeks</b>							<b>CIE + SEE Marks: 50+50</b>							
<b>Teaching Department: Master of Computer Applications</b>														
<b>Course Objectives:</b>														
<b>1.</b>	To learn to integrate theory and practice and develop work habits and attitudes necessary for job success													
<b>2.</b>	To develop communication, interpersonal and other critical skills in the job interview process and build a record of work experience.													
<p>All the students admitted to the MCA course shall have to undergo mandatory internship of 4 weeks during the vacation of II/III semester. A University examination shall be conducted during IV semester and the prescribed credit shall be included in IV semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.</p>														
<b>Course Outcomes:</b> At the end of the course student will be able to														
<b>1.</b>	Integrate theory and practice and develop work habits and attitudes necessary for job success													
<b>2.</b>	Develop communication, interpersonal and other critical skills in the job interview process and build a record of work experience.													
<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA401.1</b>	3	2	3	2	3	2	2	2	2	2	2	3	3	2
<b>22MCA401.2</b>	3	3	2	3	3	3	3	3	3	3	2	3	3	2
<b>1: Low 2: Medium 3: High</b>														

## Syllabus of IV Semester MCA (Master of Computer Applications)

<b>Major Project</b>	
<b>Course Code:</b> 22MCA402	<b>Course Type:</b> PCC
<b>Teaching Hours/Week (L:T:P: S):</b> 0:0:35:0	<b>Credits:</b> 18
<b>Total Teaching Hours:</b> 560/4 months	<b>CIE + SEE Marks:</b> 100+200
<b>Teaching Department: Master of Computer Applications</b>	
<b>Course Objectives:</b>	
<b>1.</b>	to learn to develop quality and reliable software solution individually by involving in every phase of the software development life cycle, prepare a project report, a technical paper and present it effectively.
<b>2.</b>	To learn to work in the industry as a professional.
<p>The Master of Computer Applications (MCA) programme prepares the students to take up positions as Systems Analysts, Systems Designers, Software Engineers, Programmers and Project Managers in any field related to information technology. The MCA students have been imparted with comprehensive knowledge and skills in core areas of computer science courses with equal emphasis on the theory and practical. The students pursuing MCA at NMAMIT, Nitte are encouraged to spend at least six months working on a project preferably in a software industry or any research organization.</p> <p>The objective of the MCA project work is to develop quality software solutions. During the development of the project, a student should involve in all the stages of the software development life cycle like requirements engineering, systems analysis, systems design, software development, testing strategies and documentation with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, so as to participate and manage large software engineering projects in future.</p> <p><b>The project work should be carried out individually.</b> The project work needs to be carried out with due care and should be carried out with all seriousness by the students. <b>Topics selected should be complex and large enough to justify as a MCA project and 6 months of work.</b> The project should be genuine and original and should not be copied from anywhere else. If found copied, the project report will be rejected and necessary action will be taken. <b>The project work should compulsorily involve software development.</b></p> <p><b>Before finalizing a project, a student is required to discuss the details of the project with his/her internal guide and proceed only on approval from the internal guide.</b></p> <p><b>It is also mandatory for students to prepare a technical paper on the project and after the paper being scrutinized by their respective internal guides, publish the paper in a scientific journal.</b></p>	
<b>Course Outcomes:</b> At the end of the course student will be able to	
<b>1.</b>	Work in the industry as a professional and develop quality and reliable software solution effectively by applying software engineering concepts.
<b>2.</b>	Prepare a project report and give effective presentation

<b>Course Outcomes Mapping with Program Outcomes &amp; Program Specific Outcomes</b>														
<b>Program Outcomes→</b>	1	2	3	4	5	6	7	8	9	10	11	12	<b>PSO</b>	<b>PSO</b>
<b>↓ Course Outcomes</b>													1	2
<b>22MCA402.1</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>22MCA402.2</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>1: Low 2: Medium 3: High</b>														
<b>REFERENCE BOOKS:</b>														
<b>1.</b>	Roger S. Pressman, —Software Engineering – A Practitioner’s Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010													
<b>2.</b>	Ali Bahrami, “Object oriented systems development using the unified modelling language”, 1 <sup>st</sup> Edition, McGraw-Hill, 1998													
<b>3.</b>	John Sonmez , “Soft Skills: The software developer's life manual”, 29 December 2014													
<b>4.</b>	Ian Sommerville, —Software Engineering, 9 <sup>th</sup> Edition, Pearson Education Asia, 2011													