AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE | Accredited by NAAC | Affiliated to JNTUA)

Gudur, Nellore Dist - 524101, A.P (India)

OUTCOME BASED EDUCATION

WITH

CHOICE BASED CREDIT SYSTEM

MASTER OF COMPUTER APPLICATIONS

ACADEMIC REGULATIONS

UNDER AUTONOMOUS STATUS

MCA Regular Three Year PG Programme

(for the batches admitted from the academic year 2018 - 2019)

ACADEMIC REGULATIONS (R18) FOR MCA REGULAR STUDENTS

WITH EFFECT FROM ACADEMIC YEAR 2018-2019

1.0	Post- Graduate Degree Programme in Computer Applications
1.1	These academic rules and regulations are applicable to the students admitted from the academic year 2018-19 onwards into 3 years (6 Semesters) Master of Computer Applications (MCA) in Computer Applications under Choice Based Credit System (CBCS) at its autonomous institution with effect from the academic year 2018-19.
2.0	**Eligibility for admission**
2.1	Admission to the post graduate programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test ICET conducted by the Andhra Pradesh State Government as per the norms of Andhra Pradesh State Council of Higher Education (APSCHE)
2.2	The medium of instructions for the entire post graduate programme in Computer Applications will be English only.
3.0	**MCA Programme Pattern**
3.1	A student after securing admission shall pursue the post graduate programme in MCA in a minimum period of three academic years (6 semesters), and a maximum period of six academic years (12 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit the MCA course. Each semester is structured to around 24 credits, totaling to 132 credits for the entire MCA programme. Each student shall secure 132 credits required for the completion of the post graduate programme and award of the MCA degree.
3.2	A student eligible to appear for the end examination in a course, but absent or has failed in the end examination may appear for that course at the next supplementary examination when offered
3.3	When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfillment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.
3.4	UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.
3.5	**Semester scheme** Post graduate programme is of 3 academic years (6 semesters) with the academic year being divided into two semesters of 16 weeks (around 90 instructional days) each and semester having – Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). Choice based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and curriculum / course structure as suggested by AICTE are followed.

3.6	**Credit courses** All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: Tutorial periods: Practical periods: Credits) structure based on the following general pattern. • One credit for one hour/ week/ semester for theory/ lecture (L) courses. • One credit for two hours/ week/ semester for laboratory/ practical (P) courses or Tutorials (T).
3.7	Communication Skills Practice, Soft Skills Practice, Quantitative Aptitude and Technical Aptitude are also mandatory courses. These courses are also will not carry any credits.
3.8	**Subject Course Classification** All subjects/ courses offered for the under graduate programme in Computer Applications (MCA programme) are broadly classified as follows. The ASCET has followed almost all the guidelines issued by AICTE/UGC.
4.0	**Attendance requirements:**
4.1	A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (excluding attendance in mandatory courses like Communication Skills Practice, Soft Skills Practice, Quantitative Aptitude and Technical Aptitude) for that semester.
4.2	Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.
4.3	A stipulated fee shall be payable towards condonation for shortage of attendance to the institute as decided by the College Academic Committee.
4.4	Shortage of attendance below 65% in aggregate shall in no case be condoned.
4.5	Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester. They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the same set of elective subjects offered under that category.
4.6	A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.
5.0	**Academic requirements** The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.4.

5.1	A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 40% of marks (i.e., 24) in the end semester examination and a minimum of 50% of marks (i.e., 50) in the sum total of the internal evaluation and end examination taken together.
5.2	A student shall register and put up minimum attendance in all 132 credits and earn all the 132 credits. Marks obtained in all 132 credits shall be considered for the calculation of aggregate percentage of marks obtained
5.7	Students who fail to earn 132 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in MCA Course and their admission shall stand cancelled
6.0	**Distribution and Weightage of marks**
6.1	The performance of a student in each semester shall be evaluated through internal evaluation and /or an external evaluation conducted semester wise.
6.2	The performance of a student in every theory course shall be evaluated for total of 100 marks each, of which the relative weightage for Continuous Internal Evaluation and Semester End Examination shall be 40 marks and 60 marks respectively.
6.3	The performance of a student in every practical course shall be evaluated for total of 75 marks each, of which the relative weightage for Continuous Internal Evaluation and Semester End Examination shall be 25 marks and 50 marks respectively.
6.4	**Internal Evaluation for Theory Course:** The total internal weightage for theory courses is 40 marks with the following distribution. ➢ 30 marks for Mid-Term Examination ➢ 10 marks for Assignment Test While the first mid-term examination shall be conducted on the 50% of the syllabus (Unit-I, Unit-II, & 50% of Unit-III), the second mid-term examination shall be conducted on the remaining 50% of the syllabus (50 % of Unit III, Unit-IV & Unit-V). 10 marks are allocated for assignment test (as specified by the subject teacher concerned). The first assignment should be conducted after completion of Unit-I for 5 marks and the second assignment should be conducted after completion of Unit-IV for 5 marks. The final Assignment Test marks will be the addition of these two. Two midterm examinations each for **30 marks** with the duration of 90 minutes each will be conducted for every theory course in a semester. The midterm examination marks shall be awarded giving a weightage of 80% in the midterm examination in which the student scores better performance and 20% in the remaining midterm examination. The final mid-term marks obtain by the addition of these two (80% + 20%). **Example**: If a student scores 33 marks and 34 marks in the first and second mid-term examinations respectively, then Weighted Average Marks = 34 x 0.8 + 33 x 0.2 = 33.8, rounded to 34 Marks. **Note**: The marks of any fraction shall be rounded off to the next higher mark.

6.5	**Pattern of the midterm examination question paper is as follows:** ➢ A total of three questions ➢ Question paper contains six questions are to be designed taking three questions from each unit (Unit Wise - Either or type) of the three units. (3X10=30 Marks) **Pattern of the Assignment Test is as follows:** ➢ Five assignment questions are given in advance, out of which two questions given by the concerned teacher has to be answered during the assignment test ➢ Sum of Assignment Tests marks is considered. **Note:** A student who is absent for any Mid-Term Examination/ Assignment Test, for any reason whatsoever, shall be deemed to have scored zero marks in that Mid-Term Examination/ Assignment Test and no make-up test shall be conducted.
6.6	**Internal Evaluation for Practical Course:** For practical subjects there shall be a Continuous Internal Evaluation during the semester for 25 internal marks. Out of the 25 marks for internal evaluation, day-today assessment in the laboratory shall be evaluated for 10 marks and internal practical examination shall be evaluated for 15 marks conducted by the laboratory teacher concerned.
6.7	**Internal Evaluation for Seminar:** There shall be a Seminar presentation in V Semester. A Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the department, seminar supervisor and a senior faculty member. Each Seminar shall be evaluated for 50 marks. Seminar component-I for 25 marks and component-II for 25 marks making total 50 marks. (**Distribution of marks for 25:** 5 marks for report, 5 marks for subject content, 10 marks for presentation and 5 marks for queries).
6.8	For CRT courses like Communication Skills Practice, Soft Skills Practice, Quantitative Aptitude and Technical Aptitude, a student has to secure 40 marks out of 100 marks (i.e 40% of the marks allotted) in the continuous internal evaluation for passing the subject/course. For **CRT** courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA
6.9	No marks or letter grade shall be allotted for all mandatory/non-credit courses.
6.10	**External Evaluation for Theory Course - Semester End Examination:** The Semester End Examination in each theory subject shall be conducted for 3 hours duration at the end of the semester for 60 marks. **Pattern of the Semester End Examination question paper is as follows:**

	➢ Question Paper contains ten questions are to be designed taking two questions from each unit (Unit Wise - Either or type) of the total five units. (5X12=60 Marks) A student has to secure not less than a minimum of 40% of marks (24 marks) exclusively at the Semester End Examinations in each of the theory subjects in which the candidate had appeared. However, the candidate shall have to secure a minimum of 50% of marks (50 marks) in both external and internal components put together to become eligible for passing in the subject.
6.11	**External Evaluation for Practical Course** Out of 50 marks **35** marks are allocated for experiment (procedure for conducting the experiment carries 15 marks & readings, calculation and result-20) and **10** marks for viva-voce examination with **5** marks for the record. Each Semester External Lab Examination shall be evaluated by an Internal Examiner along with an External Examiner appointed by the Principal. A candidate shall be declared to have passed in individual lab course if he secures a minimum of 50% aggregate marks (38 marks) (Internal & Semester External Examination marks put together), subject to a minimum of 50% marks (25 marks) in the semester external examination.
6.12	**Project Work :** Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ concerned department. ➢ **Registration of Project work**: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of I, II, III, IV & V Semesters) ➢ An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor/ Guide and one Internal senior expert shall monitor the progress of the project work. ➢ The work on the project work shall be initiated in the VI semester. The candidate can submit Project work dissertation with the approval of I.D.C. after 18 weeks from the date of registration at the earliest from the date of registration for the project work. • The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report. • Three copies of the Dissertation certified in the prescribed form by the supervisor and HOD shall be submitted to the HOD. • The semester end examination for project work done during VI Semester, shall be conducted by a Project Review Committee (PRC). The evaluation of project work shall be conducted at the end of the VI Semester. • The PRC comprises of an External examiner appointed by the Principal, Head of the Department and Project Guide/Supervisor to adjudicate the dissertation. The PRC shall jointly evaluate candidates work and award grades as given below

S.No	Description	Grade	Grade Point (GP) Assigned
1	Very Good	Grade A	10
2	Good	Grade B	9
3	Satisfactory	Grade C	8
4	Not satisfactory	Grade D	0

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the dissertation.

6.13 **Re-Registration For Improvement of Internal Evaluation Marks:**

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

- The candidate should have completed the course work and obtained examinations results for I, II & III semesters.
- He should have passed all the subjects for which the internal evaluation marks secured are more than 50%.
- Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one more chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.
- The candidate has to re-register for the subjects so chosen and fulfill all the academic requirements.
- For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of **'The Principal, Audisankara College of Engineering & Technology' payable at Gudur** along with the requisition through the Controller of the Examinations of the college.
- In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

7.0 **SEMESTER – WISE DISTRIBUTION OF CREDITS**

Semester	Theory	Practicals	Credits
MCA I Semester	5	2	24
MCA II Semester	5	2	24
MCA III Semester	5	2	24
MCA IV Semester	5	2	24
MCA V Semester	5	2 + Seminar	26
MCA VI Semester	0	Project Work	10
		Total	132

8.0 GRADING PROCEDURE

Grades will be awarded to indicate the performance of students in each theory subject, laboratory / practicals, Seminar and project Work Phase. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 6 above, a corresponding letter grade shall be given.

8.1 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

Marks Range	Letter Grade	Grade Points
91-100	S (Superior)	10
81-90	A (Excellent)	9
70-80	B (Very Good)	8
60-69	C (Good)	7
55-59	D (Average)	6
50-54	E (Pass)	5
<50	F (FAIL)	0
Ab (Absent)	Ab	0

8.2 A student who has obtained an 'F' grade in any subject shall be deemed to have 'failed' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier

8.3 To a student who has not appeared for an examination in any subject, 'Ab' grade will be allocated in that subject, and he is deemed to have 'failed'. A student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

8.4 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

8.5 A student earns grade point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit points (CP) = grade point (GP) x credits …. For a course

8.6 A student passes the subject/ course only when GP ≥5 ('E' grade or above)

8.7

- A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.
- For Mandatory courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA .

8.8 Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \sum_{i=1}^{n}(Ci \times Gi) / \sum_{i=1}^{n} Ci$$

Where, Ci is the number of credits of the i^{th} subject, Gi is the grade point scored by the student in the i^{th} course and n is the no. of subjects.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \sum_{i=1}^{n}(Ci \times Si) / \sum_{i=1}^{n} Ci$$

Where 'Si' is the SGPA of the i^{th} semester, Ci is the total number of credits in that semester and n is the no. of semesters.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters as mentioned in the above table

9.0 Award of Class

9.1 After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of MCA Degree he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First class with Distinction	>= 8
First class	>= 7 and < 8
Second class	>= 5 and < 7

10.0 Transitory regulations

10.1 For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R16 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R18 Regulations and he is required to complete the study of MCA programme with in the stipulated period of eight academic years from the date of first admission in I year.

	2. A student who has been detained in any semester of II, III and IV years of R16 regulations for want of attendance, shall be permitted to join the corresponding semester of R18 regulations and is required to complete the study of MCA within the stipulated period of eight academic years from the date of first admission in I Year. The R18 Academic Regulations under which a student has been readmitted shall be see rule 10.3 for further Transitory Regulations.
10.2	For students detained due to shortage of credits: A student of R16 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R18 Regulations only after acquiring the required credits as per the corresponding regulations of his/her first admission. The student is required to complete the study of MCA. within the stipulated period of eight academic years from the year of first admission. The R18 Academic Regulations are applicable to a student from the year of readmission onwards. See rule 10.3 for further Transitory Regulations.
10.3	For readmitted students in R18 Regulations: 1. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations. 2. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R18 Regulations. 3. If a student readmitted to R18 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R18 Regulations will be substituted by another subject to be suggested by the College standing committee. Note: If a student readmitted to R18 Regulations, has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R18 Regulations, the department HOD concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.
11.0	**Supplementary Examinations:** Apart from the regular End Examinations the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day.
12.0	**Student Transfers** Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.
13.0	**With–Holding of Results** If the candidate has any dues not paid to the institute or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld and he/she will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

12.0	**Conduct and Discipline** ➢ Students shall conduct themselves within and outside the premises of the Institute in a descent and dignified manner befitting the students of Audisankara College of Engineering & Technology. ➢ As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offence and is totally banned. Any form of ragging will be severely dealt with The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging. (i) Lack of courtesy and decorum; indecent behavior anywhere within or outside the college campus. (ii) Damage of college property or distribution of alcoholic drinks or any kind of narcotics to fellow students / citizens. ➢ Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs. ➢ Mutilation or unauthorized possession of library books. ➢ Noisy and unruly behavior, disturbing studies of fellow students. ➢ Hacking in computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber crime etc. ➢ Usage of camera /cell phones in the campus. ➢ Plagiarism of any nature. ➢ Any other act of gross indiscipline as decided by the college academic council from time to time. ➢ Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarring from examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances. ➢ For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief Warden, the concern Head of the Department and the Principal respectively, shall have the authority to reprimand or impose fine. ➢ Cases of adoption of unfair means and/ or any malpractice in an examination shall be reported to the principal for taking appropriate corrective action. ➢ All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the Academic council of the college. ➢ The Institute Level Standing Disciplinary Action Committee constituted by the academic council shall be the authority to investigate the details of the offence, and

	recommend disciplinary action based on the nature and extent of the offence committed. ➢ The Principal shall deal with any problem, which is not covered under these rules and regulations. ➢ **"Grievance and Redressal Committee" (General)** constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. ➢ All the students must abide by the code and conduct rules prescribed by the college from time to time.
13.0	**General** ➢ s/he represents "she" and "he" both ➢ Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers' also. ➢ The academic regulations should be read as a whole for the purpose of any interpretation. ➢ In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council will be final. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institute.

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ASCET AUDISANKARA Originating the Bright Careers

Academic Regulations (R18) for

MCA (Lateral Entry)

(Effective for the students admitted into II year from the Academic Year 2019-20 onwards)

NOTE: All the regulations adopted for MCA (Regular-Full Time) programme are applicable to lateral entry students in addition to the following:

1. Award of MCA Degree

A student will be declared eligible for the award of the MCA. Degree if he/she fulfils the following academic regulations:

i. Pursues a course of study for not less than three academic years and in not more than six academic years.

ii. Registers for 84 credits and secure all 84 credits.

iii. Students, who fail to fulfill all the academic requirements for the award of the degree within four academic years from the year of their admission, shall forfeit their seat in MCA Course and their admission stands cancelled.

2. Minimum Academic Requirements:

2.1 A student shall register and put up minimum attendance in all 84 credits and earn all the 84 credits. Marks obtained in all 84 credits shall be considered for the calculation of aggregate percentage of marks obtained.

2.2 Students who fail to earn 84 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in MCA Course and their admission shall stand cancelled.

3. Course Pattern:

3.1 The entire course of study is for two academic years. All years shall be on semester pattern.

3.2 A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.

3.3 When a student is detained due to shortage of attendance he may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

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RULES FOR
DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers, blue tooth or any other form of material concerned with or related to the course of the examination (theory or practical) in which he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the examination hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination	The candidate who has impersonated shall be expelled from examination hall. The Candidate is also debarred for four consecutive semesters from class work and all end examinations. The continuation of the

		course by the candidate is subject to the academic regulations in connection with for feature of seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that Semester/year. The candidate is also debarred for four consecutive Semesters from class work and all Semester end examinations if his involvement is established. Otherwise the candidate is debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walkout or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that Semester.

	of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	If candidate physically assaults the invigilator or/officer in charge of the examination, then the candidate is also barred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the examination hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the Courses of that

		Semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that Semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that Semester examinations depending on the recommendation of the committee.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Principal for further action to award suitable punishment.	

Note:

i. All malpractices cases are to be handled by the Chief Controller with a committee consist of Controller of Examinations, HOD concerned and subject expert.
ii. Whenever the performance of a student is cancelled in any course/ courses due to Malpractice, he has to register for the End Examination in those course/courses consequently and has to fulfill all the norms required for award of Degree.

MCA I Semester

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18MC101	Problem Solving and Programming	4	0	0	40	60	100	4
2	18MC102	Computer Organization	4	0	0	40	60	100	4
3	18MC103	Discrete Structures and Graph Theory	4	0	0	40	60	100	4
4	18MC104	Probability and Statistics	4	0	0	40	60	100	4
5	18MC105	Accounting and Financial Management	4	0	0	40	60	100	4
6	18MC106	C Programming Lab	0	0	4	25	50	75	2
7	18MC107	Computer Applications Lab	0	0	4	25	50	75	2
		Total	**20**	**0**	**8**	**250**	**400**	**650**	**24**

MCA II Semester

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18MC201	Operating Systems	4	0	0	40	60	100	4
2	18MC202	OOPs through C++	4	0	0	40	60	100	4
3	18MC203	Data Structures	4	0	0	40	60	100	4
4	18MC204	Principles of Programming Languages	4	0	0	40	60	100	4
5	18MC205	Organization Structures and Personnel Management	4	0	0	40	60	100	4
6	18MC206	C++ Programming Lab	0	0	4	25	50	75	2
7	18MC207	Data Structures Lab	0	0	4	25	50	75	2
8	18AS201	Soft Skills Practice	0	0	0	0	0	0	0
		Total	**20**	**0**	**8**	**250**	**400**	**650**	**24**

MCA III Semester

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18MC301	Database Management Systems	4	0	0	40	60	100	4
2	18MC302	Java Programming	4	0	0	40	60	100	4
3	18MC303	Design and Analysis of Algorithms	4	0	0	40	60	100	4
4	18MC304	Software Engineering	4	0	0	40	60	100	4
5	18MC305	Data Communications and Computer Networks	4	0	0	40	60	100	4
6	18MC306	Database Management Systems Lab	0	0	4	25	50	75	2
7	18MC307	JAVA Programming Lab	0	0	4	25	50	75	2
Non-Credit Course									
8	18AS301	Communication Skills Practice	0	0	2	0	0	0	0
		Total	**20**	**0**	**10**	**250**	**400**	**650**	**24**

MCA IV Semester

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18MC401	Object Oriented Analysis and Design	4	0	0	40	60	100	4
2	18MC402	Advanced JAVA Programming	4	0	0	40	60	100	4
3	18MC403	Data Warehousing and Data Mining	4	0	0	40	60	100	4
4	**Elective-I**								
	18MC404	Cyber Security	4	0	0	40	60	100	4
	18MC405	Advanced Databases							
	18MC406	Information Retrieval Systems							
5	**Elective-II**								
	18MC407	UNIX and Shell Programming	4	0	0	40	60	100	4
	18MC408	Artificial Intelligence							
	18MC409	Wireless Networks							
6	18MC410	Advanced JAVA Programming Lab	0	0	4	25	50	75	2
7	18MC411	Data Mining and OOAD Lab	0	0	4	25	50	75	2
Non-Credit Course									
8	18AS401	Quantitative Aptitude	2	0	0	0	0	0	0
Total			**22**	**0**	**8**	**250**	**400**	**650**	**24**

MCA V Semester

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18MC501	Android Application Development	4	0	0	40	60	100	4
2	18MC502	Big Data Analytics	4	0	0	40	60	100	4
3	18MC503	Software Testing	4	0	0	40	60	100	4
4	**Elective-III**								
	18MC504	Software Project Management	4	0	0	40	60	100	4
	18MC505	Machine Learning							
	18MC506	Cloud Computing							
5	**Elective-IV**								
	18MC507	Natural Language Processing	4	0	0	40	60	100	4
	18MC508	Software Quality Assurance							
	18MC509	Middleware Technologies							
6	18MC510	Android Application Development Lab	0	0	4	25	50	75	2
7	18MC511	Big Data Lab	0	0	4	25	50	75	2
8	18MC212	Seminar	0	0	4	50	-	50	2
Non-Credit Course									
9	18AS501	Technical Aptitude	2	0	0	0	0	0	0
Total			**22**	**0**	**12**	**300**	**400**	**700**	**26**

MCA VI Semester

S.No	Course Code	Course Title	Hours per Week			Marks			Credits
			L	T	P	IM	EM	T	
1	18MC601	Project Work	0	0	20	Grade			10
Total			**0**	**0**	**20**	**Grade**			**10**

AUDISANKARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
Gudur, Nellore Dist - 524101, A.P (India)

PROBLEM SOLVING AND PROGRAMMING

MCA I Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC101	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to

1. Develop programming skills using the fundamentals and basics of C language.
2. Impart the knowledge about pointers which is the backbone of effective memory handling
3. Study the advantages of user defined data type which provides flexibility for application development
4. Teach the basics of preprocessors available with C compiler

UNIT-I	**Introduction to Computers and Programming**	**Classes:12**

Introduction to Computers and Programming: Definition, Block diagram along with computer components, Characteristics & classification of computers, Types of programming languages. **Problem solving:** Top-down design, implementation of algorithms, Flowcharts.
Introduction to C Language – History of C, Features of C, General form of a C Program, Character set in C, C-Tokens, Data types, Expression Evaluation, Operators and Expressions, Type Conversions, Formatted Input and Output

UNIT-II	**Control Statements and Functions**	**Classes:12**

Decision Statements: If, if-else, Nested if and switch Statements, Loop Control Statements - while, for, do-while Statements, Nested Loops, and Other Related Statements - break, continue, go to.

UNIT-III	**Functions & Arrays**	**Classes:12**

Functions: Function prototype, Definition and accessing, Passing arguments to a function, Library Functions, Scope of a function, Storage Classes - Auto, Register, Static, Extern, Scope rules, Type qualifiers, Recursion - Recursive functions, C Preprocessor, Header files.
Arrays: Introduction, 1-Dimensional, 2-dimensional array, Declaration, Initialization and Accessing, Multidimensional Arrays.

UNIT-IV	**Pointers and Strings**	**Classes:12**

Pointers: Introduction, Features of Pointers, Pointer Declaration, Arithmetic Operations with Pointers, Pointers and Arrays, Array of Pointers, Pointers to Pointers, Void Pointers, Memory Allocation Functions, Pointer to Functions, Command- Line Arguments.
Strings: String Basics, String Handling Functions.

UNIT- V	**Structure and Union**	**Classes:12**

Structure and Union: Introduction, Features of structure, Declaration and Initialization of Structure, Structure within Structure, Array of Structures, Pointer to Structure, self referential Structures, Structures and Functions, type def and Enumerated data types, Unions, Bit fields.
Files: Introduction, Streams and file types, File operations.

Text Books:

1 Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Principles, Eighth Edition, John Wiley.
2 Andrew S Tanenbaum, Modern Operating Systems, Second Edition, PHI.

Reference Books:

1 William Stallings, Operating Systems: Internals and Design Principles,Sixth Edition– 2009, Pearson Education.
2 B.L.Stuart, Cengage learning, Principles of Operating Systems, India Edition.
3 A.S.Godbole, Operating Systems, Second Edition, TMH.
4 R.Elmasri, A.G.Carrick and D.Levine, Operating Systems, Mc Graw Hill.
5 Sibsankar Haldar, Alex A, Aravind, Operating Systems, Pearson Education India.

Web References:

1. https://nptel.ac.in/syllabus/syllabus_pdf/106105171.pdf
2. http://nielit.gov.in/chuchuyimlang/sites/default/files/Chuchuyimlang/M4-R4%20Programming%20and%20Problem%20Solving%20through%20C.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Design algorithmic solution to problems.
2. Acquire knowledge about the basic concept of writing a program.
3. Understand the role of constants, variables, identifiers, operators, and type conversions of C Language.
4. Design programs Decision making and utilizing repetition.
5. Design modular programs using functions.
6. Concept of Array and pointers dealing with memory management.
7. Structures and unions through which derived data types can be formed.

COMPUTER ORGANIZATION

MCA I Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC102	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Study the basic organization and architecture of digital computers (CPU, memory, I/O, software).
2. Understand the digital logic and microprogramming.
3. It leads to better understanding and utilization of digital computers
4. Can be useful in the design and application of computer systems or as foundation for more advanced computer-related studies.

UNIT-I	Digital Fundamentals	Classes:12

Digital Fundamentals: Computer types, Functional units, Number Systems and Conversions– Boolean Algebra and Simplification– Minimization of Boolean Functions– Karnaugh Map, Logic gates–NAND–NOR Implementation.

UNIT-II	Combinational, Sequential Circuits and Basic CPU Organization	Classes:12

Combinational and Sequential Circuits: Adders, Subtracters, Encoder, Decoder, Multiplexer, Flip-Flops.

Basic CPU Organization: Introduction to CPU, Addressing modes, Instruction formats-Zero, one, two, and three address instructions, Instruction cycle, Registers.

UNIT-III	Peripheral devices	Classes:12

Peripheral devices, Input-Output interface, Asynchronous, data transfer, Modes of transfer, Priority interrupt, Direct Memory Access, Input-Output Processor (IOP).

UNIT-IV	Direct memory Access and Memory Organization	Classes:12

Direct memory Access: DMA Controller, DMA transfer.

Memory Organization: Memory hierarchy, Cache memories, Main Memory, Secondary storage, Performance considerations, Virtual memories.

UNIT- V	Parallel Processing	Classes:12

Parallel Processing: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline, Vector processing.

Text Books:

1 Computer System Architecture, M. Morris Mano, 4rd Edition, PHI/Pearson Education, 2008.

2 Microprocessors and Interfacing, Douglas Hall, Tata Mc Graw-Hill

Reference Books:

1 Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5th Edition, McGraw Hill

2 Fundamentals of Computer Organization and Design, SivaramaP.Dandamudi, Springer Int. Edition.

Web References:

1. https://nptel.ac.in/courses/106104048/pdf/coa.pdf
2. https://nptel.ac.in/courses/106104048/pdf/coa.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1	Evaluate the number system conversion problems.
2	Acquire the knowledge about simplifying the circuits by different methods.
3	Understand the basic organization of Computer system and its Instructions.
4	Learn the instructions to write assembly language program.
5	Analyze the Pipeline processing and DMA Techniques.

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DISCRETE STRUCTURES AND GRAPH THEORY

MCA I Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC103	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to

1. Simplify and evaluate basic logic statements including compound statements, implications, inverses, converses, and contra positives using truth tables and the properties of logic.
2. Express a logic sentence in terms of predicates, quantifiers, and logical connectives
3. Apply the operations of sets and use Venn diagrams to solve applied problems;
4. Solve problems using the principle of inclusion-exclusion.
5. Determine the domain and range of a discrete or non-discrete function, graph functions,
6. Compute the product of a finite sequence, and express sequences in terms of recursive or non-recursive forms

UNIT-I	Mathematical Logic and Predicates	Classes:12

Mathematical Logic: Statements and notations, connectives, Well-formed formulas, tautologies, Equivalence of formulas, Duality law, Tautological Implications, Other connectives, Normal forms, Rules of inference, Consistency of premises and Indirect method of proof.

Predicates: Predicates, Variables and quantifiers, Predicate formula, Free and bound variables, inference theory of the predicate calculus.

UNIT-II	Relations,functions and Algebraic structures	Classes:12

Relations: Properties of binary relations, equivalence relations, compatibility relations, partial ordering relations, Hasse diagrams.

Functions: Inverse functions, composition of functions, recursive function, Lattices, The pigeon-hole principle.

Algebraic Structures: Algebraic system examples and general properties, semi groups and monoids, groups, subgroups, homomorphism, isomorphism.

UNIT-III	Combinatorics and Recurrence Relation	Classes:12

Combinatorics: Basics of counting, Combinations and permutations, Enumeration of Combinations and permutations , Enumerating Combinations and permutations with repetitions, Enumerating permutations with constrained repetitions, binomial coefficients, The binomial and Multinomial theorems , The principle of inclusion-exclusion.

Recurrence Relation: Generating functions of sequences, calculating coefficients of generating function, recurrence relation, solving recurrence relations by substitution and generating functions, methods of characteristics roots.

UNIT-IV	Graphs	Classes:12

Graphs: Introduction to graphs, types of graphs, graph basic terminology and special types of simple graphs, representation of graphs and graph isomorphism, Spanning Tree, graph traversal techniques (BFS & DFS), Minimum Spanning Tree Algorithms, Euler paths and circuits, Hamiltonian paths and circuits, planar graphs, Euler's formula, graph coloring.

UNIT- V	Binary Search Trees	Classes:12

Binary search trees, Balanced Trees, AVL trees, Splay Trees, Red-Black Trees.

Text Books:

1 J.P.Trembly, R.Manohar(1997), Discrete Mathematical Structures with Applications to Computer Science, Tata Mc Graw Hill India

2 KennethH. Rosen, Discrete Mathematics and its Applications, 6th edition, Tata Mc Graw Hill India.

Reference Books:

1. C.L.Liu, D.P.Mohapatra (2008), Elements of Discrete Mathematics, 4th edition, Mc Graw Hill, India. Ralph P.Grimaldi and B.V.Ramana (2006).
2. Discrete and Combinatorial Mathematics-an Applied Introduction, 5thedition, Pearson Education India

Web References:

1. http://www.cs.utexas.edu/~isil/cs411h/lecture-graph1b-6up.pdf
2. https://en.wikipedia.org/wiki/Graph_(discrete_mathematics)

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Study the fundamental discrete mathematical structures used in computer science
2. Remember the basic properties and operations related to sets, relations and functions
3. Study the basic properties related to groups, semi groups, monoids, homomorphism and isomorphism.
4. Apply the formulas of Combinatory in different problems.
5. Analyze the recursive definitions.
6. Understand the basic definitions of graph theory and properties of graphs.

PROBABILITY AND STATISTICS

MCA I Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC104	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

At the end of the course students will be able to

1. Revise elementary concepts and techniques encountered in M1S
2. Extend and formalise knowledge of the theory of probability and random variables
3. Introduce new techniques for carrying out probability calculations and identifying probability distributions
4. Motivate the use of statistical inference in practical data analysis
5. Study elementary concepts and techniques in statistical methodology
6. Provide introduction to subsequent statistics courses

UNIT-I	Distributions	Classes:12

Distributions: Binomial, Poisson and normal distributions –Properties of normal distribution – Areas under normal curve – Population and Sample- Sampling distributions of means (with and without replacement).

UNIT-II	Test of Hypothesis and Large Sample Tests	Classes:12

Test of Hypothesis and Large Sample Tests: Statistical Hypothesis – Tests of Significance - Null and Alternative hypotheses –Types of errors - Level of Significance – Critical values and region – One and two tailed tests – Procedure for hypothesis testing - Testing of significance of means and proportions.

UNIT-III	Small sample tests	Classes:12

Small sample tests: Degrees of freedom-chi-square test—chi square test for goodness of fit-2*2 contingency- Student's t – distribution – testing of single mean and difference means F-test.

UNIT-IV	ANOVA& SQC	Classes:12

ANOVA& SQC: AN0VA - One and Two – way classifications.

Introduction – Chance and assignable causes of variation – Process and product control – Control charts - $\bar{x}$ and R, $\bar{x}$ and $\bar{s}$ charts – p, np and c charts.

UNIT-V	Curve fitting and Correlation	Classes:12

Introduction - Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares. Simple Correlation and Regression - Rank correlation - Multiple regression

Text Books:

1 Fundamentals of Statistics – S. C. Gupta –Himalaya Publications (6th revised and enlarged edition).

2 Probability and statistics by Dr.T.K.V.Iyengar - S Chand &Co-Revised edition.

Reference Books:

1 Higher Engineering Mathematics - Dr. B.S. Grewal - Khanna Publication (2ndedition).

2 Probability & Statistics – E. Rukmangadachari & E. Keshava Reddy – Pearson Education – Revised edition.

Web References:

1. https://towardsdatascience.com/basic-probability-theory-and-statistics-4105ab647214.

2. https://www.mathsisfun.com/data/.

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1 Gain the concepts of normal distributions and sampling distribution.

2 Apply the knowledge of normal and sampling distribution to various practical situations using normal tables.

3 Test the hypothesis of various Engineering problems.

4 Investigate the small samples using χ^2 -and t –tests.

ACCOUNTING AND FINANCIAL MANAGEMENT

MCA I Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC105	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

At the end of the course students will be able to

1. Develop a foundation of financial management concepts.
2. Enable the student to understand how corporations make important investment and financing decisions, and how they establish working capital policies.
3. Lay foundation for more complex financial topics that arise in additional elective courses in finance.
4. Describes the corporation and its operating environment;
5. Understand how the finances of a company work, and how they will be interfacing with finance

UNIT-I	Introduction to Accounting and Financial Statements	Classes:12

Introduction to Accounting: Accounting Principles, Double Entry System of Accounting, Classification of Accounts.

Financial Statements: Introduction to basic books of accounts, Journal and ledger, Trial balance, Preparation of final accounts - Trading account, Profit and Loss account and Balance sheet (with small adjustments).

UNIT-II	Introduction to Financial Management	Classes:12

Introduction to Financial Management: Meaning and scope, Goals & Objectives, Role of financial manager, Sources of finance, Goals of financial management, Time value of money, Leverages: Operation, Financial leverage and combined leverage. (Simple problems)

Capital structure, Cost of capital: Cost of equity, Preference shares and bonds –Weighted average cost of capital. (Simple problems)

UNIT-III	Financial Analysis Through Ratios	Classes:12

Financial Analysis Through Ratios: Ratio Analysis, Classification of ratios – Short term solvency and Long-term solvency – Profitability ratios- Analysis and interpretation of Financial Statements. (Simple problems)

UNIT-IV	Funds Flow analysis and Break-Even Analysis	Classes:12

Funds Flow analysis: Meaning, Importance, Statement of changes of working capital, Statement of sources and Application of Funds (Simple problems).

Break Even Analysis: Concept of Break-Even Point, Cost –Volume –Profit analysis, Determination of Break-Even Point, Margin of Safety and P/V ratio. (Simple problems)

UNIT- V	Capital Budgeting and Codes/Tables	Classes:12

Capital Budgeting: Capital and its significance, types of capital, Estimation of fixed and working capital requirements, Methods and sources of raising capital. Capital budgeting: Features proposals, Methods of capital budgeting, Payback method, Accounting Rate of Return (ARR), Net Present Value Method (NPV). (Simple problems)

Codes/Tables: Present Value Tables need to be permitted into the examination Hall.

Text Books:

1. Financial accounting - Dr.S.N.Maheswari. Sultan Chandpublications,2009.
2. Financial Management – Sundhindra Bhat ,Excel publications:2009.

Reference Books:

1. Financial Management - Prasanna Chandra, TMH, NewDelhi.
2. Financial Management - I M Pandey, Vikas Publishing House, NewDelhi.
3. Financial Management and Policy - Van Horn, James c., Prentice Hall ofIndia
4. Financial Statement Analysis, Khan and Jain, PHI,2009
5. Accounting and Finance, Jai Bharat publications Prof. K.RajeswaraRao & Prof.G.Prasad

Web References:

1. https://uwaterloo.ca/future-students/programs/accounting-and-financial-management.
2. https://www.edx.org/micromasters/usmx-umuc-accounting-and-financial-management.

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1 Study various types of accounts and identify different accounting principles.
2 Create financial statements in accordance with Generally Accepted Accounting Principles.
3 Analyze financial statements using standard financial ratios of liquidity, activity, debt, profitability and market value.
4 Understand the organization financial functions and objectives.
5 Apply techniques for estimating the cost of each component of the cost of capital and understand how to assemble this information into a cost of capital.
6 Evaluate the capital budgeting and resource allocation.

C PROGRAMMING LABORATORY

MCA I Semester – Master of Computer Applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC106	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes: 48**		

OBJECTIVES:

At the end of the course students will be able to

1. Develop primary programming skills upto the higher end in order solve the different programming logics...
2. Write different type of logics at the end of the sessions.
3. Get all the fundamental knowledge in all the languages.

LIST OF EXPERIMENTS

Expt. 1	**Expressions**
program on expressions	
Expt. 2	**Decision control statements**
Programs on decision control statements.	
Expt. 3	**loop Statements**
Programs on loop statements.	
Expt. 4	**Memory Management Operators.**
Programs on Memory management operators.	
Expt. 5	**Functions**
Programs to implement on functions	
Expt. 6	**Recursion**
Programs using recursion.	
Expt.7	**Arrays.**
Programs using arrays.	
Expt. 8	**String handling functions**
Programs to implement string handling functions	
Expt. 9	**Pointers**
Programs to implement on pointers	
Expt. 10	**Structures.**
Programs to implement on structures.	
Expt. 11	**Files**
Programs on files.	
Expt. 12	**Command line arguments**
Programs on command line arguments.	

Text Books:

1 Ashok N.Kamthane, Programming with ANSI and TurboC,

2 R.G.Dromey , How to Solve it by Computer, Prentice Hall Of India Ltd, New Delhi. Pearson Education, New Delhi.

Reference Books:

1 M.Cooper, The Spirit of C, an Introduction to modern programming, Jaico publishing House

2 Ashok N.Kamthane, Programming with ANSI and Turbo C,pearsons Education, NewDelhi.

3 Byrons Gottfried , Programming with C, Schaum's Outline series, Tata McGraw Hill. Publishing Company,NewDelhi.

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE: Dev C++, Turbo C

HARDWARE: Desktop Computers

Outcomes:

At the end of the course, a student will be able to:

1. Understand the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.
2. Use of conditional expressions and looping statements
3. Solve problems associated with conditions and repetitions

COMPUTER APPLICATIONS LABORATORY

MCA I Semester – Master of Computer Applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC107	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes: 48**		

OBJECTIVES:

At the end of the course students will be able to

1. Design, implement, and debug digital hardware systems.
2. Appreciate digital logic specification methods and the compilation process that transforms these into logic networks.
3. Gain experience with computer-aided design tools for implementation with programmable logic devices. Gain experience with programming microcontrollers.

LIST OF EXPERIMENTS

Expt. 1	**MASM/TASM**
Introduction to MASM/TASM	
Expt. 2	**Display simple text message**
Write an Assembly Language Program to display simple text message.	
Expt. 3	**Read and Display the character**
Write an Assembly Language Program to Read and Display the character	
Expt. 4	**Arithmetic Operations**
Write an Assembly Language Program to perform Arithmetic Operations on two Decimal numbers. A) Addition B) Subtraction C) Multiplication D) Division	
Expt. 5	**print Upper case letters**
Write an Assembly Language Program to print Upper case letters from A to Z.	
Expt. 6	**print Digits**
Write an Assembly Language Program to print Digits from 0 to 9.	
Expt.7	**find length of the String**
Write an Assembly Language Program to find length of the String.	
Expt. 8	**Reverse the Given String**
Write an Assembly Language Program to Reverse the Given String.	
Expt. 9	**Concatenation of two Strings**
Write an Assembly Language Program to Concatenation of two Strings.	
Expt. 10	**1's Complement of a digit**
Write an Assembly Language Program to find 1's Complement of a digit	
Expt.11	**Factorial of a given number**
Write an Assembly Language Program to find Factorial of a given number.	
Expt.12	**Even or Odd**
Write an Assembly Language Program to check the given number is Even or Odd.	

Text Books:

1 Computer System Architecture, M. Morris Mano, 4th Edition, PHI/ Pearson Education, 2008.
2 Microprocessors and Interfacing, Douglas Hall, Tata Mc Graw-Hill.

Reference Books:

1. IBM PC Assembly Language and Programming, P. Abel, 5th Edition, PHI/ Pearson Education.
2. Introduction to Assembly Language Programming, Sivarama, P.Dandamudi, Springer Int. Edition, 2004.
3. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware and Application, 4th edition, W.A.Triebel, A.Singh, N.K.Srinath, Pearson Edition.

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE: MASM-6.11.

HARDWARE: Desktop Computers

COURSE OUTCOMES:

At the end of the course students are able to

1. Understand the basic concepts of MASM-6.11.
2. Understand how to work in the area of electronic design and assembly language programming of small, dedicated computers.
3. Acquire the knowledge on assembly language programs using assemblers.
4. Analyze, Write programs & implement microprocessor based system in both hardware & software.

OPERATING SYSTEMS

MCA II Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC201	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes: 60**			

OBJECTIVES:

The course should enable the students to

1 Know the fundamentals of Operating Systems.
2 Learn the mechanisms of OS to handle processes and threads and their communication
3 Learn the mechanisms involved in memory management in contemporary OS
4 Gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5 Know the components and management aspects of concurrency management
6 Learn programmatically to implement simple OS mechanisms.

UNIT-I	Operating System Overview	Classes:12

Operating System Overview: Introduction to Operating System, Operating System Services, Operating system Structures, Distributed systems, Special purpose systems, System calls, Types of System Calls.

UNIT-II	Process Management and Process Synchronization	Classes:12

Process Management: Process Concepts, Process Scheduling Criteria, Scheduling algorithms and their evaluation, Inter process communication, Multi threaded programming-overview, multithreading models.

Process Synchronization: Critical section problem, Peterson's Solution, Synchronization Hardware Semaphores, Classic problems of Synchronization, Monitors.

UNIT-III	Deadlocks and Memory Management	Classes:12

Deadlocks: System model, Deadlock Characterization, Deadlock Prevention, Deadlock Detection and Deadlock Avoidance, Recovery from deadlock.

Memory Management: Memory management strategies-Swapping, Contiguous memory allocation, Paging, Structure of the Page Table, Segmentation. Virtual Memory Management - Demand paging, Page Replacement algorithms.

UNIT-IV	File System and Secondary storage structure	Classes:12

File System: File Concept, Access methods, Directory Structure, File System mounting, File sharing and Protection. Implementing file Systems- Allocation methods, Free space management.

Secondary storage structure: Mass-Storage structure**,** Disk structure, Disk attachment, Disk scheduling, Swap – space management.

UNIT-V	I/O Systems and Protection	Classes:12

I/O Systems: I/O Hardware, Application I/O interface, Kernel I/O sub systems, Transforming I/O requests to Hardware operations.

Protection: Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Revocation of Access Rights, Capability – Based Systems, Language – Based Protection.

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Principles, Eighth Edition, JohnWiley.

2. Andrew S Tanenbaum, Modern Operating Systems, Second Edition, PHI.

Reference Books:

1. William Stallings, Operating Systems: Internals and Design Principles,Sixth Edition– 2009, PearsonEducation.
2. B.L.Stuart, Cengage learning, Principles of Operating Systems, IndiaEdition.
3. A.S.Godbole, Operating Systems, Second Edition,TMH.
4. R.Elmasri, A.G.Carrick and D.Levine, Operating Systems, McGrawHill.
5. SibsankarHaldar, Alex A, Aravind, Operating Systems, Pearson Education India.

Web References:

1. http://www.svecw.edu.in/Docs%5CCSEOSLNotes2014.pdf
2. https://lecturenotes.in/subject/56/operating-systems-os
3. http://www.cs.kent.edu/~farrell/osf04/oldnotes/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Understand the services of operating system.
2. Examine the efficiency of Scheduling algorithms.
3. Understand about Inter process communication and their methods.
4. Analyze about Deadlock and apply various methods to prevent Deadlock.
5. Understand various Memory Management concepts and Virtual memory.
6. Examine Structure of file system and Way of Accessing the file system.

OOPS THROUGH C++

MCA II Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC202	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to

1. Develop a greater understanding of the issues involved in programming language design and implementation
2. Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms
3. Implement several programs in languages other than the one emphasized in the core curriculum (Java/C++)
4. Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing
5. Develop an understanding of the compilation process.

UNIT-I	Programming Paradigms and C++ Declarations	Classes:12

Programming Paradigms: Disadvantages of Conventional programming, Object-Oriented Programming, Key concepts of Object oriented programming, Advantages of OOP, Object- Oriented Languages, Object based languages. Evolution of C++.

C++ Declarations: Parts of a C++ program, Tokens, Data Types – Basic, derived, User defined, void, Variable declaration and Initialization, Dynamic Initialization of variables, Reference variables, Constants, operators, Memory management operators, cin and cout statements.

UNIT-II	Control Structures and functions	Classes:12

Control Structures- if-else, Nested if-else, jump, goto, break, continue, while, do-while, for, switch case.

Functions: Introduction, main () function, parts of functions, passing parameters, Return by reference, default arguments, inline functions, function overloading, precautions with overloading.

UNIT-III	Class Overview and Generic Programming with Templates	Classes:12

Class Overview: Structures in C and C++, classes in C++, class declaration, Access specifiers, Defining, Member functions, Object creation, Memory allocation to class members, Accessing of class members. Static Class Members: Static member variables, Static Member Functions, static objects. Passing objects as arguments, Returning objects, Friend functions

Generic Programming with Templates: Need of templates, Function templates, Function templates with more arguments, Overloading of Template Functions, Class templates, Class templates with more arguments, Guidelines for templates.

UNIT-IV	Constructor and Destructor and Operator Overloading	Classes:12

Constructor and Destructor: Characteristics, Constructors with arguments, Constructors with default arguments, Copy Constructor, Constructor overloading, Destructors, Dynamic Initialization using constructors, Recursive Constructor.

Operator Overloading: Operator Overloading Fundamentals, Operator function, Overloading unary and binary operators, type conversions, Rules for overloading operators.

UNIT-V	Inheritance, Polymorphism, Exception handling and I/O Streams	Classes:12

Inheritance: Base class & derived class, Access specifiers and simple inheritance , types of inheritance- single, multi level, multiple, Hierarchical, hybrid, multipath, virtual base classes, Constructor and destructor in derived class. Advantages and disadvantages.
Polymorphism: Binding in C++, Pointer to derived class objects, Virtual functions – Runtime polymorphism using virtual functions, pure virtual functions, and Abstract classes.
Exception handling: Principles, keywords. Exception Handling Mechanism
I/O Streams: Console I/O-Unformatted I/O and formatted I/O, File I/O-opening and closing a file.

Text Books:

1 Ashok N. Kamthane, Object Oriented Programming with C++, Pearson Education, India, 2004.
2 Herbert Schildt, C++ the Complete Reference, Third edition, Tata McGraw Hill,1999.

Reference Books:

1 Barkakatin, objects oriented programming in C++, PHI,1995.
2 Lafore, Object Oriented Programming in C++, Fourth Edition, PEARSONEDUCATION.

Web References:

1. http://www.spcollege.co.in/lectures/646187464444918582.pdf
2. http://www.ddegjust.ac.in/studymaterial/mca-4/ms-17.pdf
3. https://thatchna.weebly.com/uploads/4/1/9/4/4194482/std_c_notes_04.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Differentiate between structures oriented programming and object oriented programming.
2. Understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.
3. Apply concepts of operator overloading, constructors and destructors.
4. Apply exception handling and use built-in classes from STL.
5. Understand the file concepts.

DATA STRUCTURES

MCA II Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC203	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to

1. Impart the basic concepts of data structures and algorithms
2. Understand concepts about searching and sorting techniques
3. Understand basic concepts about stacks, queues, lists, trees and graphs
4. Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.

UNIT-I	Introduction, Stacks and Queues	Classes:12

Introduction: Introduction to data structures, Types, Operations.
Stacks: Introduction, Stack operations, Applications.
Queues: Introduction, Operations on queues, circular queues, Priority queues, Applications

UNIT-II	Linked lists	Classes:12

Linked lists: Introduction, Singly linked lists, circular linked lists, Doubly linked lists, Multiply linked lists, applications.Implementation of Stack and Queue using linked list.

UNIT-III	Sorting and Searching	Classes:12

Sorting: Introduction, Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap Sort.
Searching: Introduction, Linear search, Binary search, Fibonacci search.

UNIT-IV	Trees	Classes:12

Trees: Introduction, Definition and basic terminologies, Representation of trees.
Binary Trees: Basic terminologies and types, Binary tree traversals, Applications.

UNIT- V	Binary search trees	Classes:12

Binary search trees, Balanced Trees, AVL trees, Splay Trees, Red-Black Trees.

Text Books:

1 Ananda Rao Akepogu, Radhika Raju Palagiri, Data Structures and Algorithms Using C++, Pearson,2011.
2 Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Third Edition, Pearson Education

Reference Books:

1 G.A.V PAI, Data Structures and Algorithms, Concepts, Techniques and Applications, Volume1, 1stEdition, Tata McGraw-Hill, 2008.
2 Richard F. Gilberg&Behrouz A. Forouzan, Data Structures, Pseudo code Approach with C, 2nd Edition, Cengage Learning India Edition, 2007.

Web References:

1 http://www.cs.yale.edu/homes/aspnes/classes/224/notes.pdf
2. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_DS_LECTURE_NOTES_2.pdf
3. http://www.vssut.ac.in/lecture_notes/lecture1428550942.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Apply Concepts of Stacks, Queues and Linked Lists.
2. Develop Programs for Sorting.
3. Interpret concepts of trees.
4. Select appropriate searching algorithms.
5. Develop programs for Trees.

PRINCIPLES OF PROGRAMMING LANGUAGES

MCA II Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC204	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Understand the significance of an implementation of a programming language in a compiler or interpreter.
2. Increase the ability to learn new programming languages .
3. Increase the capacity to express programming concepts and choose among alternative ways.
4. Express things Simulate useful features in languages that lack them .
5. Be able in principle to design a new programming language.

UNIT-I	Introduction to Preliminaries and Imperative Programming	Classes:12

Introduction: What is a programming language, Abstractions in programming languages, Computational paradigms, Language definition, Language translation, Language design.

Preliminaries: Concepts of Programming Languages, programming domains, Language Evaluation Criteria, Influences on Language design, Language Categories, Language design Trade-offs.

Imperative Programming: Introduction**,** Names, Variables, The concept of Bindings, Type Checking, strong typing, type compatibility, Scope and life time.

UNIT-II	Data Types ,Expressions and assignment Statements	Classes:12

Data Types : Data types and type information, Simple types, Type constructors, Type equivalence, Type Checking, Type conversion, Polymorphic type checking, Explicit polymorphism.

Expressions and assignment Statements: Introduction, Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short- Circuit Evaluation, Assignment Statements, Mixed-mode Assignment.

UNIT-III	Statement-Level Control Structures and Abstract Data Types	Classes:12

Statement-Level Control Structures: Introduction, Selection Statements, Iterative Statements, Unconditional Branching; Subprograms- Introduction, Fundamentals of sub- programs, Design issues for subprograms, Local Referencing Environments, Parameter- passing Methods**.**

Abstract Data Types: Concept of Abstraction, Introduction to data abstraction, design issues for abstract data types, Parameterized Abstract data types.

UNIT-IV	Object – Oriented Programming	Classes:12

Object – Oriented Programming:

Software reuse and independence, Java : objects, Classes and methods, Inheritance, Dynamic binding, C++, Small Talk, Design issues in object – oriented languages, Implementation issues In object – oriented languages.

UNIT-V	Functional Programming Languages and Logic Programming Languages	Classes:12

Functional Programming Languages: Introduction, Fundamentals of Functional programming languages, LISP, ML, Haskell.

Logic Programming Languages: Introduction, A Brief Introduction to Predicate Calculus,

Predicate Calculus and Proving Theorems, An Overview of Logic Programming, The Origins of Prolog, The Basic Elements of Prolog, Applications.

Text Books:

1. Robert W.Sebesta," Concepts of Programming Languages", Eighth Edition, PearsonEducation.
2. Terrence W.Pratt& Mervin V.Zelkowitz, "Programming Languages Design and Implementation", Fourth Edition, Pearson Education(2008).

Reference Books:

1. Kenneth C.Louden, "Programming Languages Principles and Practice", Second Edition.

Web References:

1. https://www.gnits.ac.in/sites/default/files/ONLINERESOURCES/IT/ppl.pdf
2. https://www.cs.bu.edu/~hwxi/academic/courses/CS520/Fall02/notes/lectures.pdf
3. https://www.cs.bgu.ac.il/~mira/ppl-book-full.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Express computational solutions in the main programming idioms.
2. Select an appropriate programming language for solving a computational problem, with justification.
3. Know and understand the principal programming abstractions.
4. Know and understand the functional programming language.

ORGANIZATION STRUCTURES AND PERSONNEL MANAGEMENT

MCA II Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC205	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to

1. Relate, discuss, understand, and present management principles, processes and procedures in consideration of their effort on individual actions.
2. Participate, summarize and/or lead class discussions, case problems and situations from both the text and student experience that relate to the text material.
3. Knowledge and understanding of the Principles of Management will enable the student manager and/ or employee and gain valuable insight into the workings of business and other organizations.

UNIT-I	Introduction to Management and Introduction to Organization	Classes:12

Introduction to Management: Concepts of Management– nature, Importance and functions and theories of management, Systems approach to management, Social responsibilities of management.
Introduction to Organization: Designing Organizational structures: Basic concepts related to Organization – Departmentation and Decentralization, Types and evaluation of mechanistic and structures of organization and suitability.

UNIT-II	Decision Process Approach and Personnel Management	Classes:12

Decision Process Approach: Parts of organization system, development of corporate strategy, Dynamics of decision, Role of system. Types of models: Mathematical planning models, Deterministic and probabilistic models.
Personnel Management: Evolution, objectives, Personnel policies. Personnel management vs HRM, Position of the personnel department in the organization, Role of personnel manager as line manager and staff manager.

UNIT-III	Man Power Planning , Training and Development	Classes:12

Man Power Planning: Need-strategies and limitations, Manpower inventory, Manpower forecasting, Job description, Job specification, Recruitment and selection, Interviewing techniques, Transfers and promotion policies.
Training and Development: Objectives and policies planning, Organizing the training department, Training manager and his job, On and off the job training techniques, Career planning and development, Performance appraisal.

UNIT-IV	Understanding Human Behavior	Classes:12

Understanding Human Behavior: Leadership styles, Personality – Johari Window – Transactional Analysis. Perception: Perceptual process, Development of Attitudes and Values, Understanding Group Dynamics, Team Effectiveness, Strategies to deal with conflicts and stress.

UNIT-V	Contemporary Strategies	Classes:12

Contemporary Strategies: Total Quality Management (TQM), Six sigma, People capability maturity model (PCMM) levels, Performance management, Business process outsourcing (BPO), Business process re-engineering, Bench marking and balanced score card.

Text Books:

1 Organizational Structures and Personnel Management, P.Subbarao HPH,2009.
2 Personnel Management, Mamoria&Gankar, HPH,2009.

Reference Books:

1 Organizational Behavior, Robbins: Pearson, 2008.
2 Industrial Business Management, Martand T Telsang, S.Chand.

Web References:

1. https://shodhganga.inflibnet.ac.in/bitstream/10604/76404/10/10_chapter%201.pdf
2. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_hrm.pdf
3. https://mba.mits.ac.in/assets/pdf/mba/que/9FHS201%20Organization%20Structure%20&%20Personnel%20Management%20Nov-2014.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1. Understand the nature and purpose of organization and describe the main departments or functions of a business organization.
2. Study the Decision process approaches, essence of personnel management, its objectives and basic terms.
3. Understand the methods of recruitment, selection process and training methods.
4. Understand the importance of decision making in career choices, analyze and participate in the decision making process as a personnel department employee.

C++ PROGRAMMING LABORATORY

MCA II Semester – Master of Computer Applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC206	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes: 48**		

OBJECTIVES:

The course should enable the students to

1. Learn advanced features of the C++ programming language as a continuation of the previous course.
2. Learn the characteristics of an object-oriented programming language: data abstraction and information hiding, inheritance, and dynamic binding of the messages to the methods.
3. Learn the basic principles of object-oriented design and software engineering in terms of software reuse and managing complexity.
4. Enhance problem solving and programming skills in C++ with extensive programming projects.

LIST OF EXPERIMENTS

Expt. 1	**Tokens**
Programs on Tokens	
Expt. 2	**Dynamic Initialization Of Variables.**
Programs on Dynamic Initialization of variables.	
Expt. 3	**Control Statements**
Programs on control statements (if-else, Nested if-else, jump, goto, break, continue, while, do-while, for, switch-case).	
Expt. 4	**Memory Management Operators**
Programs on Memory management operators	
Expt. 5	**Parameter Passing Techniques**
Programs to implement on parameter passing techniques.	
Expt. 6	**Inline Functions**
Programs using inline functions	
Expt.7	**Function Overloading**
Programs using function overloading.	
Expt. 8	**Access Specifiers**
Programs to implement Access specifiers.	
Expt. 9	**Friend Functions**
Programs on Friend functions.	
Expt. 10	**Copy Constructor**
Programs on Copy Constructor.	
Expt. 11	**Constructors With Default Arguments**
Programs on Constructors with default arguments.	

Expt. 12	Types Of Inheritance

Programs on types of inheritance.

Text Books:

1. Ashok N. Kamthane, Object Oriented Programming with C++, Pearson Education, India, 2004.
2. Herbert Schildt, C++ the Complete Reference, Third edition, Tata McGraw Hill,1999.

Reference Books:

1. C++ How to Program by H M Deitel and P JDeitel.
2. ObjectOrientedProgramminginTurboC++byRobert Lafore,Press.
3. Programming with C++ by DRavichandran
4. ObjectorientedProgrammingwithC++byEBalagurusamy.

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE REQUIREMENTS : Turbo c++

HARDWARE REQUIREMENTS : Desktop Computers

OUTCOMES:

At the end of the course students will be able to

1. Apply Abstraction to create models based on the real world.
2. Understand several techniques from previously established paradigms, including modularity, encapsulation and Polymorphism.
3. Apply greater flexibility and maintainability in programming.
4. Improve the knowledge on Objects and class.

DATA STRUCTURES LABORATORY

MCA II Semester – Master of Computer Applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC207	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**			**Total Classes: 48**			

OBJECTIVES:

The course should enable the students to

1. Develop skills to design and analyze simple linear and nonlinear data structures
2. Strengthen the ability to identify and apply the suitable data structure for the given real-world problem
3. Gain knowledge in practical applications of data structures
4. Write ADTS for all data structures.

LIST OF EXPERIMENTS

Expt. 1	**Stack Using Arrays**
Write C programs to implement the stack using arrays.	
Expt. 2	**Queue Using Arrays**
Write C programs to implement the Queue using arrays	
Expt. 3	**Stack Applications**
Write C programs to implement the following Stack applications i)Infix to post fix ii) Evaluations of postfix expression	
Expt. 4	**Types Of Queues**
Write C program to implement the following types of queues i) Priority Queue ii) Circular Queue.	
Expt. 5	**Singly Linked List**
Write C programs to implement the Singly linked list	
Expt. 6	**Doubly Linked List**
Write C programs to implement the doubly linked list	
Expt.7	**Search Algorithms**
Write C programs to implement the following search algorithms: i)Linear Search ii) Binary Search iii) Fibonacci Search.	
Expt. 8	**Sorting Algorithms**
Write C programs to implement the sorting algorithms	
Expt. 9	**Binary Tree Traversals**
Write a C program to implement binary tree using arrays and to perform binary tree traversals. i)inorder ii) preorder iii)postorder	
Expt. 10	**Balance A Given Tree**
Write a C program to balance a given tree.	

Text Books:

1 Ananda Rao Akepogu, Radhika Raju Palagiri, Data Structures and Algorithms Using C++, Pearson,2011.
2 Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Third Edition,PearsonEducation

Reference Books:

1 Langsam,M. J. Augenstein, A. M. Tanenbaum, Data structures using C and C++, 2nd Edition, PHI Education,2008.
2 Sartaj Sahni, Ellis Horowitz, Fundamentals of at a Structure in C, 2nd Edition, Orientblackswan,2010.

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE: Turbo C
HARDWARE: Desktop Computers

COURSE OUTCOMES:

At the end of the course students are able to

1 Develop programs using recursive functions.
2 Implement stacks and queues using arrays
3 Develop Programs for searching and sorting algorithms.
4 Develop programs using concepts of trees.

SOFT SKILLS PRACTICE

MCA II Semester – Master of Computer Applications

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
18AS201	Core	0	0	0	0	0	0	0
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 68			Total Classes: 68			

OBJECTIVES:

At the end of the course Student are able to

1. Develop effective presentation skills.
2. Conduct effective business correspondence and prepare business reports which produce results.
3. Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
4. Develop all-round personalities with a mature outlook to function effectively in different circumstances.
5. Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.

LIST OF EXPERIMENTS

Expt. 1	**Phonetics, Introduction to Vowel Sounds & Consonants.**
Practice on Phonetics, Introduction to Vowel Sounds & Consonants.	
Expt. 2	**Introduction to Stress and Intonation.**
Practice on decision control statements.	
Expt. 3	**Situational Dialogues.**
Practice on Situational Dialogues.	
Expt. 4	**Group Discussions.**
Practice on Group Discussions.	
Expt. 5	**Debate.**
Practice to Debate	
Expt. 6	**Just A Minute**
Practice on Just A Minute	
Expt.7	**Resume or Curriculum Vitae and Covering Letter.**
Practice Resume or Curriculum Vitae and Covering Letter.	
Expt. 8	**Interview Skills.**
Practice on Interview Skills.	

Reference Books:

1. "Soft Skills" – Know yourself & know the world by Dr. K. Alex.
2. Technical Writing and professional communication, Huckin and Olsen Tata McGraw-Hill 2009.
3. Speaking about Science, A Manual for Creating Clear Presentations by Scott Morgan and Barrett Whitener, Cambridge University press, 2006.
4. Technical Communication by Meenakshi Raman &Sangeeta Sharma, Oxford University Press 2009.

5. Resume's and Interviews by M. Ashraf Rizvi, Tata McGraw-Hill, 2008.
6. Form Campus to corporate by KK Ramachandran and KK Karthick, Macmillan Publishers India Ltd, 2010.
7. English Language Communication: A Reader cum Lab Manual Dr A Ramakrishna Rao

Course Home Page:

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:
SOFTWARE: English Phonetics version 2.3
HARDWARE: Desktop Computers

Outcomes:

At the end of the course Student are able to

1. Develop formal communication skills in a work place.
2. Create them acquire team skill by working in group activities.
3. Equip them with suitable language and speech patterns in a workplace.
4. Enhance the ability of critical & lateral thinking while addressing the issues at any situation.
5. Present themselves confidently in job interviews.

DATABASE MANAGEMENT SYSTEMS

MCA III Semester: Master of Computer applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18MC301	Core	4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. Understand the role of a database management system in organization.
2. Understand basic database concepts, including the structure and operation of the relational data model.
3. Construct simple and moderately advanced database queries using Structured Query Language (SQL).
4. Understand and successfully apply logical database design principles, including E-R diagrams and database normalization.
5. Understand the concept of a database transaction and related database facilities, including concurrency control, journaling, backup and recovery, and data object locking and protocols.

UNIT-I	Structured Query Language (SQL)	Classes:12

Data base System Applications, File Systems vs. DBMS, View of Data, Data Abstraction, Instances and Schemas, Data Models, Database Languages, Data base Architecture.

Structured Query Language (SQL): The Form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Functions, Conversion functions, String Functions, Math functions, Date functions, Null Values, Logical Connectivity's-AND, OR and NOT, Joins, Views, Triggers and Active Data Bases.

UNIT-II	The Entity Relationship Model and The Relational Model	Classes:12

The Entity Relationship Model: Database Design and ER diagrams, Entities, Attributes, and Entity sets, Relationships and Relationships Sets, Additional Features of the ER Model, Conceptual Design with the ER Model, Conceptual Design for Large Enterprises.

The Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data. Logical Database Design: ER Model to Relational Model, Views.

UNIT-III	Schema refinement and Normal forms	Classes:12

Schema refinement and Normal forms: Schema refinement, Problems Caused by redundancy, Decompositions, Problem related to decomposition, Functional Dependencies, Reasoning about FDS, Normal Forms, Properties of Decomposition, Normalization, Schema Refinement in Database Design, Other kinds of Dependencies.

UNIT-IV	Storage and indexing and Transactions	Classes:12

Storage and indexing: The Memory Hierarchy, RAID, Disk Space Management, Buffer Management, Files of Records, Page Formats, Record formats. Index Data Structures, Hash Based indexing, Tree based Indexing, B+ Trees.

Transactions: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability - Recoverability – Implementation of Isolation, Testing for serializability.

UNIT-V	Concurrency control and Recovery System	Classes:12

Concurrency control: Lock –Based Protocols, Timestamp Based Protocols- Validation- Based Protocols, and Multiple Granularity.

Recovery System: Failure types, Recovery and Atomicity, Log – Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Advance Recovery systems- Remote Backup systems.

Text Books:

1. Raghurama Krishnan, Johannes Gehrke, Data base Management Systems, III Edition, TATA McGrawHill.
2. Silberschatz, Korth, Sudarshan Data base System Concepts, V Edition, McGraw hill.

Reference Books:

1. RamezElmasri, ShamkantB.Navrate Fundamentals of Database Systems, 5th Edition Pearson.
2. C.J.Date , Introduction to Database Systems, Pearson Education.

Web References:

1. https://lecturenotes.in/subject/38/database-management-system-dbms
2. https://lecturenotes.in/notes/1949-notes-for-database-management-system-dbms-by-jasaswi-prasad mohanty
3. https://lecturenotes.in/notes/5536-notes-for-database-management-system-dbms-by-abhishek-chaurasia

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1 Identify and define the data models needed to design a database.
2 Create conceptual and logical database design for large enterprises.
3 Apply Integrity constrains over the relations.
4 Understand normalization process on existing database for eliminating redundancy.
5 Apply the recovery techniques for managing the database effectively to avoid the data lose.

JAVA PROGRAMMING

MCA III Semester: Master of Computer applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18MC302	Core	4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
3. Understand the principles of inheritance, packages and interfaces.

UNIT-I	Object oriented thinking and Java Basics	Classes:12

Object oriented thinking:- Need for oop paradigm, A way of viewing world – Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of oop concepts, coping with complexity, abstraction mechanisms.

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

UNIT-II	Inheritance and Packages and Interfaces	Classes:12

Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes.

Packages and Interfaces: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.Exploring packages – Java.io, java.util.

UNIT-III	Exception handling and multithreading	Classes:12

Exception handling and multithreading - Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

UNIT-IV	Event Handling and Applets	Classes:12

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – boarder, grid, flow, card and grib bag.

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet,

types of applets, creating applets, passing parameters to applets.

UNIT-V	Swings	Classes:12

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Text Books:

1. Herbert Schildt, The Complete Reference Java J2SE 7th Edition, TMH Publishing Company Ltd, NewDelhi.
2. H.M.Dietel and P.J.Dietel, Java How to Program, Sixth Edition, Pearson Education/PHI

Reference Books:

1. Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals, Seventh Edition, Pearson Education.
2. Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol 2, Advanced Features, Seventh Edition, Pearson Education.

Web References:

1. https://lecturenotes.in/subject/73/java-programming-java
2. https://lecturenotes.in/notes/2546-notes-for-java-programming-java-by-tarini-mishra
3. https://examupdates.in/java-programming-notes/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1. Solve problems using object-oriented approach and implement them using Java.
2. Develop programs with multitasking ability.
3. Understand the Thread life cycle and ability to write Multithreading programs.
4. Use Exception Handling Mechanisms to write efficient java programs.
5. Understand the Networking concepts in java.
6. Create user friendly interface using Applets, Event Handlers and Swings.

DESIGN AND ANALYSIS OF ALGORITHMS

MCA III Semester: Master of Computer applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18MC303	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to :

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures
4. Apply important algorithmic design paradigms and methods of analysis.
1. Synthesize efficient algorithms in common engineering design situations.

UNIT-I	Introduction, Disjoint Sets	Classes:12

Introduction: Algorithm Specification, Performance Analysis-space complexity, time complexity, Asymptotic notation: big oh notation, omega notation, theta notation, and little- oh notation.

Disjoint Sets: Disjoint set operations, union and find algorithms, connected components and spanning trees, bi-connected components.

UNIT-II	Divide and Conquer, Greedy Method	Classes:12

Divide and Conquer: General method, binary search, quick sort, merge sort, Stassen's matrix multiplication.

Greedy Method: General Method, job sequencing with deadlines, knapsack problem, minimum cost spanning trees, single source shortest paths.

UNIT-III	Dynamic Programming	Classes:12

Dynamic Programming: General method, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest paths, travelling sales person problem, reliability design.

UNIT-IV	Backtracking	Classes:12

Backtracking: General method, n-queens problem, sum of subsets, graph coloring, Hamiltonian cycles.

UNIT-V	Branch and Bound and P, NP and NP-Complete Problems	Classes:12

Branch and Bound: General method, travelling sales person problem, 0/1 knapsack problem. **P, NP and NP-Complete Problems**: P and NP problems, NP-complete problems, non deterministic algorithms, cook's theorem.

Text Books:

1 Ellis Horowitz, "SartajSahni and Sanguthevar Rajasekaran", Fundamentals of Computer Algorithms, Galgotia, 2004.

2 Allen Weiss, "Data structures and Algorithm Analysis in C++", 2nd Edn, Pearson Education, 1996.

Reference Books:

1 ParagHimanshu Dave, HimanshuBhalchandraDave, "Design and Analysis algorithms", Pearson.

2 M.T. Goodrich, Robert Tamassia, "Algorithm design: Foundations, Analysis and Internet examples" Wiley student Edn, John Wiley &sons.

3 Aho, Ullman and Hopcroft, "Design and Analysis of Algorithms", PearsonEducation.

4 Richard Johnson Baugh, and Marcus Schaefer, "Algorithms", PearsonEducation.
5 T H Cormen, C E Leiserson, and R L Rivest, Introduction to Algorithms, 2nd Edn, PearsonEducation.

Web References:

1. https://lecturenotes.in/subject/12/design-and-analysis-of-algorithm-daa
2. http://www.cse.iitd.ernet.in/~ssen/csl356/root.pdf
3. https://www2.cs.duke.edu/courses/fall08/cps230/Book.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1 Analyze the asymptotic runtime complexity of algorithms for real world problems developed using different algorithmic methods.
2 Find the optimal solutions by using advanced design and analysis of algorithm techniques like greedy method and dynamic programming.
3 Apply the search space and optimization problem techniques like backtracking and branch and bound method to solve problems optimally where advanced algorithm design techniques fail to find solution.
4 Distinguish the problems and its complexity as polynomial and NP problems and can formulate some real-world problems to abstract mathematical problems.

SOFTWARE ENGINEERING

MCA III Semester: Master of Computer applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18MC304	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**		**Practical Classes: Nil**			**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Know the basics of SW engineering methods and practices, and their appropriate application.
2. Describe software engineering layered technology and Process frame work. Understanding of software requirements and the SRS documents.
3. Understand the role of project management including planning, scheduling, risk management, etc.
4. Describe data models, object models, context models and behavioural models.
5. Understanding of different software architectural styles.
6. Understanding of implementation issues such as modularity and coding standards.

UNIT-I	**Introduction to Software Engineering and Process Models**	**Classes:12**

Introduction to Software Engineering: The Evolving Role of Software, Changing Nature of Software, Legacy Software, Software Myths, Software Engineering - A Layered Technology, A Process Framework, The Capability Maturity Model Integration (CMMI), Process Patterns, Process Assessment.
Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, the Unified Process.

UNIT-II	**Software Requirements and Requirements Engineering Processes**	**Classes:12**

Software Requirements: Functional and non-functional requirements, User Requirements, System requirements, the software requirements document.
Requirements Engineering Processes: Requirements elicitation and analysis, Requirements validation, Requirements management.

UNIT-III	**System models and Design Engineering**	**Classes:12**

System models- Context models, Behavioral models, Data models, Object models, Structured methods.
Design engineering: Design process and Design quality, Design concepts, Design model, Pattern based software design, Software architecture, Architectural styles and patterns, Assessing alternative architectural designs.

UNIT-IV	**Modeling Component-Level Design and Testing Strategies**	**Classes:12**

Modeling Component-Level Design: Designing Class-Based Components, Designing Traditional Components. User Interface Design- The Golden Rules, User Interface Analysis and Design, Design Evaluation.
Testing Strategies- A Strategic Approach to Software Testing, Test Strategies for Conventional Software, Black-Box and White-Box Testing, The Art Of Debugging.

UNIT-V	**Product Metrics and Risk management**	**Classes:12**

Product Metrics: Software Quality, A Frame work for Product metrics, Metrics for Requirements Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.
Risk management: Reactive vs Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Text Books:

1 Software Engineering: A practitioner's Approach, Roger S. Pressman, Seventh Edition. McGraw-Hill International Edition,2010
2 Software Engineering, Ian Sommerville, Eighth Edition, Pearson Education,2009.

Reference Books:

1 K.K. Agarwal & Yogesh Singh, Software Engineering- New Age International Publishers.
2 James F. Peters, WitoldPedrycz, John Wiely, Software Engineering, an Engineering approach.
3 Shely Cashman Rosenblatt, Systems Analysis and Design- Thomson Publications.
4 Waman S Jawadekar, Software Engineering principles and practice- The McGraw-Hill Companies.

Web References:

1. https://lecturenotes.in/subject/104/software-engineering-se
2. https://lecturenotes.in/notes/1294-note-for-software-engineering-se-by-sushri-rout
3. http://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1 Understand ethics and professional issues important for software engineering.
2 Examine how CMMI Levels will be assigned for organizations.
3 Apply various processes used for developing the software.
4 Examine various models will be used for representing the requirements.
5 Learn about Design and Different Architectural styles.
6 Evaluate Software by different testing Techniques.
7 Analyses various types of risks in software.

DATA COMMUNICATIONS AND COMPUTER NETWORKS

MCA III Semester: Master of Computer applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18MC305	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. The evolution of computer networks and the concepts data communication;
2. Know the general principles of network design and compare the different network topologies
3. Understand the digital and analogue representations and channels
4. Describe the mechanism and techniques of encoding

UNIT-I	**Introduction to Networks and Physical Layer**	**Classes:12**

Introduction to Networks: internet, protocol and standard, the OSI model, layer in OSI model, TCP/IP suite, ATM, Analog and digital signals.
Physical Layer: digital transmission, multiplexing, transmission media, circuit switched networks, Datagram networks, virtual circuit networks, switch and Telephone network.

UNIT-II	**Data link layer and Medium Access sub layer**	**Classes:12**

Data link layer: Introduction Block coding, cyclic codes,, checksum, framing, flow and error control, Noiseless channels, noisy channels, HDLC , point to point protocols
Medium Access sub layer: Random access, controlled access, channelization, Ethernet, wireless LANs.

UNIT-III	**Network Layer**	**Classes:12**

Connecting LANs, backbone networks and virtual LANs, Wireless WANs, SONET, frame relay
Network Layer: Logical addressing, internetworking, tunneling, address mapping, ICMP, IGMP, Forwarding, uni-cast routing protocols, multicast routing protocols.

UNIT-IV	**Transport Layer**	**Classes:12**

Transport Layer: Process to process delivery, UDP and TCP protocols, SCTP, data traffic, congestion, Congestion control, Qos.

UNIT-V	**Application Layer**	**Classes:12**

Application Layer: Domain name space, electronic mail, FTP, WWW, HTTP, SNMP.

Text Books:

1 Behrouz A. Forouzan, Data Communication and Networking, Fourth Edition,TMH.
2 Andrew S Tanenbaum, Computer Network, 4th Edition, PersonEducation.

Reference Books:

1 S.Keshav, Engineering Approach to Computer Network, 2nd Edition, PersonEducation.
2 W.A.Shay,Understanding communication and Networks,3rd Edition, CengageLearning.
3 NNader F. Mir ,Computer and Communication Networks, PearsonEdition
4 JamesF.Kurose, K.W.Ross Computer Networking: A Top-Down Approach Featuring the Internet 3rd Edition, Person Edition.

Web References:

1. https://lecturenotes.in/subject/86/computer-network-cn
2. https://www.cse.iitk.ac.in/users/dheeraj/cs425/
3. https://nptel.ac.in/downloads/106105080/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1 Understand basic computer network technology, Data Communications System and its components.
2 Analyze the different types of network topologies and protocols.
3 Study the layers of the OSI model, TCP/IP and the function(s) of each layer.
4 Study the different types of network devices and their functions within a network.
5 Understand and building the skills of sub netting and routing mechanisms.
6 Learn the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

DATABASE MANAGEMENT SYSTEMS LABORATORY

MCA III Semester: Master of Computer applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
18MC306	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 33**				**Total Classes: 33**		

Objectives:

At the end of the course students are able to:

1. Familiarise with the nuances of database environments towards an information-oriented data-processing oriented framework.
2. Give a good formal foundation on the relational model of data.
3. Present sql and procedural interfaces to sql comprehensively.
4. Give an introduction to systematic database design approaches covering conceptual design, logical design and an overview of physical design.
5. Motivate the participants to relate all these to one or more commercial product environments as they relate to the developer tasks.

LIST OF EXPERIMENTS

Expt. 1	**DDL Commands**
Practice DDL Commands: Creation, altering and dropping of tables with out and with Integrity Constraints.	
Expt. 2	**DML Commands**
Practice DML Commands: Inserting, updating and deleting rows of a table and enforce Integrity Constraints.	
Expt. 3	**DISTINCT, AND, OR, NOT, BETWEEN, LIKE, IS NULL, ORDER BY.**
Queries using DISTINCT, AND, OR, NOT, BETWEEN, LIKE, IS NULL, ORDER BY.	
Expt. 4	**Queries along with sub Queries**
Queries (along with sub Queries) using ANY, ALL, IN, NOT IN, EXISTS, NOTEXISTS,UNION, INTERSET, MINUS.	
Expt. 5	**Aggregate functions**
Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY,HAVING and Creation and dropping of Views	
Expt. 6	**Conversion Functions**
Queries using Conversion functions, string functions, date functions.	

Expt.7	Declaration section, Executable section and Exception –Handling section
i) Creation of simple PL/SQL program which includes declaration section, executable section and exception – Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found). ii) Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.	
Expt. 8	**Using loops**
Program development using WHILE LOOPS, FOR LOOPS, nested loops.	
Expt. 9	
Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.	
Expt. 10	**Stored functions, invoke functions**
Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.	
Expt. 11	**Features parameters**
Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR,WHERE CURRENT of clause and CURSOR variables.	
Expt. 12	**BEFORE and AFTER Triggers**
Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.	

Reference Books:

1 Dr. P.S.Deshpande, SQL & PL/SQL for Oracle 10g, Black Book, DreamTech.
2 Rick F.VanderLans, Introduction to SQL, Pearson Education.
B.Rosenzweig and E.Silvestrova,Oracle PL/SQL, Pearson Education.

Web References:

1. https://lecturenotes.in/practicals/13627-lab-manuals-for-database-management-system-dbms-by-abhishek-apoorv
2. https://lecturenotes.in/practicals/19314-lab-manuals-for-database-management-system-dbms-by-anna-superkings
3. https://lecturenotes.in/practicals/14984-lab-manual-for-database-management-system-dbms-by-jntu-heroes

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1 Understand, analyze, and apply common SQL Statements including DDL, DML and DCL statements to perform different operations.
2 Apply Integrity constrains over the tables.
3 Understand, analyze, and apply PL/SQL blocks using Cursors and Triggers.

JAVA PROGRAMMING LABORATORY

MCA III Semester: Master of Computer applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC307	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 33**				**Total Classes: 33**		

OBJECTIVES:

At the end of the course students are able to:

1. Build software development skills using java programming for real world applications.
2. Implement frontend and backend of an application.
3. Implement classical problems using java programming.

LIST OF EXPERIMENTS

Expt. 1	**Simple java programs**

Write a Java program:

a. To prints all real solutions to the quadratic equation $ax^2 + bx + c = 0$. Read in a, b, c and use the quadratic formula. If the discriminate $b^2 - 4ac$ is negative, display a message stating that there are no real solutions.

b. The Fibonacci sequence is defined by the following rule.

Expt. 2	**Amstrong no, Simple Interest**

Write a Java program:

a. To print the given number is Armstrong or not.

b. To find simple Interest.

Expt. 3	**Strings**

Write a Java program:

a. To Checks whether a given string is a palindrome or not. Ex: MALAYALAM is a palindrome.

b. To Sorting a given list of names in ascending order.

Expt. 4	**Prime Number**

Write a Java program:

a. To make frequency count of words in a given text.That prompts the user for an integer and then prints out all prime numbers up to that integer.

Expt. 5	**String Tokenizer**

Write a Java program:

a. To find the product of matrices.

b. that reads a line of integers, and then displays each integer, and the sum of all the integers (Use StringTokenizer class of java.util)

Expt. 6	Files
Write a Java program: a. That reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes. b. That reads a file and displays the file on the screen, with a line number before each line. c. That displays the number of characters, lines and words in a text file.	
Expt.7	**Stack Applications**
Write a Java program: a. To Implements stack ADT. b. To Converts infix expression into Postfix form c. Evaluates the postfix expression	
Expt. 8	**Applets**
Write a Java program: a. To develop an applet that displays a simple message. b. To develop an applet that receives an integer in one text field, and computes its factorial Value and returns it in another text field, whenthe button named "Compute" is clicked.	
Expt. 9	**Simple Calculator**
Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.	
Expt. 10	**Mouse Events**
Write a Java program for handling mouse events.	
Expt. 11	**Multi threading**
Write a Java program: a) To illustrate Multi-Threading. b) That correctly implements producer consumer problem using the concept of inter thread communication.	
Expt. 12	**Exception Handling**
Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.	
Reference Books:	
1 Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol1, Fundamentals, Seventh Edition, PearsonEducation. 2 Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol2, Advanced Features, Seventh Edition, PearsonEducation. 3 Cay Horstmann, John Wiley and Sons, Big Java 2ndEdition. 4 E.Balagurusamy, Programming with JAVA; Primer Fourth edition, TMH.	

Outcomes:

At the end of the course students are able to:

1. Understand how object-oriented concepts are incorporated into the Java programming language.
2. Develop problem-solving and programming skills using OOPconcept.
3. Design efficient interactive programs in Java using Applets, Event Handlers andSwings.
4. Solve real-world problems through software development injava.

COMMUNICATION SKILLS PRACTICE

M.Tech III Semester: Master of Computer Applications

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
18AS301	Core	0	0	2	0	0	0	0
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 68			Total Classes: 68			

OBJECTIVES:

At the end of the course students will be able to

1. Define and understand communication and the communication process
2. List and overcome the barriers/filters in the communication pocess
3. Practice active listening
4. Tips to improve verbal and nonverbal communication

LIST OF EXPERIMENTS

Expt. 1	**Introduction to Communication**
What is communication and Components, Barriers in Communication	
Expt. 2	**Kinds**
Kinds of Communication	
Expt. 3	**Communication at Workplace**
Communication at Workplace	
Expt. 4	**Public Speaking Practice**
Better public speaking and presentation	
Expt. 5	**Effective Communication**
The seven C's of effective communication	
Expt. 6	**Writing Skills**
Practice on Writing Skills	
Expt.7	**Reading Skills**
Practice on Reading Skills	
Expt. 8	**Listening Skills**
Practice on Listening Skills	
Expt. 9	**Speaking Skills**
Practice on Speaking Skills	
Expt. 10	**Communication**
Grammar, Style, Punctuation, Practice in actual Communication	

Reference:

1. Adair, John. Effective Communication. London: Pan Macmillan Ltd., 2003.
2. Ajmani, J. C. Good English: Getting it Right. New Delhi: Rupa Pubications, 2012.
3. Amos, Julie-Ann. Handling Tough Job Interviews. Mumbai: Jaico Publishing, 2004.
4. Bonet, Diana. The Business of Listening: Third Edition. New Delhi: Vivaθ Books, 2004.

5. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman.
6. Business Communication Today: Tenth Edition. New Jersey: Prentice Hall, 2001

Outcomes:

At the end of the course, a student will be able to:

1. Recall potential barriers at each point of the communication and take actions to avoid barriers
2. Plan and use Pyramid method to structure communication
3. Acquire skills and techniques for active listening, reframing questions and adopting the right mindset
4. Practice effective, clear, focused communication that saves time
5. Break the vicious circle of not communicating due to the lack of time

OBJECT ORIENTED ANALYSIS AND DESIGN

MCA IV Semester: Master of Computer applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18MC401	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Create a requirements model using UML class notations and use-cases based on statements of user requirements, and to analyze requirements models given to them for correctness and quality.
2. Create the OO design of a system from the requirements model in terms of a high-level architecture description, and low-level models of structural organization and dynamic behavior using UML class, object, and sequence diagrams.
3. Comprehend enough Java to see how to create software the implements the OO designs modeled using UML.
4. Comprehend the nature of design patterns by understanding a small number of examples from different pattern categories, and to be able to apply these patterns in creating an OO design.
5. Given OO design heuristics, patterns or published guidance, evaluate a design for applicability, reasonableness, and relation to other design criteria.

UNIT-I	**Introduction to UML**	**Classes:12**

Introduction to UML: Object, Object Orientation, Development, Modeling, Object Modeling, Importance of Modeling, Principles of Modeling, Conceptual model, Model Driven Architecture with UML, Software Development Life Cycle of UML, UML Architecture.

UNIT-II	**Basic Structural Modeling and Advanced structural Modeling**	**Classes:12**

Basic Structural Modeling: Classes, Relationships, Diagrams.

Advanced structural Modeling: Advanced Classes, Advanced relations, Interfaces, Types and Roles.

UNIT-III	**Class & Object diagrams and Basic Behavioral Modeling–I**	**Classes:12**

Class & Object diagrams: Terms, Concepts, Common Modeling techniques for Class &Object diagrams.

Basic Behavioral Modeling–I: Interactions, Interaction diagrams, Common Modeling techniques.

UNIT-IV	**Basic Behavioral Modeling–II and Advanced Behavioral Modeling**	**Classes:12**

Basic Behavioral Modeling–II: Use Cases, Use Case Diagrams, and Activity Diagrams, Common Modeling techniques.

Advanced Behavioral Modeling: Events and Signals, State machines, State chart diagrams.

UNIT-V	**Architectural Modeling**	**Classes:12**

Architectural Modeling: Component, Development, Component Diagrams and Deployment Diagrams. Patterns and Frame works, Artifact Diagrams. Case Study: The Unified Library application.

Text Books:

1. Grady Booch, James Rambaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Edition.

2. Object Oriented Analysis and Design Bennett, Simon McGrawHill.

Reference Books:

1 Craig Larman, "Applying UML and Patterns-An Introduction to Object orientated Analysis and Design and Iterative Development", 4rdEdition PearsonEdition.

2 Hans Eriksson, Magnus, Penker, Brain Lyons, David Fado: UML 2 Toolkit, WILEY Dreamtech India Pvt.Ltd.

3 Meilir Page-Jones: Fundamentals of Object Oriented Design in UML – Pearson education.

4 AtulKahate: Object Oriented and Design, the McGraw-Hill Company.

Web References:

1. https://lecturenotes.in/subject/216/object-oriented-analysis-and-design-with-uml-ooad
2. https://www.tutorialspoint.com/object_oriented_analysis_design/
3. https://dzone.com/articles/object-oriented-analysis-and-design-part-1

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1. Understand basic Object Oriented analysis and design and its difference from structured design.
2. Understand the Unified Modeling Language (UML) diagrams.
3. Apply the UML as a modeling and communication tool.
4. Create a static conceptual model and behavioral model of your system.
5. Design and build a software system using the Unified Process approach.

ADVANCED JAVA PROGRAMMING

MCA IV Semester: Master of Computer applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18MC402	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Introduce the students to some concepts of advanced programming and practice on reusing components.
2. Focus on Graphical User Interface (GUI), multithreading, networking, and database manipulation.
3. Write sophisticated Java applications.

UNIT-I	Servlets and XML	Classes:12

Servlets: The Lifecycle of a Servlet, Using Tomcat for Servlet Development, A Sample Servlet, The Servlet API, The javax.servletpackage, Reading Servlet Parameters. The javax.servelet. Http Package, Handling Http Request & Responses, Using Cookies-Session Tracking.

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.

UNIT-II	Java Beans and Introduction to JavaBeans	Classes:12

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, and Java Beans API.

Introduction to JSP: The problem with Servlet. The anatomy of a JSP Page, JSP processing. JSP application design with MVC.

Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat.

UNIT-III	JSP Application Development and Using Java Beans Components in JSP Pages	Classes:12

JSP Application Development: Generating Dynamic Content, Creating a JSP Page, Installing a JSP Page, Running a JSP Page, Using JSP Directive Elements, Using Template Text, Using JSP Action Elements.

Using Java Beans Components in JSP Pages: Declaring a Bean in a JSP Page, Reading BeanProperties, and Setting Bean Properties.

Using Custom Tag Libraries and the JSP Standard Tag Library: Custom Tag Library, installing a Custom Tag Library, Declaring a Custom Tag Library.

UNIT-IV	Processing Input and Output and Error Handling and Debugging	Classes:12

Processing Input and Output: Reading Request Parameter Values, Validating User Input, Formatting HTML Output.

Error Handling and Debugging: Dealing with Syntax Errors, Debugging a JSP application, dealing with Runtime Errors.

UNIT-V	Sharing Data between JSP pages, Requests, and Users and Accessing A Database	Classes:12

Sharing Data between JSP pages, Requests, and Users: Passing Control and Date between Pages, Sharing Session and Application Data, Memory Usage Considerations.

Accessing A Database: Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from a JSP Page, Application – Specific Database Actions, Deploying JAVA Beans in a JSP Page.

Text Books:

1. Hans Bergsten, Java Server Pages, SPDO'Reilly.
2. Herbert Scheldt, The Complete Reference Java J2SE Fifth Edition,TMH.

Reference Books:

1. Marty Hall and Larry Brown Pearson, Core Servlets and Java Server Pages Volume CoreTechnologies.
2. java Server Pages, Pekowsky,Pearson.

Web References:

1. https://www.udemy.com/advanced-java-programming/
2. https://www.edureka.co/blog/advanced-java-tutorial
3. https://www.roseindia.net/java/Advanced-Java-Tutorials.shtml

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Design and implement programs in the Java programming language that make strong use of classes and objects.
2. Learn to print formatted text to the console output and read/parse console input text using a Scanner object.
3. Apply logical constructs for branching and loops as well as use iterator objects when appropriate. learn to define classes and methods. In addition, students

DATA WAREHOUSING AND DATA MINING

MCA IV Semester: Master of Computer applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
18MC403	**Core**	4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Introduce the basic concepts of Data Warehouse and Data Mining techniques.
2. Examine the types of the data to be mined and apply preprocessing methods on raw data.
3. Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

UNIT-I	Introduction and Data Preprocessing	Classes:12

Introduction: Fundamentals of data mining, Data Mining Functionalities, Major issues in Data Mining.

Data Preprocessing: Needs Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Warehouse and OLAP Technology for Data Mining Data Warehouse, Multi -Dimensional Data Model, Data Warehouse Architecture.

UNIT-II	Data Mining Primitives, System Architectures Characterization and Comparison	Classes:12

Data Mining Primitives and System Architectures: Data Mining Primitives, Architectures of Data Mining Systems, Concepts Description.

Characterization and Comparison: Data Generalization and Summarization Based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between Different Classes.

UNIT-III	Mining Association Rules in Large Databases and Classification	Classes:12

Mining Association Rules in Large Databases: Association rule mining, mining single-dimensional boolean association rules from transactional databases, mining multilevel association rules from transaction databases.

Classification: issues regarding Classification and Prediction, classification by Decision tree induction, Bayesian classification.

UNIT-IV	Cluster Analysis Introduction	Classes:12

Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Density-Based Methods, hierarchical methods, outlier analysis.

UNIT-V	Mining Complex Types of Data	Classes:12

Mining Complex Types of Data- Mining Multimedia Databases, Mining Text Databases, Mining the World Wide Web.

Text Books:

1. Mining – Concepts and Techniques - JiaweiHan &MichelineKamberHarcourt, India.
2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.

Reference Books:

1. Data Mining Techniques – Arun K Pujari, UniversityPress.

2. Data Mining Introductory and advanced topics –Margaret H Dunham, PearsonEducation.
3. Data Warehousing in the Real World – Sam Anahory& Dennis Murray. PearsonEdn.
4. Data Warehousing Fundamentals – PaulrajPonnaiah Wiley StudentEdition.

Web References:

1. https://www.tutorialspoint.com/dwh/dwh_overview.htm
2. https://www.trifacta.com/data-warehousing-and-data-mining/
3. https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Apply relevant preprocessing techniques on different data sets for mining.
2. Implement Association rule mining concept and generate association rules.
3. Apply classification/clustering techniques on different types of data and analyze patterns.
4. Suggest appropriate data mining techniques to mine different types of data.

CYBER SECURITY
(Elective – I)

MCA IV Semester: Master of Computer applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18MC404	Core	4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
2. Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
3. Develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
4. Develop an understanding of security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges

UNIT-I	Introduction to Cybercrime	Classes:12

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT-II	Cyber Offenses	Classes:12

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT-III	Cybercrim	Classes:12

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT-IV	Tools and Methods Used in Cybercrime	Classes:12

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT-IV	Cyberspace and the Law	Classes:12

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.DavidIrwin.CRC Press T&F Group.

Web References:

1. http://www.uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf
2. http://www.vssut.ac.in/lecture_notes/lecture1424184198.pdf
3. http://www.frwa.net/uploads/4/2/4/5/42459811/cybersecuritynotes.pdf

E-Text Books:

1. .https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1. Possess a fundamental knowledge of Cyber Security
2. Understand what a vulnerability is and how to address most common vulnerabilities
3. Know basic and fundamental risk management principles as it relates to Cyber Security
4. Have the knowledge needed to practice safer computing and safeguard your information
5. Understand basic technical controls in use today, such as firewalls and Intrusion Detection systems.

ADVANCED DATABASES
(Elective – I)

MCA IV Semester: Master of Computer applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18MC405	Core	4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. Inculcate knowledge on Centralized and Distributed Databases.
2. Understand Transparency and Fragmentation in Distributed Databases
3. Understand about Query Processing and Optimization in both Centralized and Distributed Databases.
4. Learn about transaction management, concurrency control, and reliability in Distributed Databases
5. Explore the features of Object-Oriented databases.
6. Create awareness on the major technical challenges in distributed systems design and implementation.

UNIT-I	PARALLEL AND DISTRIBUTED DATABASES	Classes:12

PARALLEL AND DISTRIBUTED DATABASES: Inter and Intra Query Parallelism – Architecture – Query evaluation – Optimization – Distributed Architecture – Storage – Catalog Management – Query Processing - Transactions – Recovery- Large-scale Data Analytics in the Internet Context – MapReduce Paradigm - run-time system for supporting scalable and fault-tolerant execution - paradigms: PigLatin and Hive - Parallel databases versus Map Reduce.

UNIT-II	INTELLIGENTAND INTERNET DATABASES	Classes:12

INTELLIGENTAND INTERNET DATABASES: Active Databases – Syntax and Semantics: Starburst, Oracle, DB2 – Taxonomy – Applications – Integrity Management – Workflow Management – Business Rules – Design Principles – Properties – Rule Modularization – Rule Debugging – IDEA Methodology .XML Databases -XML Databases: XML-Related Technologies- XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases.

UNIT-III	TEMPORAL AND OBJECT DATABASES	Classes:12

TEMPORAL AND OBJECT DATABASES: Overview – Data types – Associating Facts – Temporal Query Language – TSQL2 – Time Ontology – Language Constructs – Architecture – Temporal Support – Object Database and Change Management – Change of Schema – Implementing Database Updates in O2 – Benchmark Database Updates – Performance Evaluation.

UNIT-IV	COMPLEX QUERIES AND REASONING	Classes:12

COMPLEX QUERIES AND REASONING: Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Data log – Fix point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – NoSQL – The Need – Basics – Interfacing and Interacting with NoSQL.

Text Books:

1. RaghuRamakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2012.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian and Roberto Zicari, ―Advanced Database Systems‖, Morgan Kauffmann Publishers, 2006.

Reference Books:

1. ArisGkoulalas-Divanis and AbderrahimLabbi, ―Large-Scale Data Analytics‖, Springer Science and Business Media, 2014.
2. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, ―Database System Concepts‖, Sixth Edition, McGraw-Hill Education, 2010.
3. C.J.Date, A.KannanandS.Swamynathan, ―An Introduction to Database Systems‖,EighthEdition, Pearson Education, 2006.
4. R. Elmasri, S.B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition, Pearson Education India, 2010. 5. ShashankTiwari, ―Professional NoSQL‖, Wrox, 2011.

Web References:

1. https://www.wileyindia.com/advanced-database-management-systemm.html
2. http://www.exploredatabase.com/p/blog-page.html

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Write programs involving query optimization.
2. Write programs related to large scale data processing.
3. Use Map-Reduce in data analytics.
4. Evaluate the performance of temporal and spatial databases.
5. Write suitable indexing programs for multimedia databases.
6. Understand the state-of-the-art in advanced databases distributed systems.

INFORMATION RETRIEVAL SYSTEMS
(Elective – I)

MCA IV Semester: Master of Computer applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18MC406	Core	4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. understand the underlined problems related to IR
2. acquired the necessary experience to design, and implement real applications using
3. Information Retrieval systems.
4. Learn document management and retrieval, metadata management, and searching the web.
5. Understand how Web search engines work and how they could be improved.
6. Know about hypermedia architectures, design and usability of information retrieval systems.

UNIT-I	Introduction and Information Retrieval System Capabilities	Classes:12

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses,

Information Retrieval System Capabilities - Search, Browse, Miscellaneous.

UNIT-II	Cataloging and Indexing and Data Structures	Classes:12

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.

Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext datastructure.

UNIT-III	Automatic Indexing and Document and Term Clustering	Classes:12

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT-IV	Types Of IR And Applications	Classes:12

Types Of IR And Applications: Parallel and Distributed IR –Data Partitioning – ParallelIR – Cluster-based IR – Distributed IR - Multimedia Information Retrieval – Challenges – Content Based Image Retrieval – Audio and Music Retrieval – Retrieving and Browsing Video – Fusion Models – Segmentation – Compression - Enterprise Search –Tasks – Architecture of Enterprise Search Systems – Enterprise Search Evaluation - Library Systems – Digital Libraries.

Text Books:

1. Information Storage and Retrieval Systems: Theory and Implementation by Kowalski, Gerald, Mark T Maybury Kluwer Academic Press,2000.
2. Modern Information RetrivalBy Ricardo Baeza-Yates, Pearson Education,2007.
3. Information Retrieval: Algorithms and Heuristics By David A Grossman and OphirFrieder, 2nd Edition, Springer International Edition,2004.
4. Ricardo Baeza-Yates and BerthierRibeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search‖, Second Edition, ACM Press Books, 2011.

5. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines‖, The MIT Press, 2010.

Reference Books:

1. C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval‖, Cambridge University Press, 2008.
2. Bruce Croft, Donald Metzler and Trevor Strohman, ―Search Engines: Information Retrieval in Practice‖, First Edition, Addison Wesley, 2009.
3. Information Retrieval Data Structures and Algorithms By William B Frakes, Ricardo Baeza-Yates,
4. Pearson Education,1992.
5. Information Storage &RetievalBy Robert Korfhage – John Wiley &Sons.
6. IntroductiontoInformationRetrieval ByChristopher D.Manning and PrabhakarRaghavan, Cambridge University Press,2008.

Web References:

1. https://www.nap.edu/read/10866/chapter/80
2. http://www.bii.a-star.edu.sg/docs/education/lsm5191_04/notes/04%20InfoRetriev.pdf
3. https://link.springer.com/chapter/10.1007/978-0-487-21721-5_12

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Use an open source search engine framework and explore its capabilities.
2. Represent documents in different ways and discuss its effect on similarity.
3. Design and implement an innovative feature in a search engine.

UNIX AND SHELL PROGRAMMING
(Elective – II)

MCA IV Semester: Master of Computer Applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
18MC407	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes: 60			

OBJECTIVES:

The course should enable the students to

1. History and main features of Unix systems
2. Elementary Unix Shell utilities (awk, sed, tr, grep and etc.)
3. Basic Unix Shell programming concepts (variables, expressions, control structures)
4. Interactions between C and Unix

UNIT-I	Introduction to UNIX	Classes:12

Introduction to UNIX: The UNIX architecture, Features of Unix, General purpose utilities, File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities, grep, sed, awk.

UNIT-II	Working with the Bourne again shell(bash)	Classes:12

Working with the Bourne again shell(bash): Introduction, shell responsibilities, pipes and input Redirection, output redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, debugging shell scripts.

UNIT-III	Files	Classes:12

Files: File Concept, File System Structure, Inodes, File Attributes, File types, Library functions, the standard I/O and formatted I/O in C, stream errors, kernel support for files, System calls, file descriptors, low level file access – File structure related system calls(File APIs), file and record locking, file and directory management – Directory file APIs, Symbolic links & hard links. Process – Process concept, Kernel support for process, process attributes, process control - process creation, waiting for a process, process termination, zombie process, Process APIs.

UNIT-IV	Inter process Communication	Classes:12

Inter process Communication: Introduction to IPC, Pipes, FIFOs, Signals– Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, kill, raise, alarm, pause, abort, sleep functions. Introduction to three types of IPC-message queues, semaphores and shared memory. Message Queues- Kernel support for messages. Semaphores-Kernel support for semaphores, Shared memory example.

UNIT- V	Multithreaded Programming	Classes:12

Multithreaded Programming: Differences between threads and processes, Thread structure and uses Threads and Lightweight Processes, POSIX Thread APIs, Creating Threads, Thread Attributes, Thread Synchronization with semaphores and with Mutexes. Sockets: Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs (TCP Socket and UDP Socket).

Text Books:

1. Unix System Programming using C++, T.Chan, PHI (UNIT II to UNIT IV), Pretince Hall, 1996.
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH. (UNIT I to UNIT II), 2006

Reference Books:

1. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones, Wrox, Wiley India Edition.
2. Linux System Programming, Robert Love, O'Reilly, SPD.
3. Advanced Programming in the UNIX environment, 2nd Edition, W.R.Stevens, Pearson Education.
4. Unix Network Programming, W.R.Stevens, PHI.
5. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson Education.

Web References:

1. en.wikipedia.org/wiki/Shell_script
2. steve-parker.org/sh/sh.shtml
3. man7.org/tlpi/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

OUTCOMES:

At the end of the course students will be able to

1. Understand the some basic utilities of UNIX File.
2. Compare UNIX shell and popular shell.
3. Learn the basic components in constructing a shell Script(program).

ARTIFICIAL INTELLIGENCE
(Elective – II)

MCA IV Semester: Master of Computer applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
18MC408	Core	4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes: 0	Practical Classes: Nil			Total Classes:60			

OBJECTIVES:

The course should enable the students to:

1. Present an overview of artificial intelligence (AI) principles and approaches.
2. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.
3. Implement a small AI system in a team environment.

UNIT-I	PROBLEM SOLVING	Classes:12

PROBLEM SOLVING: Introduction – Agents – Problem formulation – uninformed search strategies – heuristics – informed search strategies – constraint satisfaction.

UNIT-II	LOGICAL REASONING	Classes:12

LOGICAL REASONING: Logical agents – propositional logic – inferences – first-order logic – inferences in firstorder logic – forward chaining – backward chaining – unification – resolution.

UNIT-III	PLANNING	Classes:12

PLANNING:Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world.

UNIT-IV	UNCERTAIN KNOWLEDGE AND REASONING	Classes:12

UNCERTAIN KNOWLEDGE AND REASONING: Uncertainty – review of probability - probabilistic Reasoning – Bayesian networks – inferences in Bayesian networks – Temporal models – Hidden Markov models.

UNIT-V	LEARNING	Classes:12

Learning : Overview of different forms of learning, Learning Decision Trees, Neural Networks. Introduction to Natural Language Processing.

Text Books:

1. S. Russel and P. Norvig, ―Artificial Intelligence – A Modern Approach‖, Second Edition, Pearson Education, 2004.

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel, ‖Computational Intelligence: a logical approach‖, Oxford University Press, 2004.
2. G. Luger, ―Artificial Intelligence: Structures and Strategies for complex problem solving‖, Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, ―Artificial Intelligence: A new Synthesis‖, Elsevier Publishers, 1998.

Web References:

1. https://skymind.ai/wiki/ai-vs-machine-learning-vs-deep-learning
2. https://www.marutitech.com/artificial-intelligence-and-machine-learning/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Select a search algorithm for a problem and estimate its time and space complexities.
2. Possess the skill for representing knowledge using the appropriate technique for a given problem
3. Apply AI techniques to solve problems of game playing, expert systems, machine learning and natural language processing.

WIRELESS NETWORKS
(Elective – II)

MCA IV Semester: Master of Computer Applications								
Course code	Category	Hours/week			Credits	Maximum Marks		
18MC409	Core	L	T	P	C	CIA	SEE	TOTAL
		4	0	0	4	40	60	100
Contact Classes:60	Tutorial Classes:0	Practical Classes: Nil				Total Classes:60		

OBJECTIVES:

The course should enable the students to

1. Study about Wireless networks, protocol stack and standards.
2. Study about fundamentals of 3G Services, its protocols and applications.
3. Study about evolution of 4G Networks, its architecture and applications.

UNIT-I	WIRELESS LAN	Classes:12

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security – IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX.

UNIT-II	MOBILE NETWORK LAYER	Classes:12

Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol – mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing

UNIT-III	MOBILE TRANSPORT LAYER	Classes:12

TCP enhancements for wireless protocols – Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility – Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP – TCP over 3G wireless networks.

UNIT-IV	WIRELESS WIDE AREA NETWORK	Classes:12

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT- V	4G NETWORKS	Classes:12

Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

Text Books:

1 Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)

2 Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier 2007.(Unit IV,V)

Reference Books:

1 Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE for Mobile Broadband”, Second Edition, Academic Press, 2008.

2 Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, First Edition, Elsevier 2011.

3 Simon Haykin, Michael Moher, David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013.
Web References: 1. https://www.cse.rutgers.edu/~marsic/books/WN/book-WN_marsic.pdf **E-Text Books:** 1. https://ndl.iitkgp.ac.in/
Outcomes: **At the end of the course students will be able to** 1 Conversant with the latest 3G/4G and WiMAX networks and its architecture. 2 Design and implement wireless network environment for any application using latest wireless protocols and standards. 3 Implement different type of applications for smart phones and mobile devices with latest network strategies.

ADVANCED JAVA PROGRAMMING LABORATORY

MCA IV Semester: Master of Computer applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC410	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 44**				**Total Classes: 44**		

OBJECTIVES:

The course should enable the students to :

1. Understand integrated development environment
2. Create, debug and run multi-tier and enterprise-level applications.

LIST OF EXPERIMENTS

Expt. 1	**Simple Bean Program For Displaying The Rectangular Box**

Write a Simple Bean Program for displaying the rectangular box. Your Bean Program must possess

Properties namely height & width. If we changevalues of these 2 properties then size of box must be changed accordingly.

Expt. 2	**Simple Bean Program For Displaying Either Line Or Rectangle**

Write a Simple Bean Program for displaying either line or rectangle the selection should be made by user by using property rectangle that means if rectangle property is true then a rectangle must be drawn otherwise a line must be drawn.

Expt. 3	**Simple Bean Program on Constrained Properties**

Write a Simple Bean Program on Constrained Properties.

Expt. 4	**Simple Bean Program For Generating Traffic Signal.**

Write a Simple Bean Program for generating Traffic signal.

Expt. 5	**Install TOMCAT Web Server And APACHE**

Install TOMCAT web server and APACHE.

a. While installation assign port number 4040 to TOMCAT and 8080 to APACHE. Make sure that these ports are available i.e., no other process is using this port.

Access the above developed static web pages for books web site, using there servers by putting the web pages by using the urls: http://localhost:4040/sree/books.html tomcat) http://localhost:8080/books.html(for Apache).

Expt.	**Do Get &Do Post Methods**

6	
Write a Servlet Program using do Get &do Post Methods.	
Expt. 7	**Servlet Program To Connect To The Database**
Write a Servlet Program to connect to the database and extract the data from the table and display in html tabular model	
Expt. 8	**User Authentication**
User Authentication: Assume four users user1, user2, user4 and user4 having the passwords pwd1, pwd2, pwd4 and pwd4 respectively. Write a Servlet for doing the following. 1. Create a Cookie and add these four user ids and passwords to thisCookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies. If he is a valid user you should welcome him by name else you should display "You are not an authenticated user".	
Expt. 9	**Install A Database And Insert Data From The Registration Form**
Install a database (My sql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form).	
Expt. 10	**Experiment With Various SQL Queries**
Write a Servlet program to connect to that database and extract data from the tables and display them Experiment with various SQL queries. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.	
Expt. 11	**JSP Program With Various SQL Queries**
Write a JSP program to connect to that database and extract data from the tables and display them Experiment with various SQL queries. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.	
Expt. 12	**Web Site By Using Registration Form**
Write a JSP which does the following job: Insert the details of the 4 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form Using the user name and password from the database.	
Expt. 13	**Create Tables In The Database Using JDBC**
Create tables in the database which contain the details of items of each category. Modify your Catalogue page in such a way that you should connect to the database and extract data from the Tables and display them in the catalogue page using JDBC	
Reference Books:	
1 Marty Hall and Larry Brown, Core Servlets and Java Server Pages Volume 1: Core Technologies, Pearson. 2 Pekowsky, Java Server Pages, Pearson.	

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE: Apache Tomcat, Net beans

HARDWARE: Desktop Computers

Outcomes:

At the end of the course students are able to

1. Understand the Servlets Concepts.
2. Integrate java and server side scripting languages to develop web applications.
3. Develop and deploy real time web applications in web servers and in the cloud.
4. Understand the JSP Concepts.
5. Develop simple database driven web applications using a server-side scripting language.

DATA MINING AND OOAD LABORATORY

MCA IV Semester: Master of Computer applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC411	**Core**	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 44**				**Total Classes: 44**		

OBJECTIVES:

1. Differentiate On Line Transaction Processing and On Line Analytical processing
2. Learn Multidimensional schemas suitable for data warehousing
3. Understand various data mining functionalities
4. Inculcate knowledge on data mining query languages.
5. Know in detail about data mining algorithms
6. The analysis, design, coding, documentation, database design of mini project

LIST OF EXPERIMENTS

Expt. 1	**Apriori Algorithm**
Implement Apriori algorithm to generate frequent Item Sets using WEKA.	
Expt. 2	**Clustering Algorithms**
Implement the following clustering algorithms using WEKA. a. K-means b.K-mediods	
Expt. 3	**Classification Algorithms**
Classification algorithms using WEKA.	
Expt. 4	**Data Preprocessing**
Perform data preprocessing using WEKA.	
Expt. 5	**Discritization Of Data**
Perform Discritization of data using WEKA.	
Expt. 6	**Data Transformations Using An ETL Tool**
Perform data transformations using an ETL Tool.	
Expt.7	**Atm Application.**
ATM Application.	
Expt. 8	**Online Railway Reservation System**
Online Railway Reservation System.	
Expt. 9	**Bank Simulated Company Application**
Bank Simulated Company Application.	
Expt. 10	**Auction Application**
Auction Application.	
Expt. 11	**Point Of Sale Application.**
Point Of Sale Application.	
Expt. 12	**E- Seva Application.**
E- seva Application.	

Expt.13	Online Student Course Application.
Online Student Course Application.	
Expt.14	**Library System Application.**
Library System Application.	

Reference Books:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and the Unified Process", 2nd ed., Pearson Education Asia,2002.
2. Simon Sennet, Steve McRobb, and Ray Farmer, "Object Oriented Systems Analysis and Design using UML", 2nd ed., McGraw Hill,2002.
3. Andrew Haigh, "Object-Oriented Analysis & Design," 1st ed., Tata McGraw-Hill,2001.
4. Ian H.Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine learning tools and techniques, 4rd Edition.
5. www.cs.waikato.ac.nz/ml/weka.

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE: Star UML, Rational Rose, Informatica ,WEKA

HARDWARE: Desktop Computers

Outcomes:

At the end of the course students are able to

1 Classify the given patterns.
2 Find the frequent patterns from the given datasets.
3 Represent the project scenario in terms of UML diagrams.
4 Recognize the difference between various object relationships: inheritance, association, whole-part, and dependency relationships.
5 Show the role and function of each UML model in developing object-oriented software.

QUANTITATIVE APTITUDE

MCA IV Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18AS401	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		2	0	0	0	0	0	0
Contact Classes: 30	**Tutorial Classes:0**		**Practical Classes: Nil**			**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Know the basic concepts of Simple Arithmetic Problems
2. Understand the reasoning Concepts
3. Analyze Logical deductions and Reasoning
4. Learn Logical deductions and Reasoning

UNIT-I		**Classes: 6**
Number - H.C.F. & L.C.M. of Numbers – Decimal Fractions –Simplification –Square Root and Cube Root – Average – Problems on Numbers – Problems on Ages – Percentage –Profit & Loss – Ratio & Proportion-Partnership – Chain Rule – Time & Work – Pipes & Cisterns		
UNIT-II	**Time& Distance, Series Completion**	**Classes: 6**
Time& Distance – Problems on Trains – Boats & Streams – Allegation or Mixture – Simple Interest –Compound Interest– Calendar – Clocks –Races &Games of Skill – Number Series . **Series Completion** – Analogy – Coding–Decoding –Classification – Blood Relations – Puzzle test – Sequential output tracing - Direction Sense test –Logical Venn diagrams – Alphabet test – Alpha-Numeric Sequence puzzle		
UNIT-III	**Mathematical & Logical**	**Classes: 6**
Number, Ranking and time sequence test – Mathematical operations – Logical sequence of words – Arithmetical reasoning– Insert the missing character – Data sufficiency – Eligibility test – Assertion and reason – Situation reaction test Verification of Truth of the Statement –Cubes and dice.		
UNIT-IV		**Classes: 6**
Syllogism – Statement-Arguments – Statement-Course of action-Statement-Assumptions – Deriving conclusion from passages – Theme detection – Cause and effect reasoning.		
UNIT-V	**Tabulation**	**Classes: 6**
Tabulation – Pi –Chart – Bar Diagram – Line Graphs- Area Volume & Surface Areas		

Text Books:

1. RS Agarwal , A textbook on Quantitative Aptitude
2. RS Agarwal, A textbook on verbal and reasoning.

Reference Books:

1. Bryman, A. *Research Methods and Organization Studies*, Unwin Hyman, London, 1989.
2. Denzin, N.K. and Lincoln, Y.S. (eds.). *Handbook of Qualitative Research*, Sage, Thousand Oaks, 1994.

Web References:

1. https://www.w3schools.com/quiztest/quiztest.asp?qtest=PHP
2. https://www.tutorialspoint.com/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Improve the competitive spirit.
2. Understand the key points that is useful for every competitive exam as well as placements.
3. Enhance their problem solving skill in their real life.
4. Think always in a short way..

ANDROID APPLICATION DEVELOPMENT

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC501	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Install and configure Android application development tools.
2. Design and develop user Interfaces for the Android platform.
3. Save state information across important operating system events.

UNIT-I	Introduction to JAVA, Android, Fundamentals	Classes:12

Java introduction : OOPs Concepts, Abstract class & Interface, Exception handling, Multi threading(Thread class & Runnable Interface)

Android: Why Android? , Android Run Time , Android Studio • Introduction to Gradle

Fundamentals : Basic Building blocks – Activities, Services, Broadcast Receivers & Content providers • UI Components- Views & notifications • Components for communication -Intents & Intent Filters • Android API levels(versions & version names)

UNIT-II	Application Structure	Classes:12

Android Manifest.xml ,uses-permission , Activity/services/receiver declarations , Resources & R.java , Layouts & Drawable Resources , Activities and Activity lifecycle ,Fundamental of Android UI design,Exploring Screen Layouts and Screen Densities,Creating Specific Device oriented Screen Layouts

UNIT-III	Basic UI design, Styles & Themes	Classes:12

Form widgets Text Fields Layouts RelativeLayout ,TableLayout, FrameLayout, LinearLayout, Nested layouts [dip,dp,sip,sp] versus px styles.xml drawable resources for shapes,gradients(selectors) , Style attribute in layout file , Applying themes via code and manifest file, AlertDialogs & Toast, Time and Date , Images and media

UNIT-IV	Adapters , emulator	Classes:12

Adapters ,ArrayAdapters , BaseAdapters , ListView and ListActivity, Custom listview, GridView using adapters ,Gallery using adapters ,Android Session and Session management

Launching emulator , Editing emulator settings , Emulator shortcuts , Logcat usage, Introduction to Android Device Monitor (ADM) , File explorer

UNIT-V	Content Providers, Notifications	Classes:12

Launching emulator ,Editing emulator settings , Emulator shortcuts, Logcat usage , Introduction to Android Device Monitor (ADM) ,File explorer

SQL : DML & DDL Queries in brief ,SQLiteDatabse, SQLiteOpenHelper, Cursor , SQLite Programming Reading and updating Contacts ,Android Debug Bridge(adb) tool ,Broadcast Receivers ,Services Notifications ,Alarm ,Via service

Text Books:

1. Professional Android4 Application Development, Reto Meier
2. Programming Android Java Programming for the new generation of Mobile Devices, Zigurd Mennieks

Reference Books:

1. Android Cook Book, Ian F Darwin

Web References:

1. https://lecturenotes.in/materials/14728-note-of-android-app-development-by-kailash-jadhav
2. https://lecturenotes.in/materials/16600-note-of-android-by-sourav-kumar

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Save state information across important operating system events.
2. Apply Java programming concepts to Android application development.

BIG-DATA ANALYTICS

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC502	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hodoop Eco System
6. Apply analytics on Structured, Unstructured Data.
7. Exposure to Data Analytics with R.

UNIT-I	INTRODUCTION TO BIGDATA	Classes:12

BigData: Introduction, Classification, Characteristics, Major Challenges, Traditional Approach of Storing and Processing.

Hadoop: Introduction, Important Features, How it Works, Eco Systems.

UNIT-II	HADOOP DISTRIBUTED FILE SYSTEMS	Classes:12

Introduction to HDFS, HDFS Daemons, Core Components of HADOOP, HADOOP Architecture. Name Node, Data Node, Secondary Name Node, Job Tracker, Task Tracker. Reading Data from HDFS, Writing Data to HDFS. Setting up Development Environment, Exploring HADOOP Commands, Rack Awareness.

UNIT-III	MAP REDUCE	Classes:12

Map Reduce Architecture, Job submission, Job Initialization. Task Assignment, Task execution, Progress and status updates, Job Completion. Shuffle and sort on Map and reducer side.

Map Reduce Types, Input formats, Output formats, sorting. Map side and Reduce side joins. Map Reduce Programs - Word Count Program, Maximum Temperature Program.

UNIT-IV	HIVE AND PIG	Classes:12

Hive: The Hive shell, Hive services, Comparison with traditional databases, Hive QL, Tables, Querying data, User-defined functions.

Pig: Introduction to Pig, Pig Latin.

UNIT-V	WORK EFFECTIVELY WITH COLLEAGUES, SQL USING R	Classes:12

Work effectively with Colleagues (NOS 9002): Introduction to work effectively, Team Work, Professionalism, Effective Communication skills, etc.

SQL using R: Introduction to NoSQL, Connecting R to NoSQL databases. Excel and R integration with R connector.

Text Books:

1. Tom White, Hadoop: The Definitive Guide, 4rd Edition, O'Reilly Publications, 2012.
2. Paul Zikopoulos, Chris Eaton, and Paul, Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data, The McGraw-Hill Companies, 2012.

Reference Books:

1. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publications, 2014.

Web References:

1. https://lecturenotes.in/subject/610/big-data-bd
2. https://lecturenotes.in/notes/6099-notes-for-data-analytics-da-by-prasanta-bal
3. https://lecturenotes.in/download/material/24002-note-for-big-data-analytics-bda-by-anurag-verma

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Obtain, clean/process and transform data.
2. Analyze and interpret data using an ethically responsible approach.
3. Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.
4. Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.
5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges.
6. Perform well in a group.
7. Interpret data findings effectively to any audience, orally, visually and in written formats

SOFTWARE TESTING

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC503	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes: 0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
2. Discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
3. Learn planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
4. Expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
5. Gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.

UNIT-I	Software Testing	Classes:12

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relating test life cycle to development life cycle Software Testing Methodology.

UNIT-II	Verification and Validation and Dynamic Testing I	Classes:12

Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low-level designs, How to verify code, Validation.

Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.

UNIT-III	Dynamic Testing II	Classes:12

Dynamic Testing II: White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing Static Testing: inspections, Structured Walk throughs, Technical reviews.

UNIT-IV	Validation activities	Classes:12

Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing Regression testing: Progressives Vs regressive testing, Regression test ability, Objectives of regression testing, When regression testing done?, Regression testing types, Regression testing techniques.

UNIT-V	CHANGE MANAGEMENT	Classes:12

Managing Change: Software Configuration Management, Change Management

Risks – Risk Analysis and Management with examples

User Acceptance testing – in detail explanation with details

Case Study: How to test web, stand alone and database applications – with examples.

Text Books:

1. Software Testing, Principles and Practices, Naresh Chauhan, Oxford
2. Foundations of Software testing, Aditya P Mathur, 2ed, Pearson
3. Software Testing- Yogesh Singh, CAMBRIDGE

Reference Books:

1. Software testing techniques – Baris Beizer, International Thomson computer press, second edition.
2. Software Testing, Principles, techniques and Tools, M G Limaye, TMH
3. Effective Methods for Software testing, Willian E Perry, 4ed, Wiley

Web References:

1. https://lecturenotes.in/notes/20947-note-for-software-testing-methodologies-stm-by-ram-sunnihith
2. https://lecturenotes.in/subject/488/software-testing-methodologies-stm
3. https://www.smartzworld.com/notes/software-testing-methodologies-pdf-notes-stm-pdf-notes/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Apply software testing knowledge and engineering methods.
2. Design and conduct a software test process for a software testing project.
3. Identify the needs of software test automation, and define and develop a test tool to support test automation.
4. Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
5. Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.

SOFTWARE PROJECT MANAGEMENT
(Elective – III)

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC504	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Understand the fundamental principles of Software Project management
2. Be familiar with the different methods and techniques used for project management.
3. have good knowledge of the issues and challenges faced while doing the Software project Management
4. Understand why majority of the software projects fails and how that failure probability can be reduced effectively.
5. Understand the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.

UNIT-I	SOFTWARE PROJECT MANAGEMENT CONCEPTS	Classes:12

SOFTWARE PROJECT MANAGEMENT CONCEPTS- Introduction to Software Project Management, An Overview of Project Planning, Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, identify activity risks, and Allocate resources.

UNIT-II	SOFTWARE EVALUATION AND COSTING	Classes:12

SOFTWARE EVALUATION AND COSTING-Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation.

Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods.

UNIT-III	SOFTWARE ESTIMATION TECHNIQUES AND ACTIVITY PLANNING	Classes:12

SOFTWARE ESTIMATION TECHNIQUES- Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy.

Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model.

UNIT-IV	RISK MANAGEMENT	Classes:12

RISK MANAGEMENT- Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.

UNIT- V	SOFTWARE QUALITY MANAGEMENT	Classes:12

SOFTWARE QUALITY MANAGEMENT-TQM, Six Sigma
SOFTWARE QUALITY: defining Software quality, ISO9126, External Standards, Comparison of project management software's Dot Project, Launch pad, open Proj.
Case study: PRINCE2.

Text Books:

1 Software Project Management, Walker Royce:PearsonEducation, 2005.
2 Software Project Management, Joel Henry, Pearson Education.

Reference Books:

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012.
2. 2. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition ,2014.
3. Richard H.Thayer "Software Engineering Project Management,": IEEE Computer Society
4. Futrell , "Quality Software Project Management", Pearson Education India, 2008
5. http://en.wikipedia.org/wiki/Comparison_of_project_management_software
   http://www.ogc.gov.uk/methods_prince_2.asp

Web References:

1. https://lecturenotes.in/subject/125/software-project-management-spm
2. https://lecturenotes.in/notes/18454-note-for-software-project-management-spm-by-kishan-chandra
3. https://www.studocu.com/en/document/swinburne-university-of-technology/software-project-practices-and-management/lecture-notes/software-project-practises-and-management-lecture-notes-lectures-1-12/502081/view

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students are able to:

1. Understand the activities during the project scheduling of any software application.
2. Learn the risk management activities and the resource allocation for the projects.
3. Can apply the software estimation and recent quality standards for evaluation of the software projects
4. Acquire knowledge and skills needed for the construction of highly reliable software project
5. Create reliable, replicable cost estimation that links to the requirements of project planning and managing.

MACHINE LEARNING
(Elective – III)

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC505	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Design and implement machine learning solutions to classification, regression, and clustering problems
2. Evaluate and interpret the results of the algorithms.

UNIT-I	Introduction & Supervised Learning	Classes:12

Linear Algebra, Matrix Calculus, Probability and Statistics, Linear Regression(Gradient Descent, Normal Equations),Weighted Linear Regression (LWR),Logistic Regression, Perceptron, Newton's Method, KL-divergence, (cross-)Entropy, Natural Gradient, Exponential Family and Generalized Linear Models, Generative Models ,Gaussian Discriminant Analysis, Naive Bayes),Kernel Method (SVM, Gaussian Processes).Tree Ensembles (Decision trees, Random Forests, Boosting and Gradient Boosting)

UNIT-II	Learning theory & Deep Learning	Classes:12

Regularization, Bias-Variance Decomposition and Tradeoff, Concentration, Inequalities, Generalization and Uniform Convergence, VC-dimension Neural Networks, Back propagation Deep Architectures

UNIT-III	Unsupervised Learning	Classes:12

K-means, Gaussian Mixture Model (GMM),Expectation Maximization (EM), Variational Auto-encoder (VAE),Factor Analysis, Principal Components Analysis (PCA),Independent Components Analysis (ICA)

UNIT-IV	Reinforcement Learning	Classes:12

Markov Decision Processes (MDP), Bellmans Equations, Value Iteration and Policy Iteration Value Function Approximation, Q-Learning

UNIT-V	Applications	Classes:12

Advice on structuring an ML project, Evaluation Metrics

Text Books:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer 2006.

Reference Books:

1. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013.
2. Pattern Classification, 2nd Ed., Richard Duda, Peter Hart, David Stork, John Wiley & Sons, 2001.

Web References:

1. http://faculty.ucmerced.edu/mcarreira-perpinan/teaching/CSE176/lecturenotes.pdf
2. https://www.holehouse.org/mlclass/

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Develop an appreciation for what is involved in learning models from data.
2. Understand a wide variety of learning algorithms.
3. Understand how to evaluate models generated from data.
4. Apply the algorithms to a real-world problem
5. optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

CLOUD COMPUTING
(Elective – III)

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC506	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Learn how to use Cloud Services.
2. Implement Virtualization.
3. Implement Task scheduling algorithms.
4. Apply Map-Reduce concept to applications.
5. Build Private Cloud.
6. Know the impact of engineering on legal and societal issues involved.

UNIT-I	Cloud architecture and model	Classes:12

Cloud architecture and model:

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

UNIT-II	Virtualization	Classes:12

Virtualization

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

UNIT-III	Cloud infrastructure	Classes:12

Cloud infrastructure: Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

UNIT-IV	Programming Models in Cloud	Classes:12

Programming Models in Cloud: BSP Model, Map Reduce Model, SAGA, Transformer, Grid Batch Framework Operating Systems: Role of OS in Cloud Computing, Features of Cloud OS, Cloud OS Requirements, Cloud-Based OS Application Environment

Application Environment: Need for Effective ADE, Application Development Methodologies, Power of Cloud Computing in Application Development

UNIT-V	Cloud Application Development Platforms	Classes:12

Cloud Application Development Platforms: Windows Azure, Google App Engine, Force.com, Manjrasoft Aneka

Cloud Computing APIs: Rackspace, IBM, Intel Software Development in Cloud : Introduction, Different perspectives on SaaS development, New challenges, Cloud aware software development using PaaS technology.

Text Books:

1 Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2 Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009. 4. Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India, 2011.
3 John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

Reference Books:

1 George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud"O'Reilly
2 James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3 Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing – A Business Perspective on Technology and Applications",Springer.
4 Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010.
5 Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, 'Mastering Cloud Computing", TMGH, 2014.

Web References:

1. https://www.iare.ac.in/sites/default/files/lecture_notes/CC%20LECTURE%20NOTES.pdf
2. http://www.srideviengg.com/documents/cse/cloud%20computing.pdf
3. https://lecturenotes.in/notes/14414-note-for-cloud-computing-cc-by-ayush-agrawal

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1 Differentiate between structures-oriented programming and object-oriented programming.
2 Apply concepts of operator overloading, constructors and destructors.
3 Apply exception handling and use built-in classes from STL.
4 Understand the file concepts.

NATUAL LANGUAGE PROCESSING
(Elective – IV)

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC507	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**			**Total Classes:60**			

OBJECTIVES:

The course should enable the students to:

1. Understand the key concepts from NLP are used to describe and analyze language
2. Learn POS tagging and context free grammar for English language
3. Understand semantics and pragmatics of English language for processing
4. Write programs in Python to carry out natural language processing

UNIT-I	Introduction	Classes:12

Introduction- Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes

Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, NLTK.

UNIT-II	Regular expressions	Classes:12

Regular expressions, Finite State Automata, word recognition, lexicon. Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF.

Part of Speech tagging- Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions

UNIT-III	survey on natural language grammars	Classes:12

A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax. Parsing- Unification, probabilistic parsing, TreeBank

UNIT-IV	Semantics	Classes:12

Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet Word Sense Disambiguation- Selectional restriction, machine learning approaches, dictionary based approaches.

UNIT-V	Discourse ,Applications of NLP	Classes:12

Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure.

Applications of NLP- Spell-checking, Summarization Information Retrieval- Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries. Machine Translation– Overview

Text Books:

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009
2. Speech and Language processing An introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216) 2. Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward

Reference Books:

1. James A.. Natural language Understanding 2e, Pearson Education, 1994 2. Bharati A., Sangal R., Chaitanya V..
2. Natural language processing: a Paninian perspective, PHI, 2000 3. Siddiqui T.,
3. Tiwary U. S.. Natural language processing and Information retrieval, OUP, 2008

Web References:

1. https://www.slideshare.net/abasit84/software-quality-assurance-lecture-1
2. http://www.cs.toronto.edu/~yijun/csc408h/handouts/lecture5.pdf
3. https://www.vidyarthiplus.com/vp/Thread-Software-Quality-Assurance-Lecture-Notes-2012-Edition#.XPiwftIzbDc

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

SOFTWARE QUALITY ASSURANCE
(Elective – IV)

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC508	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

OBJECTIVES:

The course should enable the students to:

1. Understand quality management processes
2. Distinguish between the various activities of quality assurance, quality planning and quality control.
3. Understand the importance of standards in the quality management process and their impact on the final product.

UNIT-I	Introduction To Software Quality & Architecture	Classes:12

Introduction To Software Quality & Architecture:

Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall‟s quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.

UNIT-II	Sqa Components And Project Life Cycle	Classes:12

Sqa Components And Project Life Cycle: Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.

UNIT-III	Software Quality Infrastructure	Classes:12

Software Quality Infrastructure:

Procedures and work instructions – Templates – Checklists – 4S developmenting – Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.

UNIT-IV	Software Quality Management & Metrics:	Classes:12

Software Quality Management & Metrics:

Project process control – Computerized tools – Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.

Text Books:

1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.

Reference Books:

1. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 1997.
2. Mordechai Ben-Menachem “Software Quality: Producing Practical Consistent Software”,

International Thompson Computer Press, 1997.

Web References:

1. https://www.slideshare.net/abasit84/software-quality-assurance-lecture-1
2. http://www.cs.toronto.edu/~yijun/csc408h/handouts/lecture5.pdf
3. https://www.vidyarthiplus.com/vp/Thread-Software-Quality-Assurance-Lecture-Notes-2012-Edition#.XPiwftIzbDc

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

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

1. learn software quality factors
2. Know about common software testing strategies
3. Understand about project process control and software Metrics About standards and certifications.

MIDDLEWARE TECHNOLOGIES
(Elective – IV)

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC509	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		4	0	0	4	40	60	100
Contact Classes:60	**Tutorial Classes:0**	**Practical Classes: Nil**				**Total Classes:60**		

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand different types of client server computing models and also Benefits of client server computing, pitfalls of client server programming
2. Establish communication between client and server through java RMI and JDBC
3. Implement C#, Net applications using Assemblies, Callback Interfaces, Delegates, and Events.
4. Carry out client server communication using heterogeneous programming languages using CORBA.
5. Learn java bean component model EJBS and CORBA

UNIT-I	Introduction to client server computing	Classes:12

Introduction to client server computing: Evolution of corporate computing models from centralized to Distributed computing, client server models. Benefits, pitfalls of client server Programming.

Advanced Java: Review of Java concept like RMI and JDBC.

UNIT-II	Introducing C# and the .NET Platform and Building c# applications	Classes:12

Introducing C# and the .NET Platform; Understanding .NET Assemblies, Object–Oriented Programming with C#, Callback Interfaces.

Building c# applications: Type Reflection, Late Binding, and Data Access with ADO.NET.

UNIT-III	Core CORBA / Java and Existential CORBA:	Classes:12

Core CORBA / Java: Two types of Client/ Server invocations-static, Dynamic. The static CORBA, First CORBA program, ORBlets with Applets, Dynamic CORBA-The portable count, The dynamiccount

ExistentialCORBA: CORBA initialization protocol, CORBA activation.services, Introduction to Service Oriented Architecture (SOA).

UNIT-IV	Java Bean Component Model	Classes:12

Java Bean Component Model: Events, Properties, Persistency, Introspection of beans, CORBA Beans.

UNIT-V	EJBs and CORBA	Classes :12

EJBs and CORBA: Object transaction monitors CORBA OTM's, EJB and CORBA OTM's, EJB container frame work, Session and Entity Beans.

Text Books:

1. Client/Server programming with Java and CORBA Robert Orfali and Dan Harkey, John.

Reference Books:

1. Kenneth C.Louden, "Programming Languages Principles and Practice", Second Edition.

Web References:

1. https://www.vidyarthiplus.com/vp/Thread-MC9251-MiddleWare-Technologies-Lecturer-Notes-All-Units-V-Edition#.XPjFzdIzbIU
2. http://csetube.blogspot.com/2014/05/it1402-middleware-technologies-anna_4741.html
3. https://www.technicalsymposium.com/alllecturenotes_MCA.html#.XPjF2NIzbIU

E-Text Books:

1. https://ndl.iitkgp.ac.in/

Outcomes:

At the end of the course students will be able to

1 Express computational solutions in the main programming idioms.
2 Select an appropriate programming language for solving a computational problem, with justification.
3 Know and understand the principal programming abstractions.
4 Know and understand the functional programming language.

ANDROID APPLICATION DEVELOPMENT LABORATORY

MCA V Semester – Master of Computer Applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC510	Core	-	-	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 44**				**Total Classes: 44**		

OBJECTIVES:

The course should enable the students to:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

LIST OF EXPERIMENTS

Expt. 1	**GUI Components**
Develop an application that uses GUI components, Font and Colors.	
Expt. 2	**Layout Managers and Event Listeners**
Develop an application that uses Layout Managers and event listeners.	
Expt. 3	**calculator application**
Develop a native calculator application.	
Expt. 4	**Graphical primitives**
Write an application that draws basic graphical primitives on the screen.	
Expt. 5	**Database.**
Develop an application that makes use of database.	
Expt. 6	**RSS Feed**
Develop an application that makes use of RSS Feed.	
Expt.7	**Multi threading**
Implement an application that implements Multi threading	
Expt. 8	**GPS location information**
Develop a native application that uses GPS location information.	
Expt. 9	**Writes data to the sd card.**
Implement an application that writes data to the SD card.	
Expt. 10	**Alerts**
Implement an application that creates an alert upon receiving a message	
Expt. 11	**Alarm clock application**
Write a mobile application that creates alarm clock.	

Reference Books:

1 Android Cook Book, by Ian F. Darwin, O‟reilly (SPD) publications.
2 Sam's Teach yourself Android Application Development (24 Hours)

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:

SOFTWARE REQUIREMENTS: Java Software Development Kit (JDK),Android Software Development Kit (SDK),Android Studio,Android Virtual Device Manager

HARDWARE REQUIREMENTS: Desktop Computers

OUTCOMES:

At the end of the course students will be able to

1. Install and configure Android application development tools.
2. Design and develop user Interfaces for the Android platform.
3. Save state information across important operating system events.
4. Apply Java programming concepts to Android application development.
5. Apply essential Android Programming concepts.
6. Develop various Android applications related to layouts & rich uses interactive interfaces
7. Develop Android applications related to mobile related server-less database like SQLITE

BIG-DATA TECHNOLOGIES LABORATORY

MCA V Semester – Master of Computer Applications								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
18MC511	Core	0	0	4	2	25	50	75
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes: 48**		

OBJECTIVES:

The course should enable the students to:

1. Introduce students the concept and challenge of big data (4 V's: volume, velocity, and variety).
2. Apply skills and tools to manage and analyze big data.
3. Provides an overview of approaches facilitating data analytics on huge datasets
4. Make classical analytics tools amenable for big datasets, analytics tools that can be applied in the batch or the speed layer of a lambda architecture, stream analytics, and commercial attempts
5. Make big data manageable in massively distributed or in-memory databases.
6. Assess the application of big data analytics technologies for different usage scenarios and start with their own experiments.

LIST OF EXPERIMENTS

Expt. 1	**Hadoop**
Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one Node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).	
Expt. 2	**Map Reduce application**
Map Reduce application for word counting on Hadoop cluster	
Expt. 3	**Unstructured data into nosql**
Unstructured data into NoSQL data and do all operations such as No SQL query with API	
Expt. 4	**K-means clustering**
K-means clustering using map reduce	
Expt. 5	**Page Rank Computation**
Page Rank Computation.	
Expt. 6	**Mahout Machine learning library**
Mahout Machine learning library to facilitate the knowledge build up in big data analysis.	
Expt.7	**Hadoop/mahout libraries**
Application of Recommendation Systems using Hadoop/mahout libraries	

Reference Books:

1 Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series,2012.

2 Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill,2011.

SOFTWARE AND HARDWARE REQUIREMENTS FOR STUDENTS:
SOFTWARE REQUIREMENTS: HADOOP, HIVE, PIG, Mongo DB, LINUX OS
HARDWARE REQUIREMENTS: Desktop Computers

OUTCOMES:

At the end of the course students will be able to

1. Identify the need for big data analytics for a domain.
2. Apply big data analytics for a given problem.
3. Suggest areas to apply big data to increase business outcome.
4. Use Hadoop, Map Reduce Framework handle massive data.

SEMINAR

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC212	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		0	0	4	2	50	-	50
Contact Classes: 0	**Tutorial Classes:0**		**Practical Classes: 40**			**Total Classes: 40**		

Objectives: To get involved with the latest advancements and developments to enhance communication and presentation skills, exchange of ideas, greater connectivity to develop a research bent of mind.

For the seminar, the student shall collect the information on a specialized relevant topic and prepare a report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Department Committee consisting of Head of the department, Seminar Supervisor and a Senior Faculty Member. Each Seminar shall be evaluated for 100 marks with a break up of 20 marks for report, 20 for subject content, 40 for presentation and 20 for queries.

TECHNICAL APTITUDE

MCA V Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18AS501	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		2	0	0	0	0	0	0
Contact Classes:36	**Tutorial Classes:0**		**Practical Classes: Nil**			**Total Classes:36**		

The external examination will be conducted for 50 Marks with 1 credit, examination type is Multiple Choice Question (MCQ) – Offline/Online.

PROJECT WORK

MCA VI Semester: Master of Computer Applications								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
18MC601	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		0	0	20	10	GRADE		
Contact Classes:0	**Tutorial Classes:0**	**Practical Classes: 80**				**Total Classes:80**		

Internal Evaluation for Major Project Work: 6th Semester:

Students are required to take up a project work, in which the student can choose any specific problem of Industry or Industry based project work. Alternatively it can be secondary source based or Field based project work. Before the commencement of the project work each student is required to submit a synopsis indicating the objectives, Methodology, Framework for analysis, Action plan with milestones in order to have clarity for the subsequent work. The project should have an internal faculty as guide. The student can initiate the project work in the penultimate semester of the course. The assignment normally includes:

- Preparing an action plan for conducting the investigation.
- In depth study of the topic assigned.
- Review and finalization of the approach to the problem relating to the assigned topic.
- Final development of product/process, testing, results, conclusions and further direction.
- Preparing a paper for conference presentation/ publication in journal if possible.
- Preparing a dissertation in the standard format for being evaluated by the department.
- Final presentation of the work done before the Project Review Committee (PRC).