ORDINANCE

FOR

MASTER OF COMPUTER APPLICATIONS

GNA UNIVERSITY

Inspiring Innovation.....

(THIS ORDINANCE HAS BEEN APPROVED IN THE MEETING OF BOARD OF STUDIES HELD ON DATED 2 June, 2022)

APPLICABLE W.E.F. ACADEMIC SESSION 2022-2023

GNA UNIVERSITY
SRI HARGOBINDGARH, PHAGWARA – HOSHIARPUR ROAD,
PHAGWARA 144401, PUNJAB

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ORDINANCE FOR MASTER OF COMPUTER APPLICATIONS

SHORT TITLE AND COMMENCEMENT

I. This ordinance shall be called the ordinance for the MCA of GNA University, Phagwara.

II. This ordinance shall come into force with effect from academic session 2022-23.

1. Name of Program: Master of Computer Applications

- **2. Name of Faculty: Faculty of Computational Science**
- **3. Vision of the department:** To develop the skilled computer and IT professionals meeting global requirements of IT industry
- **4. Mission of the department M1:** To provide state of art infrastructure and conducive environment for budding IT professionals.
- **M2:** To establish strong industry academia relationship to enhance the technical skills of the students and make them readily employable.
- **M3:** To provide exposure to the emerging and establish tools and technology in the field of computer applications.
- **M4:** To develop curriculum in accordance with the industry requirements.
- **5. Program Educational Outcomes (PEO):**

PEO1: To prepare graduates who will be successful professionals in the industry, government, academia, research, entrepreneurial pursuit, and consulting firms.

PEO2: To prepare graduates who will contribute to society as broadly educated, expressive, ethical, and responsible citizens with proven expertise.

PEO3: To prepare graduates who will achieve peer-recognition; as an individual or in a team; through demonstration of good analytical, design and implementation skills.

PEO4: To prepare graduates who will thrive to pursue life-long learning to fulfil their goals

6.Program Outcomes (PO):

PO1: Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

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PO2: Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO3: Design/Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex Computing problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, adapt, and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO6: Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PO7: Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO8: Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9: Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations and give and understand clear instructions.

PO10: Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

PO11: Individual and Teamwork: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12: Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large

7.Program Specific Outcomes (PSO):

PSO1: Understand the concepts and applications in the field of Computer Science like Web designing and development, Cyber Security, Data Science, Network and communication technologies.

PSO2: Apply the learning from the courses and develop applications for real-world problems.

PSO3: Understand the technological developments in the usage of modern design and development tools to analyze and design for a variety of applications.

PSO4: Communicate in both oral and written forms, demonstrating the practice of professional ethics and the concerns for social welfare

.8. General Regulations for Faculty of Computational Science:

- The University may introduce programs under the Faculty of Computational Science which are specified under the UGC Act 1956. The Governing Body may approve the introduction, suspending or phasing out a program on the recommendation of the Academic Council either on its own or on the initiative of faculty
- The admissions to Faculty of Computational Science programs shall be generally governed by the rules of the UGC/AICTE or any other competent authority of the MHRD or as approved by Governing Body of University and shall be as notified in the admission notification of the respective academic year.
- The minimum entry qualification for admission to the students of Faculty of Computational Science shall be such as may be laid down in the regulations or specified by the Governing Body like Minimum qualification for admission to the first-year program of Faculty of Computational Science shall be the Bachelor degree. While deciding the admission procedure, the University may lay down compulsory subjects in the qualifying examination for admission for various programs in the admission policy.
- A student shall be required to earn a minimum number of credits through various academic components of a curriculum, as provided for in the regulations.
- A student shall be required to complete all the requirements for the award of the degree within such period as may be specified in the regulations.

- A student may be granted such scholarship as may be specified in accordance with the directions of the Governing Body from time to time or regulations laid down for the same.
- A student admitted to the program shall be governed by the rules, regulations and procedures framed and implemented by the University from time to time.
- The students shall abide by the regulations mentioned in student handbook issued by the University. These standing regulations shall deal with the discipline of the students in the Hostels, Faculty, and University premises or outside. The standing orders may also deal with such other matters as are considered necessary for the general conduct of the students' co-curricular and extra-curricular activities.
- In exceptional circumstances the chairman of Academic Council may, on behalf of the Council, approve amendments, modifications, Insertions or deletions of an Ordinance(s) which in his/her opinion is necessary or expedient for the smooth running of the program: provided all such changes are reported approved to the Council in its next meeting.

9.General Regulations for the MCA Program:

- **Short Title and Commencement:** These regulations shall be called regulations for the PG program in the Faculty of Computational Science of the University and shall come into force on such date as the Academic Council may approve.
- **Duration:** The duration of the PG programs leading to degrees of MCA shall be minimum two years and each year will comprise of two semesters. However, the duration may be extended up to four years from the registered batch. The maximum duration of the programs excludes the period of withdrawal, due to medical reasons. However, it shall include the period of rustication or any other reason of discipline /academics e.g. detention, willful absence by the student, not getting a promotion to the next class due to poor academic performance etc. Under detention, the student shall attend the University for an additional semester or more time, as equated to a period of absence/suspension.
- **Starting or Phasing out of Program:** The University offers Postgraduate programs in the Faculty of Computational Science leading to award a degree in Master of Computer Applications, as per nomenclature laid by the AICTE regulations on the subject. A program may be phased out on recommendations of the Academic Council and approval of the Governing Body, on account of continuous low registration in the program or any other justifiable reason like becoming obsolete etc. Similarly, the Academic Council may approve starting of a new program or modifying the existing one on the recommendations of the Academic Council.
- **Admissions:** Admission to MCA program shall be made as per procedure approved by the Governing Body and may be reviewed periodically as required. Fee structure, refund policy, the total number of seats, reservation policy, and special category seats, e.g. sponsored seats.
- **Eligibility for Admission:** Students who have passed Bachelor of Computer Application or bachelor's degree in Computer Science Engineering or equivalent degree. Candidates must have obtained at least 50 percent marks or 45 percent marks in the case of candidates belonging to reserved categories in the qualifying examination.

OR

Students who have passed Bachelor of Science, Bachelor of Commerce or Bachelor of Arts with mathematics at ten plus twelve levels or at the graduation level with additional bridge courses as per the norms of the concerned university. Candidates must have obtained at least 50 percent marks or 45 percent marks in the case of candidates belonging to reserved categories in the qualifying examination.

- **Semester System:** The MCA academic programs in the University shall be based on Semester System; namely, Even (Jan to June) and Odd (July to Dec) Semesters, in an academic year. The courses whether offered in a regular semester shall be evaluated as per the policy and procedure laid down.
- **Semester Duration:** A semester will be of approximately 18-20 weeks duration. Of these, 90 days will be available for actual instructions including Mid Semester Exam.
- **Admission Process:** The centralized admission cell shall make a selection of a candidate for admission to the program. The selection of the candidate shall be strictly on a merit basis, subject to fulfillment of the eligibility criteria. Candidates are required to fill the prescribed application form and submit the same to the admission cell. The admission cell after verifying the eligibility will forward the form to the Registrar Office for further processing. If the candidate is selected, he/she is required to deposit the prescribed fee along with the application form and the required documents to the Registrar Office.
- **Curriculum:** The one year's curriculum has been divided into two semesters and shall include lectures/ tutorials/laboratory work/Industry training/Industry visits/project work/viva-voce/seminars/presentations/ assignments/ etc. The curriculum will also include other curricular, co-curricular and extra-curricular activities as may be prescribed by the

university from time to time.

11.Choice Based Credit System:

● The University has adopted Choice Based Credit System (CBCS), which provides an opportunity to the students to choose courses from the offered courses comprising of Professional Core Course, Professional Elective courses, Humanities & Social Sciences including Management course, Industry Training and Project. The choice-based credit system provides a "flexible" approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Following are the types of courses and structure for the program:

Courses:

I. Professional Core Course: A course, which should compulsorily be studied by a candidate as a core requirement to complete the requirement of the program in a said discipline of study.

II. Professional Elective courses: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/specialization/subject of study or which provides an extended scope, or which enables exposure to some other discipline/subject/ domain or nurtures the candidate's proficiency/skill is called a professional Elective Course. The students will have options of selecting the electives from the different tracks/threads depending on the specialization one wishes to acquire.

III. Humanities & Social Sciences including Management courses: A course which is based upon the content that leads to Knowledge enhancement. i.e. Environmental Science, English/MIL Communication, and management-based subjects etc.

IV. Industry Training: Each student would work with an IT industry, on a project for a period of a minimum of 4 - 6 weeks at the end of the first year. The objective is to allow students, intense day-to-day interaction with the IT industry. Summer Training would provide exposure to the student to working of the industry in the real-life setting. It would also help students to develop technical skills and competencies and facilitates an informed career choice by the students.

V. Project: A project shall be a multifaceted assignment that serves as a culminating academic and intellectual experience for students, typically during the 3rd semester at the University. The project may take a wide variety of forms, but they shall be semester-long investigative projects that culminate in a final product, presentation, or performance.

VI. Industrial Training (Six-month): Each student would work with an IT industry, on a project for a period of a minimum of 6 months in the fourth semester. The objectives of six months training will expose to students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.

VII. Research /Technical Seminar: A technical presentation on a seminar topic will help a student to understand the topic well and also gain knowledge about that topic by doing background research.

12. Medium of Instructions:

12.1 The medium of instructions and examination will be English.

12.2 Practical/Laboratory work/Project Work/Project Report/Training Report etc., if any, should be presented in English.

13. Mode: The program is offered in 'Full Time' mode of study only.

14. Attendance Requirement to be Eligible to Appear in End Semester Examination:

14.1 Every student is required to attend at least 75% of the lectures delivered squaring tutorials, practical and other prescribed curricular and co-curricular activities.

14.2 Dean of Faculty may give a further relaxation of attendance up to 10% to a student provided that he/she has been absent with prior permission of the Dean of the Faculty for the reasons acceptable to him/her.

14.3 Further, relaxation up to 5% may be given by the Vice-Chancellor to make a student eligible under special circumstances only.

14.4 No student will be allowed to appear in the end semester examination if he/she does not satisfy the attendance requirements. Further, the attendance shall be counted from the date of admission in the University or commencing of academic session whichever is later.

14.5 Attendance of N.C.C/N.S.S. Camps or Inter-Collegiate or Inter-University or Inter-State or International matches or debates or Educational Excursion or such other Inter-University activities as approved by the authorities' involving journeys outside the city in which the college is situated will not be counted as an absence. However, such absence shall not exceed four weeks per semester of the total period of instructions. Such type of facility should not be availed twice during the study.

15. Credit: Each course, except a few special audit courses, has a certain number of credits

assigned to it depending upon its lecture, tutorial and/or laboratory contact hours in a week.

A letter grade, corresponding to a specified number of grade points, is awarded in each course for which a student is registered. On obtaining a passing grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average. A minimum number of credits should be acquired to qualify for the programs. The absolute grading system has been followed for awarding grades for the course.

Earned Credits (EC): The credits assigned to a course in which a student has obtained 'D' (a minimum passing grade) or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained F, or W or "I" grade will not be counted towards his/her earned credits.

Contact Hours per Week	Credit Assigned
1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
2 Hours Practical (Lab) per week	1 credit

16. Grading System: University follows eight-letter grading system (A+, A, B+, B, C+, C, D, and F) that have grade points with values distributed on a 10-point scale for evaluating the performance of a student. The letter grades and the corresponding grade points on the 10-point scale are as given in the table below.

Academic Performance	Range of marks	Grades	Grade Points
Outstanding	≥90	A+	10
Excellent	≥80 & < 90	A	9
Very Good	≥70 & < 80	B+	8
Good	≥60 & < 70	B	7
Fair	≥50 & < 60	C+	6
Average	>40 & < 50	C	5
Minimally Acceptable	40	D	4
Fail	< 40	F	0
Incomplete		I	–
Withdrawal		W	–
Grade Awaited		GA	–
S-Satisfactory, US-Unsatisfactory Minor Project		**S/US**	

Description of Grades:

A. D Grade: The D grade stands for marginal performance, i.e. it is the minimum passing grade in any course. D grade shall not be awarded below 30% marks, though each teacher may set higher marks for the same.

B. F Grade: The 'F' grade denotes a very poor performance, i.e. failing a course. A student has to repeat all courses in which she/he obtains 'F' grade until a passing grade is obtained. In the case of 'F', no Grade points are awarded. However, the credits of such courses shall be used as the denominator for calculation of GPA or CGPA.

C. W Grade: The 'W' grade is awarded to a student if he/she is allowed to withdraw for an entire Semester from the University on medical grounds for a period exceeding five weeks.

D. I" Grade: The 'I' grade is awarded when the student is allowed additional opportunity like makeup Examination etc. based on which the grade is to be decided along with other components of the evaluation during the semester 24 An incomplete grade of 'I' may be given when an unforeseen emergency prevents a student from completing the work in a course. The 'I' must be converted to a performance grade (A to F) within 90 days after the first day of classes in the subsequent regular semester.

E. X Grade: It is equivalent to Fail grade but awarded due to a student falling below the laid down attendance requirement. Students having X grade shall be required to re-register for the course, when offered next.

Cumulative Grade Point Average (CGPA), it is a measure of the overall cumulative performance of a student for all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all Semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimals places.

NB: The CGPA can be converted to percentage by using the given formula:

CGPA x 10 = %

e.g. 7.8 x 10 = 78%

Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (Course title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

16.1 Acceptance of MOOC courses

Faculty of Faculty of Computational Science accepts the MOOC course available on SWAYAM platform for credit transfer. 40% of the courses can be taken from the available list of MOOCs on SWAYAM.

Instructions for MOOC courses

1. MOOC courses taken for credit transfer must be approved and recommended by Dean Academics and Dean of the Faculty before the start of the semester.
2. The copy of the list of courses taken by the students for any course has to be submitted to the Controller of the Examination.
3. MOOC course should be done from SWAYAM platform as per the guidelines of UGC.
4. To obtain the credit the student needs to complete the assessment of the course and provide the certificate of the course issued by the SWAYAM/NPTEL. After completing the certificate,

the student must submit the certificate within a week to the department.

5. The fees (if any) for the registration and / or assessment of the MOOC course must be borne by the student only.
6. The student can opt for a particular online MOOC course if and only if the credit of that course is equivalently mapped with the program structure.
7. If the student obtains the same course credit which mapped with the course, then credit shall be considered for this course and the grade/marks provided by the accessing authority shall be transfer to the student. The result of the MOOC shall be taken on record by the university examination cell and a result declared for these papers.
8. For any particular semester, all results for the MOOC course must be submitted along with the marks of other papers of the same semester by the course coordinator.
9. MOOC course coordinators shall be appointed for each of the course taken by the student.

17. Program Structure:
As per GNA University

Course Category	Papers	Credits	Total Credits
Professional core courses (PCC)	14	3	42
Professional core courses (PCC) Lab	3	2	6
Professional core courses (PCC) Lab	7	1	7
Professional Elective courses (PEC)	4	3	12
Humanities & Social Sciences including Management courses (HSMC)	1	2	2
Capstone Project	1	2	2
Professional Training	1	2	2
Industry Training (Six Months)	1	28	28
Research /Technical Seminar	1	2	2
Total	33	-	104

18. Industrial Training:

● Summer Industrial training is a core course, to be done typically during the summer vacations. A student should undergo industrial training for 4-6 weeks, starting after the first year, preferably in IT industry, R & D institutions is of repute permitted. Summer Industry Training will be evaluated during the 3rd semester.

● Six months Industrial training is a core course, and it is a mandatory course for each student to pass the MCA degree. A student should undergo industrial training for 6 months, starting after 3rd semester, preferably in a reputed IT industry, R & D institutions of repute permitted. Industry Training will be evaluated and is essential part of the degree requirement after completing the industry training.

● It is the responsibility of the Corporate Relations Department (CRD) to arrange training for all the students. At the beginning of each academic session, the Corporate Relations Department will prepare a program wise list of potential training organizations. These organizations will be approached by the Corporate Relations Department with a request to provide training seats. Consolidated lists of training offers will be made available to the eligible students at the beginning of the semester of the session. If a student is interested in making his/her own arrangement for the training seat, he/she will need to have the training organization approved by routing the application to the Dean/HOD of Faculty of Computational Science for approval.

● Students will be required to get their training activity and results reviewed by an organization in which they have attended the training. The department will nominate a training coordinator from amongst the faculty members. The faculty members will scrutinize the training report and the certificate issued by the corporate and will award a grade, which must be sent to the controller of examination office within a month. The student will have to undergo fresh industrial training in part or full duration as decided by the Dean/HOD of Faculty of Computational Science. The industrial training, submission of training report and obtaining satisfactory grade is a mandatory requirement for the award of MCA degree.

18. Examination/Evaluation System: The evaluation system of the University shall be oriented to encourage academic qualities. The University follows two components to evaluate student's performance:

18.1. Internal Assessment: It includes components such as Attendance, Mid-Semester Examination, Assignments, Continuous Assessment Test etc. carrying a weightage of 40%. This is applicable to all theory courses.

18.2. Laboratory Courses: The examination/evaluation criteria of the practical courses shall be decided by the respective faculty member and wherever required on the availability of the external experts/visiting faculty. Faculty may set/design the practical exercises out of any marks but the overall weightage shall be in pre-defined percentage, which the concerned faculty/course coordinator shall announce in the first class of the semester and upload on the GU-MS. Methodology for evaluation of Lab component may include day to day work, lab records, quantity/quality of work and Viva-voce/Seminar/Practical as may be decided.

18.3. Laboratory Internal Assessment: It includes components Lab evaluation, Internal viva-voce, Attendance, Lab Practical File/Report Submission carrying a weightage of 60%. carrying a weightage of 60%. The internal marks of special courses like Project, summer industry training, and six-months industry training have been predefined.

18.4. External Assessment:

a) **End Semester Examination:** These examinations shall be conducted by Controller of Examination. The examination dates and schedule shall be released by the University.

b) End Semester Examination, carrying a weightage of 60%.

c) The external marks of special courses like Project, summer industry training, and six-months industry training have been predefined.

d) External Lab Assessment which includes components (External Lab Viva-Voce) carrying a weightage of 40 %.

e) Every student has to score at least 25% marks each in Continuous Assessment and End Semester Examination. The minimum pass percentage is 40% in aggregate. In case a student scores more than 25% each in Continuous Assessment and End Semester Examination, but the overall percentage in the concerned subject remains less than 40%, then a student has to repeat End Semester Examination in that subject.

18.5. Failing to meet Attendance Requirement:

a) A student is required to attend all the classes.

b) If the attendance profile of a student is unsatisfactory, he/she will be debarred. Any student, who has been debarred due to attendance shortage, shall not be allowed to take the supplementary Examination. The student shall have to register for the course in the regular semester when offered.

18.6. Make Up Examinations for Mid Semester Examination: A student may apply for a makeup examination where he/she is not able to attend the examination schedule due to reasons of personal medical condition or compassionate reason like the death of a very close relative. No other contingencies are acceptable. Except in case of a medical emergency, a student needs to seek advance approval from appropriate authority before missing the Examination.

Theory Courses:

- A student missing Mid Term Examination only shall be required to take a make-up examination.
- The students must put-up the request for make-up Examination along with the medical documents to prove the genuineness of the case (for having missed the Examination) within 5 days of the last date of Examination.
- The genuineness shall be reviewed and approved by the Vice-Chancellor, whose decision shall be final.
- In case a student misses the make-up Examination also, then no further chance will be provided.
- The duration of Examination shall be as decided by the faculty member.
- Genuine approved cases shall be notified by the Controller of Examination based on the requests received and only such students shall be allowed to take make-up Examination in the subjects where approval has been granted.
- The date sheet need not be taken out as the makeup examination shall be conducted under arrangement concerned faculty, who after evaluation and sharing the evaluated answer sheet with the student shall submit marks to the Controller of Examination.

18.7. Makeup of End Semester Examination: It is mandatory to appear the end semester major examination to obtain any grade for a course. A student who misses the end semester major examination shall follow a similar procedure as outlined above, to obtain approval of the Vice-Chancellor to prove the genuineness of the case. The student whose case is approved as genuine shall be awarded "I" Grade in the semester results in the given subject. The student shall be allowed to appear in the supplementary examination of the said subject. However, the grades shall be worked out by computing the marks obtained by students in Mid Term Exams, TA, Lab and supplementary examination (equated to the weightage of end semester examination). The total marks shall be compared with the marks of the class as in the regular semester for the award of grade.

18.8. Makeup of End Semester Viva of Projects: It is mandatory to appear in the final Viva examination to obtain any grade for a project course. In case of a student missing the same for genuine reasons; a similar method as given for written examination of theory courses shall be followed.

18.9. Procedure to be adopted by students in case of missing any of the specified Examination(s): Following procedure shall be adopted for establishing the genuineness of the case.

a. Action by the student (Medical Cases)

I. They should report an absence from the Examination(s) by the fastest possible means to the Controller of Examination. It could be email or written communication by speed post or sent by hand through any means. In the case of Hosteller's, if a student falls sick while residing in the hostel, he/she should seek the advice of the available qualified doctor.

II. The said report should preferably be sent before the Examination, but no later than 5 days after the last date of the said Examination.

III. The student should on rejoining:

a. Report to the Controller of Examination with complete medical documents to include referral/Prescription slip of the doctor specifically indicating the disease and medicine prescribed, investigation/Lab reports and discharge slip in case of admission should be provided.

b. Submit the Documents to the Controller of Examination, not later than 5 days after the last date of Examination.

IV. In case delay beyond 5 days is anticipated the student should arrange for the medical documents to be sent to the University Medical Officer by hand through a friend / relative etc. and get the said genuineness deposit with the Controller of Examination.

V. No request later than 5 days after the last date of Examination shall be accepted for reasons of ignorance or any other reasons.

b. Action by students (any other reason)

In case the student must miss Examination due to genuine reason other than medical, prior written sanction of Vice-Chancellor and in his absence Dean is mandatory. No post facto requests shall be accepted in any case. The approval should be deposited with the Controller of Examination before the examination.

19. Supplementary Examination:

19.1. The supplementary examinations shall be held for each commiserating semester in December for Odd semester and May/June for Even semester respectively. For the final semester students, there is privilege to appear in the supplementary exams of all previous semester.

19.2. Eligibility: Student with 'F' grade is eligible to appear in the Supplementary Examination.

19.3. Supplementary for Projects: There shall be no supplementary examinations for the projects, except makeup examination for missing the final viva as per rules outlined above.

20. General Rules: Examinations:

a) Showing the Answer Scripts: The answer scripts of all written Examinations i.e. Mid Term or end semester examination or any other written work conducted by a teacher shall be shown to the students. Students desirous of seeing the marked answer scripts of End Semester Examination has to ensure their presence before results are declared, as per dates notified by the Controller of Examination.

b) Marks/Answer Sheets of all other tests shall also be shared with the students and thus, there shall be no scrutiny of grades. However, before the grades are forwarded to Registrar/Controller of Examination, they should be displayed on GU-MS and time are given to students, to discuss the same with respective faculty.

c) No appeal shall be accepted for scrutiny of grades.

d) Examination Fee for Supplementary. A fee of Rs.1000/- per course or as decided by the Management from time to time will be charged from the students.

21. Improvement of overall Score: A candidate having CGPA < 5.5 and wishes to improve his/her overall score may do so within two academic years immediately after passing the degree program by reappearing into maximum four course(s)/subject(s). The improvement would be considered if and only if the CGPA becomes > 5.5.

22. Program qualifying criteria: For qualifying the Program every student is required to earn prescribed Credits **(i.e. 104).** If any student fails to earn prescribed credits for the program, then he/she will get a chance to complete his/her Program in two more years than the actual duration of the degree.

23. Revision of Regulations, Curriculum and Syllabi: The University may revise, amend, change or update the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies and the Academic Council as and when required.

24. Conditions for Award of a Degree:

a) Earning a minimum credit as specified in the curriculum of the respective program.

b) Should complete the requirements of the Degree in maximum duration specified for the program. Semester withdrawals due to medical reasons are not counted in five years. However, forced withdrawal of students e.g., rustication or expulsion or nonattendance by the student due to any other reasons shall count in the maximum period of five years and minimum period of four years.

c) Successfully completing the Internship studies.

d) Should have cleared all the foundational, electives and core courses of the programs.

Master of Computer Applications Semester I (First year)

Sr. No	Category	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credits
				L	T	P	Internal	External		
1	Professional Core Courses	MCA1101	Python Programming	3	0	0	40	60	100	3
2	Professional Core Courses	MCA1121	Python Programming Lab	0	0	2	30	20	50	1
3	Professional Core Courses	MCA1112	Advanced Computer Networks	3	0	0	40	60	100	3
4	Professional Core Courses	MCA1132	Advanced Computer Networks Lab	0	0	2	30	20	50	1
5	Professional Core Courses	MCA1113	Relational Database Management System	3	0	0	40	60	100	3
6	Professional Core Courses	MCA1113	Relational Database Management System Lab	0	0	2	30	20	50	1
7	Professional Core Courses	MCA1109	Advanced Computer Architecture	3	0	0	40	60	100	3
8	Professional Core Courses	MCA1110	Advanced Software Engineering	3	0	0	40	60	100	3
9	Professional Core Courses	MCA1111	Research Methodology	3	0	0	100		100	3
	Total Credits			**18**	**0**	**6**	**390**	**360**	**750**	**21**

Master of Computer Applications Semester II (First year)

Sr. No	Category	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credits
				L	T	P	Internal	External		
1	Professional Core Courses	MCA1213	Advanced Data Structure and Algorithms	2	1	0	40	60	100	3
2	Professional Core Courses	MCA1233	Advanced Data Structure and Algorithms Lab	0	0	4	30	20	50	2
3	Professional Core Courses	MCA1214	Artificial Intelligence	3	0	0	40	60	100	3

4	Professional Core Courses	MCA1234	Artificial Intelligence Lab	0	0	2	30	20	50	1
5	Professional Core Courses	MCA1215	Full Stack Web Development	3	0	0	40	60	100	3
6	Professional Core Courses	MCA1235	Full Stack Web Development Lab	0	0	2	30	20	50	1
7	Professional Core Courses	MCA1204	Java Programming	3	0	0	40	60	100	3
8	Professional Core Courses	MCA1224	Java Programming Lab	0	0	4	30	20	50	2
9	Professional Elective courses	MCA****	Elective-I	3	0	0	40	60	100	3
10	Professional Elective courses	MCA****	Elective-II	3	0	0	40	60	100	3
	Total Credits			**17**	**1**	**12**	**360**	**440**	**800**	**24**

*** The students will take 4-6 weeks summer training in Industry after semester 2nd.**

Master of Computer Applications Semester III (Second year)

Sr. No	Category	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credits
				L	T	P	Internal	External		
1	Professional Core Courses	MCA1301	Theory of Computation	3	0	0	40	60	100	3
2	Professional Core Courses	MCA1313	Data Analytics Using R	3	0	0	40	60	100	3
3	Professional Core Courses	MCA1333	Data Analytics Using R Lab	0	0	2	30	20	50	1
4	Professional Core Courses	MCA1314	Advanced Operating systems	3	0	0	40	60	100	3
5	Professional Core Courses	MCA1334	Advanced Operating systems Lab	0	0	2	30	20	50	1
6	Professional Core Courses	MCA1315	Computer Graphics	3	0	0	40	60	100	3
7	Professional Core Courses	MCA1335	Computer Graphics Lab	0	0	2	30	20	50	1
8	Humanities and Social Sciences including Management courses	MCA1316	Soft Skills	2	0	0	-	-	100	2
9	Professional Core Courses	MCA****	Elective-III	3	0	0	40	60	100	3
10	Professional Elective courses	MCA****	Elective-IV	3	0	0	40	60	100	3
11	Project	MCA1350	Capstone Project	0	0	4	60	40	100	2
12	Professional Training	MCA1340	Summer Industry Training	-	-	-	60	40	100	2
	Total Credits			**20**	**0**	**10**	**500**	**500**	**1050**	**27**

Master of Computer Applications Semester IV (Second year)
(Industrial Training)

Sr. No	Category	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credits
				L	T	P	Internal	External		
1	Project (Six Months internship)	MCA1440	Industrial Training and Project	0	0	0	300	400	700	28
2	Seminar	MCA1450	Research / Technical Seminar	0	0	0	-	-	100	2
	Total Credits			**0**	**0**	**0**	**300**	**400**	**800**	**30**

LIST OF ELECTIVES (SPCIALIZATION)

DATA SCIENCE DOMAIN

Elective course	Seminar	Course Name
Elective-I	MCA1216	Data Mining and Warehousing
Elective-II	MCA1209	Data Sciences
Elective-III	MCA1305	Data Visualization
Elective-IV	MCA1319	Data Science with Python

AI & ML DOMAIN

Elective course	Seminar	Course Name
Elective-I	MCA1217	Machine Learning and Pattern Recognition
Elective-II	MCA1219	Natural Language Processing
Elective-III	MCA1317	Deep Learning
Elective-IV	MCA1320	Soft Computing

CYBER SECURITY DOMAIN

Elective course	Seminar	Course Name
Elective-I	MCA1220	Cyber Security Fundamentals
Elective-II	MCA1211	Network Security
Elective-III	MCA1318	Fundamentals of Ethical Hacking
Elective-IV	MCA1311	Blockchain Technology

OPEN ELECTIVES

Elective course	Seminar	Course Name
Elective-I	MCA1218	Professional Ethics
Elective-II	MCA1212	Accounting and Financial Management
Elective-III	MCA1308	Enterprise Management and Computing
Elective-IV	MCA1312	Entrepreneurship Development

Open electives are based on Industrial perspectives for MCA Students.

Note: The electives will be offered to the students depending upon the availability of the teachers. The decision of the Head/Dean of the Department in this respect will be final.

Bridge Course (MCA 2 Years)

This bridge course is conducted for the Non-IT graduates i.e., BA, B. Com, and B.Sc. and compulsory for non-computer background students. It is mandatory to complete the syllabus of the bridge course at the beginning of MCA 1st Semester. These courses are non-credits.

Master of Computer Application

[Bridge Course]

Sr. No	Category	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credits
				L	T	P	Internal	External		
1	Bridge Course	MCA1107	Computer Fundamentals and Programming in C	0	0	0	60	-	60	S/US
2	Bridge Course	MCA1108	OOPS using C++	0	0	0	60	-	60	S/US
	Total Credits			**0**	**0**	**0**	**120**		**120**	**-**

Examination Pattern

1. The student will have to appear for MCQ based paper of 60 questions carrying 1 mark. There is no negative marking for wrong answer. All questions are compulsory.
2. The bridge course is mandatory for all non-IT students. MCA degree shall not be awarded unless student successfully complete the Bridge course.
3. Examination will be conducted by the Department internally at the end of first semester.
4. The student has to secure 40 percentage marks in order to pass the examination.
5. The 15 questions from each unit of the syllabus.

FACULTY OF COMPUTATIONAL SCIENCES

Annexure-I (MCA)

MASTER OF COMPUTER APPLICATIONS

(Applicable for 2022-2023 onwards)

MCA 1101: Python Programming

Credits: 3

LTP 300

Course Objectives: The course aims to equip the students to learn computer programming via python programming language. In this course student will be able to:
1. Develop the programming skills in core Python.
2. Understand the basic and advanced programming concepts of Python.
3. Understand python-based web application framework like Django.
4. Build database applications in Python.

Course Outcomes (CO):
Upon successful completion of the course, the students should be able to:
CO1: Describe the Python environment, data types, operators used in Python.
CO2: Design and implement basic applications with database connectivity.
CO3: Use of control structures and numerous native data types with their methods.
CO4: Identify and handle the exceptions in programs through appropriate exceptions handling methods.
CO5: Develop python-based web application framework like Django.

Course Content

Unit I

Introduction: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, First Python Program, Python Interactive Help Feature, Python differences from other languages, Installing and setting Python environment in Windows and Linux, basics of Python interpreter, Execution of python program, Editor for Python code, syntax, variable, Data types. Flow control: if, if else, for, while, functions, continue, pass, break. Strings: Sequence operations, String Methods, Pattern Matching.

Unit II

Lists: Basic Operations, Iteration, Indexing, Slicing and Matrixes; Dictionaries: Basic dictionary operations; Tuples and Files; Functions: Definition, Call, Arguments, Scope rules and Name resolution; Modules: Module Coding Basics, Importing Programs as Modules, Executing Modules as Scripts, Compiled Python files(.pyc), Standard Modules: OS and SYS, the dir () Function, Packages, Different ways to import Packages.

Unit III

Classes and Objects: The concept of OOPS in Python, designing classes, creating objects, accessing attributes, editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

Exception Handling and Classes: Exception Handling-Introduction, Exceptions, and its types, how to handle exceptions**.**

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read () & write () methods, tell () & seek () methods, renaming & deleting files in Python, directories in Python.

Python SQL Database Access: Introduction, Installation, DB connection, Creating DB table, INSERT, READ, UPDATE, DELETE operations.

Unit IV

Python Django Framework: Introduction to Django Web Framework, features of Django, Installing Django, MVC model, HTTP concepts, Views, URL Mapping, Creating Template Objects, Form validation and Error Messages, Form Display, Django Models, Model Fields, Model Inheritance, CRUD on DB, Session and Caching, Dynamic Webpages, Toggle Hidden Content.

Recommended Books / Suggested Readings:

1. Swaroop, "A Byte of Python", Lulu.com (October 1, 2008)
2. Mark Lutz, "Programming Python, Tata McGraw Hill Publication, 2005
3. David Ascher, "Core Python Cookbook, Springer Publication.
4. Learning Python, O'Reilly Publications by Mark Lutz.
5. Python Essential Reference, David Beazley, Third Edition.
6. Fluent Python, O'Reilly Publications
7. "Python crash course - A hands-on, project-based introduction to programming", by Eric Matthes.
8. Justin Seitz,2009, "Gray Hat Python: Python Programming with Hackers and Reverse Engineers", No Starch Press, Inc.
9. Paul Berry,2011, "Headfirst Python". O'REILLY Media, Inc.
10. Jeeva Jose & P. Sojan Lal. 2016. Introduction to Computing & Problem Solving with Python.
11. Wesley J Chun, Core Python Applications Programming, 3 rd Edition, Pearson.
12. Python online documentation: www. python.org/doc.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1121: Python Programming Lab

Credits: 1

LTP 002

Course Objectives: The course aims to equip the students to gain practical experience with basic coding concepts such as conditional statements, iteration, strings, functions etc. In this course student will be able to:

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Implement functions for structuring Python programs.
4. Build Programs using Python lists, tuples, dictionaries.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Write, Test and Debug Python Programs.

CO2: Develop applications to real time problems.

CO3: Use functions and represent Compound data using Lists, Tuples and Dictionaries.

CO4: Read and write data from & to files in Python and develop Application using Pygame.

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following –

1. Problem solving using computers: Familiarization with programming environment.
2. Branching and logical expressions: Problems involving if-then-else structures.
3. Loops, while and for loops: Iterative problems e.g., sum of series.
4. Searching, sorting.
5. Strings, memory structure: String operations.
6. Functions: All types of functions.
7. Numerical methods: Root finding, numerical differentiation, numerical integration.
8. Recursion, structure of recursive calls: Recursive functions.
9. Demonstrate the use of Lists, Dictionaries.
10. Exception handling.
11. Find the most frequent words in a text read from a file.

12. Simulate elliptical orbits and bouncing ball using Pygame.
13. Create Database Connection and execute INSERT, READ, UPDATE, DELETE operations, COMMIT & ROLLBACK operation on the tuple created in the database.
14. Divide students into batches and suggest them to develop any interested mini project based on Django Web Framework.

Software Required: Python IDE.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1112: Advanced Computer Networks

Credits: 3

LTP 300

Course Objectives: The course aims to equip the students to the evolution of computer networks and the concepts of data communication. In this course, student will be able to:

1. Learn fundamental concepts of computer networking.
2. Understand Network, routing algorithms and switching protocols.
3. Understand the concepts of traditional as well as modern day computer networks – wireless Network.
4. Learn advanced concepts of networking.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe fundamental underlying principles of computer networking.

CO2: Describe the concepts of LAN, WAN and its protocol.

CO3: Describe the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks.

CO4: Discuss Networking management and routing algorithms and advanced concepts in networking.

Course Content

Unit I

Computer Networks: Uses of Computer Networks, Network Software, Network Hardware, Network elements (LAN, WAN, host, workstation, server), Physical topologies (bus, star, ring, mesh, backbone), Reference Models-OSI Protocols on different layers, TCP/IP, Networking Devices: Hub, Switch, Repeater, Bridge, Router, Gateways; Broadcasting, Multicast, Unicast, Transmission Mode, bandwidth, switching approaches: Circuit Switching, Packet Switching, Virtual Circuit.

Unit II

LAN Switching and its concepts: Structure of a Switch, Basic Switch Configuration, LAN IEEE 802.x standards., Virtual LANs (VLANs), VLAN Trunking Protocol (VTP), Spanning Tree Protocol (STP), Inter-VLAN Routing.

Wide Area Networks (WANs): Introduction to WANs, Point-to-Point Protocol (PPP) concepts, Frame Relay concepts, Dynamic Host Configuration Protocol (DHCP).

Unit III

Wireless LANS: Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Bluetooth Layers Other Wireless Networks: WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation (3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites.

Unit IV

Routing and Forwarding: CIDR, Building and Using a Routing Table, Router IDs, Numbered Links and Unnumbered Links, Distributing Routing Information, Distance Vectors, Link State Routing.

Internet Protocol: IPv4, IP Datagram Formats, Data and Fragmentation, Address Masks, Prefixes and Subnetworks, Network Address Translation (NAT), IP Switching and Routing, Local Delivery and Loopbacks, Address Resolution Protocol, Route Control and Recording, ICMP, Discovering Routers, Path MTU Discovery, Multicast, IP Version Six.

Advanced Concepts in Networks: Voice/video over IP networks, software-defined Networking (SDN), Adhoc Networks, Mobile Adhoc Networks, wireless Sensor Networks, TCP over wireless networks, Delay Tolerant Networks DTN, Ipvs.

Recommended Books / Suggested Readings:

1. Data Communications & Networking by Forouzan, Tata McGraw Hills.
2. D.E. Cormer," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.
3. D. Bertsekas and R. Gallagar, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
4. Computer Networks, Tanenbaum, PHI.
5. W. Stallings, "Data and Computer Communication", Macmillan Press.
6. Comer, "Computer Networks and Internet", PHI.
7. Comer, "Internetworking with TCP/IP", PHI.
8. W. Stallings, "Data and Computer Communication", McMillan.
9. J. Martin, "Computer Network and Distributed Data Processing", PHI.
10. W. Stallings, "Local Networks", McMillan.

11. M.Schwertz, “Computer Communication Network Design and Analysis”, PHI.
12. S. Keshav, “An Engineering Approach to Computer Networking, Pearson”, 2001.
13. Computer networks, Mayank Dave, CENGAGE.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit I.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1132: Advanced Computer Networks Lab

Credits: 1

LTP 002

Course Objectives:

The course aims to equip the students are going to experiment in a real test bed networking environment and learn about network design and troubleshooting. In this course student will be able to

1. Build an understanding of the fundamental concepts of computer networking.
2. Understand Network cables, and network troubleshooting commands.
3. Familiarize the packet tracer simulation tool.
4. Analyze the various routing algorithms.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss fundamental underlying principles of computer networking.

CO2: Identify the networking and troubleshooting commands.

CO3: Experiment how to configure switch and router using Packet Tracer.

CO4: Identify the complete understanding of computer network architecture.

Lab Work

1. Study of different types of network cables and Practically implements the cross-wired cable and straight through cable using clamping tool.
2. Networking and troubleshooting commands.
3. Who is command.
4. Connect the different computers in LAN and share the hard drive.
5. Socket Program for Echo/Ping/Talk commands.
6. Test weather a machine is alive. Machine can be specified using IP address and domain name of the machine.
7. To install any one open source packet capture software like packet tracer.
8. Computer networks practical based on Packet Tracer (using network topology, switch, and router configuration).
9. Simulation of ARP

10. Case study of routing algorithms.
11. To install and configure wireless access points.
12. To configure Adhoc Networks.
13. Designing and Implementing Class A, B, C Network.
14. Subnet Planning and its Implementation
15. Develop a mini project using CISCO Packet Tracer.

Note: Software required: Packet Tracer.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1113: Relational Database Management System

Credits : 3

LTP 300

Course Objectives:

The course aims to equip the students with fundamentals concepts of Database Management System, Data Models and Transaction management. In this course student will be able to:

1. List and explain relational database concepts and structures and various Data Models.
2. Understand the conceptual modeling of databases using ER diagrams.
3. Learn the various normalization forms.
4. Study about transaction management and concurrency control mechanisms.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain the basic concepts of data models, database design for transaction processing and query language.

CO2: Derive an information model expressed in the form of an entity relation diagram.

CO3: Transform high-level conceptual model to relational data model, populate database and formulate queries based on principles of normalization.

CO4: Design and Implement a Database for any given problem.

CO5: Understand the various emerging Database Models, Technologies and Applications.

Course Content

Unit I

Data and Database: Database Approach, Characteristics of a Database Approach, Database System Environment. Database Architecture - Database Users and Administrators: Database Users and Interfaces, DBA - Introduction to the Relational Model- Structure of Relational Database, database Schema, Keys.

Relational Algebra: Basic Operations, Additional Operations, Example Queries. Relational Calculus: Tuple and Domain Relational Calculus, Example Queries.

Unit II

Database Design: Informal Design Guidelines for Relation Schemas, Problems of Bad Database Design.

Normalization: Normalization and its various forms, Functional Dependencies, Multivalued Dependencies, Join Dependencies Database Integrity: Domain, Entity, Referential Integrity Constraints.

Unit III

Transaction Management and Query Optimization: Properties of Transaction, Serializability, Concurrency Control, Locking Mechanisms, Two Phase Commit Protocol, Deadlock, Query Processing, Heuristics of Query Optimization, Cost Based Query Optimization.

Concurrency Control and recovery: Two phase locking techniques for concurrency control; concurrency control based on timestamp ordering; multi-version concurrency control techniques; validation(optimistic) concurrency control techniques; granularity of data items and multi granularity locking, recovery concepts and recovery techniques.

Unit IV

Object Based Databases: Overview, Complex Data types, Structured types and inheritance in SQL, Table Inheritance, Array and Multiset types in SQL, Object identity and reference types in SQL.

Parallel Databases: I/O Parallelism, Inter and Intra Query Parallelism, Inter and Intra operation Parallelism.

Temporal Databases: Introduction to Temporality, Temporal relationships, temporal hierarchies.

XML database: DTD and XML Schema, XML presentation, XML Applications.

Recommended Books / Suggested Readings:

1. Silberschatz, H.F. Korth and S. Sudharshan, 2006, Database System Concepts, 5th Edition, Tata McGraw Hill, New Delhi.

2. J. D. Ullman, 1988, Principles of Database Systems, Galgotia Publishers, New Delhi. Matthes.

3. C.J. Date, 1985, An Introduction to Database Systems, Third Edition, Narosa, New Delhi.

4. Elmasri and Navathe, 1999, Fundamentals of Database Systems, Third Edition, Pearson Education, Delhi.

5. Bipin C. Desai, An Introduction to Database System, Revised Edition, 2022, Galgotia Publications Pvt Ltd-New Delhi.

6. Database Management Systems, Raghu Ramakrishnan, Third Edition, 2014, McGraw-Hill.

7. SQL, PL/SQL the Programming Language of Oracle, Ivan Bayross, 4th Revised Edition, 2009, BPB Publications.

8. Judith Hurwitz, Alan Nugent, Fern Halper, and Marcia Kaufman, “Big Data for Dummies”, Wiley Publication, New Delhi, 2013.

9. Guy Harrison, “Next Generation Databases: NoSQL, NewSQL, and Big Data”, Apress, 1st Edition, 14 December 2015. Refer Chapters 8 and 3 (for Module 5 - Next Generation Databases and CAP Theorem).

10. Rob, Peter and Carlos Coronel, “Database Principles: Fundamentals of Design, Implementation and Management”, 9th Edition, 2011.

11. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems “, Pearson Education, 5th Edition, 2007.

12. Thomas M Connolly and Carolyn E Begg, “Database systems- A Practical Approach to Design, Implementation and Management”, Pearson Education, 4th Edition (2014).

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks

	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1133: Relational Database Management System Lab

Credits : 1

LTP 002

Course Objectives:

The course aims to equip the students to introduce Database management system, with an emphasis on foundational material and the basic knowledge of SQL queries and PL/SQL. In this course student will be able to:

1. Understand basic database concepts, applications, data models, schemas, and instances.
2. Provide a formal good foundation on the relational database.
3. Construct various queries in SQL and PL/SQL.
4. Facilitate students in Database design.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Design conceptual models of a database using ER modeling for real life applications.

CO2: Write queries in SQL to retrieve any type of information from a data base.

CO3: Analyze and apply concepts of PL/SQL.

CO4: Design and Implement a Database for any given problem.

CO5: Construct problem definition statements for real life applications and implement a database for the same.

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following:

1. Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher.

2. Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, represent attributes as columns, identifying keys) Note: Student is required to submit a document showing the database tables created from ER Model.

3. Create a table and display data from table to understand the concept of create, insert, and select command. Use of update, Delete, Truncate command to understand the concept of DML. Apply Alter command and Drop command to understand the concept of DDL.

4. Apply constraints to understand the concept of Primary Key, Foreign key, Unique key, integrity constraints.

5. Transaction Control statements: Commit, Rollback.

6. Advanced Concepts: View, Index, Sequences, rowed, rownum, Default Value Concept, Data dictionary.

7. Basic SQL: This covers simple SQL queries. (Inbuilt functions in RDBMS.), Intermediate SQL: This covers more complex SQL queries. (Nested Queries & Join Queries, Control structures).

8. Advanced SQL: This covers even more complex SQL queries. (Procedures and Functions, .PL/SQL, Cursors and Triggers).

9. To write programs using control structures of PL/SQL.

10. Mini Project: Each student is assigned with a problem. The student is to develop a logical and physical database design for the problem and develop Forms, Menu design and Reports. (e.g. Retailer database, Sales database, Real Estate database and so on.

Note: Software required: Oracle 10g/11g/12C.

Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1109: Advanced Computer Architecture

Credits: 3

LTP 300

Course Objectives: The course aims to equip the students to provide basic concepts of computer architecture, Pipeline and Vector Processing, memory organization and Multiprocessors. In this course the student will be able to:

1. Learn the basic concepts and structure of computers.
2. Study about Parallelism concepts in Programming.
3. Elaborate the idea about the different memory systems.
4. Know about the importance of multiprocessor and Interconnection structures.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate concepts of parallelism in hardware/software.

CO2: Interpret performance of Pipeline and Vector Processing.

CO3: Identify SIMD and MIMD architecture.

CO4: Describe memory organization and architectural features of processors.

Course contents:

Unit I

Fundamentals of Computer Architecture: Computational model, Evolution of computer architecture, process thread, Concurrent and parallel execution, types of parallelism, levels of parallelism.

Instruction set principles: Classifying instruction set architecture, memory addressing, address modes for signal processing, Operations in the instruction sets, instruction for control flow, MIPS architecture.

Unit II

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors. Computer Arithmetic: Addition & Subtraction, Multiplication algorithms, Division Algorithms, Floating point arithmetic operations, Decimal Arithmetic unit, Decimal Arithmetic operations.

SIMD Architecture- Introduction, Parallel Processing, classification of Parallel Processing, Fine-Grained SIMD Architecture, coarse-Grained SIMD Architecture.

Unit III

Vector architecture and MIMD Architecture-, addressing modes, instructions formats, effect of simplification on the performance, example processors such as MIPS, PA-RISC, SPARC, Power PC, etc.

IO Organization: Peripheral devices, I/O interfaces, asynchronous data transfer, Modes of Data transfer, Priority Interrupts, DMA, I-O processors, Serial Communication.

Memory Organization: Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Virtual Memory, Memory management hardware.

Unit IV

Multiprocessors: single cycle processors, hardwired and micro-coded FSM processors, pipelined processors, multi-core processors, analyzing processor performance.

Interconnection structures: Time Shared, Common bus, Multi-port, Crossbar switch, Multistage, Inter-processor arbitration, Inter-processor communication & synchronization, cache coherence. Parallel Computing: Parallel Virtual Machine and message passing interface, Libraries, and calls. Advanced architectures today's Fastest Computer.

Recommended Books / Suggested Readings:

1. Morris M. Mano, Computer System & Architecture, PHI Publications.
2. Stallings & Williams, Computer Organization & Architecture, Maxwell Macmillan.
3. V. Rajaraman & Radhakrishnan, Introduction to Digital Computer Design, PHI Publications.
4. P. Pal Chowdhary, Computer Organization & Design, PHI Publications.
5. Computer Architecture: A Quantitative Approach, by J.L Hennessy and D.A Patterson.
6. Digital Design and Computer Architecture, by D.M Harris and S.L Harris.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1110: Advanced Software Engineering

Credits: 3

LTP 300

Course Objectives: The course aims to equip the students to provide knowledge about various methodologies used in software engineering and various models used in software development. In this course student will be able to:

1. Understand Generic models of software development process.
2. Learn about the fundamental concepts of requirements engineering and Analysis Modeling.
3. Study about the different design, and testing techniques and their implementation.
4. Understand Web Engineering and Agile methodology.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Interpret the basic concepts of Software Engineering and demonstrate the phases of software development Life cycle using various system models.

CO2: Compare various testing techniques and relate Software advancement methods to build Quality Software products.

CO3: Describe the Design Patterns, Software Testing and its automation.

CO4: Describe the concepts of Web Engineering and Agile methodology.

Course Content

Unit I

Introduction: Problem Domain, Challenges, Software Engineering Approach; Software Development process: Process Characteristics.

Software Engineering models: Predictive software engineering models, model approaches, predictive and adaptive waterfall, waterfall with feedback (Sashimi), incremental waterfall, V model, Prototyping and prototyping models.

Software Requirements Analysis and Specification: Analysis Approaches, Characteristics and Components of SRS, Validation, Metrics.

Unit II

Software Design: Design Principles, Module level concepts, Design Notation and Specification, Structured Design Methodology, Verification, Metrics, OO Analysis and OO Design, OO Concepts, Object –oriented Design Methodology approach.

Design Patterns: Basic concepts of Design patterns, how to select a design pattern, Creational patterns, Structural patterns, Behavioral patterns. Concept of Anti-patterns.

Software Testing: Software testing principles, Program inspections, Program walkthroughs, Program reviews.

Blackbox testing: Equivalence class testing, Boundary value testing, Decision table testing, pairwise testing, State transition testing, Use-case testing; White box testing: control flow testing, Data flow testing.

Testing automation: Defect life cycle; Regression testing, testing automation; Testing non-functional requirements.

Unit III

Software Quality: CASE tools, metrics, Standards, Certification and Assessment. TQM, Bootstrap methodology, The SPICE project, ISO-IEC 15504, Six Sigma Concept for Software Quality.

Software Configuration Management: Using version control, managing dependencies, managing software configuration, Managing build and deployment environments.

Continuous Integration: Prerequisites for continuous integration, Essential practices.

Continuous Delivery: Principles of Software delivery, Introduction and concepts.

Unit IV

Web Engineering: Attributes of web-based applications, the WebE process, a framework for WebE. Formulating, analyzing web-based systems, design and testing for web-based applications, Management issues.

Agile: Introduction to Agile, Value points of Agile, Principle of Agile, Agile comparisons with traditional model of Software Engineering, Agile Team, Agile Implementation, Introduction to Scrum, DevOps.

Recommended Books / Suggested Readings:

1. E. Fairley, "Software Engineering Concepts", McGraw-Hill, 1985.
2. Rohit Khurana, “Software Engineering: Principles and Practices”, Vikas Publishing House 2007.
3. Ian Sommerville, “Software Engineering “, Pearson Education, 2001
4. Designing User Interface, James E Powell, Galgotia Publications, 1991.
5. Roger S. Pressman, Software Engineering, A Practitioner's Approach, McGraw Hill International Edition (2009) 7th edition.
6. Philip A. Laplante, What Every Engineer Should Know about Software Engineering, CRC, Press.
7. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company, (2006) 8th ed.
8. KK Aggarwal, Yogesh Singh, Software Engineering, (2012), 3rd Edition, New Age International.
9. James F. Peter, Software Engineering - An Engineering Approach, John Wiley (2004).
10. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa (2005).
11. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill Edition, 2008
12. Ali Behforroz, Frederick J. Hudson, “Software Engineering Fundamentals”, Oxford Indian Reprint, 2012
13. Kassem A. Saleh, “Software Engineering”, First Edition, J. Ross Publishing, 2009.
14. Jibitesh Mishra, Ashok Mohanty, “Software Engineering”, Pearson Education, First Edition, 2012.
15. Erich Gamma et. al., Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley.
16. Vaskaran Sarcar, Java Design Patterns: A Hands-On Experience with Real-World Examples, Apress.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1111: Research Methodology

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to provide knowledge about Research Methodology. In this course student will be able to:

1. Explore the motivational points of the research.
2. Identify an open research problem in the domain of interest.
3. Draw out the plans of the progress of research.
4. Plan for the appropriate data collection.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.

CO2: Carry out literature survey, define the problem statement and suggest suitable solution for the given problem.

CO3: Analyze the problem and conduct experimental design with the samplings.

CO4: Perform the data collection from various sources segregate the primary and secondary data

Course Content

Unit I

Research Methodology: Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research process, criteria of good research, and problems encountered by researchers in India.

Unit II

Literature review, Data collection and sampling design: Review concepts and theory, review previous findings, Sources of data: Primary and secondary data, Methods of data collection, Sampling fundamentals.

Unit III

Modeling and Analysis: Probability distributions, Processing and analysis of data, Data analysis skills, Distributions, Statistical and multivariate analysis, Correlation and regression, Fundamentals of Time series analysis, spectral analysis, Error analysis, Simulation techniques.

Unit IV

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Recommended Books / Suggested Readings:

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.

2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011 Study Material.

3. Research Methods: the concise knowledge base Trochim, Atomic Dog Publishing, 2005.

4. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

5. Richard I Levin amp; David S. Rubin, Statistics for Management, 7/e. Pearson Education, 2005.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1213: Advanced Data Structures and Algorithms

Credits :3

LTP 210

Course Objectives:

The course aims to equip the students to understand several fundamental algorithms and data structures in computer science. Some of the data structures we will encounter include linked lists, stacks, queues, trees, and graphs. In this course student will be able to:

1. Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
2. Understand about basic concepts about array, stacks, queues, and their applications.
3. Learn about Trees, linked list, and its types.
4. Understand different searching and sorting techniques.

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Discuss data abstraction and data structures such as stacks, queues, lists, trees, and graphs.

CO2: Identify relevant data structures to develop solutions for a problem.

CO3: Examine the use of data structures in relevant applications.

CO5: Evaluate different data structures to solve real world problem.

Course Content:

Unit I

Introduction: Concept of data type, definition and brief description of various data structures, data structures versus data types, operations on data structures, Algorithm complexity.

Arrays: Linear and multi-dimensional arrays and their representation, operations on arrays, sparse matrices, and their storage.

Linked List: Introduction, Linked lists, Representation of linked lists in Memory, traversing a linked list, searching a linked list, Memory allocation and Garbage collection, insertion into linked list, Deletion from a linked list, Types of linked list.

Unit II

Stack and Queue: Introduction, Array Representation of Stack, Linked List Representation of stack, Application of stack, Queue, Array Representation of Queue, Linked List Representation of Queue.

Advanced Tree Structures: Balanced Binary Search trees, Red-Black trees- Properties of Red Black trees, Rotations, Insertion, Deletion. B-Trees: Basic operations on B-Trees, Insertion and Deletion, Introduction to Splay Trees and Suffix Trees.

Unit III

Advanced Heap Structures: Mergeable Heaps and operations on Mergeable Heaps. Binomial Heaps, Binomial Heap operations and Analysis, Fibonacci Heaps, Fibonacci Heap operations and Analysis.

Graphs and their Applications: Basic terminology, representation of graphs (adjacency matrix, adjacency list), traversal of a graph (breadth-first search and depth-first search), and applications of graphs, Traversing a Graph, Dijkstra's Algorithm for Shortest Distance, Floyd's Algorithm, Bellman-Ford algorithm, Minimal Spanning Tree, Prim's and Kruskal's algorithm.

Unit IV

Divide and Conquer: Quick sort, Binary Search. Greedy Method: General Method, knapsack problem.

Back Tracking: General Method, 8-queens, Sum of Subsets.

Branch and Bound: General Method, Travelling Salesperson problem.

Hashing: Introduction to hash table, hash function, resolving collision by chaining and open addressing, deleting items from a hash table, Dynamic Hashing Techniques.

Recommended Books / Suggested Readings:

1. Tanenbaum, Y. Lanhgsam and A.J. Augenstein, "Data Structures Using C", Prentice Hall of India, 1990
2. Mary E. S. Loomis, "Data Management and File Structures", PHI, 1995.
3. Vishal Goyal, Lalit Goyal and Pawan Kumar, "Simplified Approach to Data Structures", Shroff Publications.
4. Shubhnandan S. Jamwal, Programming in C, Pearson Publications

5. Seymour Lipschultz, “Theory and Practice of Data Structures", McGraw-Hill, 1988.
6. E. Horowitz and S. Sahni, “Data Structures with Pascal", Galgotia, 3rd Edition, 1991.
7. Robert Sedgewick, “Algorithms in C”, Pearson Education.
8. M. J. Folk, B. Zoellick, G Riccardi, “File Structures”, Pearson Education.
9. Yang, Xiaojing, Jinshan Liu, and Xiaohe Li. "Research and Analysis of Blockchain Data." Journal of Physics: Conference Series. Vol. 1237. No. 2. IOP Publishing, 2019.
10. Aho A.V., Hopcroft J.E., and Ullman J.D., Data Structures and Algorithms, Pearson Education, New Delhi, 1983.
11. Sahni S., Data Structures, Algorithms, and Applications in C++, Mc Graw Hill, Singapore, 1998.
12. E. Horowitz, S. Sahni and S. Rajasekaran, “Computer Algorithms”, Galgotia Publishers, 2001.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1233: Advanced Data Structures and Algorithms Lab

Credits: 2

LTP 004

Course Objectives:

The course aims to equip the students to understand the abstract properties of various data structures such as stacks, queues, lists, trees, and graphs. In this course student will be able to:

1. Develop problem solving skills with programming.
2. Develop skills to design and analyze simple linear and nonlinear data structures.
3. Identify and apply the suitable data structure for the given real-world problem.
4. Solve practical applications of data structures.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of data structure, data types and how basic data structure like arrays, records, linked list, stacks, queues, trees, and graphs are represented in memory and are used in various applications.

CO2: Apply standard algorithm for sorting and searching.

CO3: Analyze algorithm and determine their complexity.

CO4: Choose and implement efficient data structures and apply them to solve problems.

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Programs may be implemented using C/C++/ Java Programming/Python Programming. Various programs should be practiced in the lab based on each of the following –

1. Write a menu driven program that linear array: implements following operations (using separate functions) on a) Insert a new element at end as well as at a given position. b) Delete an element from a given whose value is given or whose position is given. c)To find the location of a given element. d)To display the elements of the linear array.
2. Write a menu driven program that maintains a linear linked list whose elements are stored in on ascending order and implements the following operations (using separate functions): a)

Insert a new element. b) Delete an existing element c) Search an element d) Display all the elements.

3. Write a program to demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.

4. Program to demonstrate the use of stack (implemented using linear linked lists) in evaluating arithmetic expression in Postfix notation.

5. Program to demonstration the implementation of various operations on a linear queue represented using a linear array.

6. Program to demonstration the implementation of various operations on a circular queue represented using a linear array.

7. Program to demonstration the implementation of various operations on a queue represented using a linear linked list (linked queue).

8. Program to illustrate the implementation of different operations on a binary search tree.

9. Program to perform on Red-Black trees.

10. Program to perform the following: i) Creating an B-Tree ii) Traversing the above binary tree in preorder, inorder and postorder.

11. Program that uses functions to perform the following: i) Creating a Splay Tree of integers ii) Traversing the above binary tree in preorder, inorder and postorder

12. Program to illustrate the traversal of graph using breadth-first search.

13. Program to illustrate the traversal of graph using depth-first search.

14. Program that implements Kruskal's algorithm using a disjoint set data structure. The program takes as input a file (data.txt), in which each line either represents a vertex or an edge. For the edge lines, the first integer on that line representing the starting vertex, the second the ending vertex, and the third the weight of the edge. Use this file to construct, line by line, the graph upon which Kruskal's algorithm will be run Program to sort an array of integers in ascending order using selection sort.

15. Program to find the minimal spanning tree of a graph using the Prim's algorithm. The program should be able to read in the weight matrix of a graph and produce the minimal spanning tree Generate weight matrices (using a random number generator) with a large number of nodes and estimate the time complexity of the algorithm.

16. Program to sort an array of integers in ascending order using heap sort.

17. Program to demonstrate the use of linear search to search a given element in an array.

18. Program to demonstrate the use of binary search to search a given element in a sorted array in ascending order.

19. To perform various operations on graphs (i) Vertex insertion. ii) Vertex deletion. iii) Edge insertion. (iv)Edge deletion. (v) BFS. (vi) DFS.

20. Implementation of Quick Sort algorithm using Divide & Conquer method.

21. Program to implement knapsack problem using greedy method.

22. Program to implement 8-queens problem using backtrack method.

23. To implement dictionaries using hashing technique.

Note: Software required: Newbie IDE/Code Blocks/ Code Lite, DEV-C++/ NetBeans IDE/ Eclipse IDE.

Lab Assessment Evaluation Pattern:

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)		

MCA1214: Artificial Intelligence

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to learn Artificial Intelligence. In this course student will be able to:

1. Understand concepts and problem-solving techniques in Artificial Intelligence.
2. Get insight into intelligent agents, Reasoning & Logic prepositional Logic.
3. Understand the concept of planning in Artificial intelligence.
4. Understand concepts on Learning in Artificial Neural Networks and various neural network models

Course Outcomes (CO):

Upon successful completion of the course:

CO1: Assess critically the techniques presented and to apply them to real world problems.

CO2: Understand the major concepts of Intelligent agents, Reasoning & Logic prepositional Logic

CO3: Apply and analyze the different types of control and heuristic search methods to solve problems

CO4: Understand the Learning in Artificial Neural Networks and fuzzy logic.

Course contents:

Unit I

Artificial Intelligence: Role of AI in engineering, AI in daily life, Intelligence and Artificial Intelligence, Different task domains of AI, Programming methods, Limitations of AI Intelligent Agent: Agent, Performance Evaluation, task environment of agent, Agent classification, Agent architecture. Example AI Problems (8 Puzzle problem, Missionary Cannibals Problem, Crypt arithmetic Problems, block world Problem)

Unit II

Problems, problem spaces and search: Define the problem as a state space search, Production systems, Problem characteristics, Production system characteristic.

Search Strategies: Blind search strategies -Depth First Search, Breadth First Search, Best First Search, Iterative Deepening Search, Heuristic Search strategies- Admissible Heuristics and examples - Simple Hill Climbing and Steepest Ascending Hill Climbing, Simulated Annealing, A* algorithm.

Unit III

Knowledge Representation: Need to represent knowledge, Knowledge representation with mapping scheme, Properties of good knowledge-based system, Knowledge representation issues, AND-OR graph, Types of knowledge.

Unit IV

Learning in Artificial Neural Networks: How the Brain Works, Neural Networks, perceptions, Multi-layered Feed Forward Networks Applications Back propagation algorithm Applications of Neural Networks.

Fuzzy Logic: -fuzzy Variables, Fuzzy Sets and Fuzzy Set Operations, Typical Examples using Fuzzy Sets.

Recommended Books / Suggested Readings:

1. Kevin Night and Elaine Rich, "Artificial Intelligence (SIE)", McGrawHill-2008.
2. Stuart Russel and Peter Norvig "AI - A Modern Approach", 2nd Edition, Pearson Education2007.
3. Padhy N.P., Artificial Intelligence and Intelligence Systems, Oxford.
4. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education,2007.
5. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)		

MCA1234: Artificial Intelligence Lab

Credits : 1

LTP 002

Course Objectives:

The course aims to equip the students to learn Android Concepts and Programming Skills. In this course student will be able to:

1. Learn the Artificial Intelligence problems.
2. Know about how to AI work.
3. Study and discuss various techniques and algorithms of AI used in general problem solving.
4. Study the applications of AI.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Outline various Artificial Intelligence techniques

CO2: Design and implement solutions for classical Artificial Intelligence problems.

CO3: Apply search and knowledge representation techniques to solve AI problems.

CO4: Design and implement heuristic search procedures.

Lab Work.

1. Implementing state space search algorithms for solving puzzle problems. a. A* Search b. Hill-climbing Search.
2. Write a program to implement BFS/DFS Traversal?
3. Write simple facts for the statements and querying it.
4. Write a program for Family-tree.
5. Write Program for Monkey-banana Problem.
6. Write a program to implement Tic-Tac-Toe game.
7. Write programs for computation of recursive functions like factorial Fibonacci numbers, etc.
8. Write program to solve 5-queens problem.
9. Write a Program for water jug problem.
10. Write a program for travelling salesman problem.

11. Write a program to implement all set operations.

12. Develop a mini project based on AI Applications.

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1215: Full Stack Web Development

Credits :3

LTP 300

Course Objectives:

The course aims to equip the students to learn Android Concepts and Programming Skills. In this course student will be able to:

1. To learn the basics of Angular JS.
2. Study about the fundamental language of internet i.e. HTML5 and CSS3.
3. Understand the basics of client-side JavaScript and server-side programming constructs.
4. Understand advanced technology concepts.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand and describe the role of front-end development in modern web applications.

CO2: Discuss the fundamentals concept designing of web pages using HTML5 and CSS3.

CO3: Describe the scripting concepts using Java Script.

CO4: Explain different front end and back end web technologies.

Course Content

Unit I

HTML5 & CSS3: Introduction, Elements, Tags, Lists, Tables, Images, Forms - Form Elements & Attributes, Hidden Fields, Semantic Elements, Media Elements, Canvas, SVG, Drag & Drop, Geolocation, Web Storage, Special Tags, Formatting Tags. CSS: Introduction, Styling, Box Model, Padding & Dimension, Transforms, Transitions, Animations, Multiple columns, User Interface.

Unit II

Java Script: Introduction, Usage of variables, operations, control structures, looping structures, predefined keywords, arrays, predefined functions, user defined functions, arrays and functions, mathematical functions, string functions, objects, expressions, pattern matching using RegEXp Class, String Class, Exception Handling, Built–in objects,

Bgcolor/Fgcolor, Date Object, Events and Event Handling, Validations, Window, Confirmation, alert messages.

Unit III

AJAX and JQuery: Introduction to AJAX 10.1 Asynchronous access to remote data, GET HTTP request, AJAX Load, Send Data, Callback Handlers, Change AJAX data type, Status Codes, JSON, Accessing and Consuming remote JSON Data. HTML5 Forms and JQuery UI - Understanding Forms, Adding Smarts to Your Forms, Form Validation, Validation Tutorial, Updating Database Table Values, Introduction to jQuery UI, Animation and Special Effects.

Unit IV

Angular JS: introduction, Features, Angular JSModel, View-Controller, Expression, Directives and Controllers, Angular JS Modules, Arrays, working with ng-model, Working with Forms, Form Validation, Error Handling with Forms, Nested Forms with ng-form, Other Form Controls.

Node Js And Express Framework9: Introduction, Using the Terminals, Editors, Building a Webserver with Node, The HTTPModule, Views and Layouts, Middle ware, Routing, Form Handling with Express, The Request and Response Objects, Handle bars, Comments and Blocks.

Recommended Books / Suggested Readings:

1. Paul S. Wang Sanda S. Katila, an Introduction to Web Design plus Programming, Thomson (2007).
2. Robert W. Sebesta, Programming the World Wide Web, Third Edition, Pearson Education (2007).
3. Thomas A. Powell, the Complete Reference HTML & XHTML, Fourth Edition, Tata McGraw Hill (2006).
4. Abders Moller and Michael Schwartzbach, An Introduction to XML and Web Technologies, Addison Wesley (2006).
5. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed. Paperback ,2016 by DT Editorial Servi.
6. Brad Dayley, "Learning Angular JS", Addison-Wesley Professional, First Edition, 2014.
7. Evan M. Hahn,"Express in Action", Manning Publications, First Edition, 2014.
8. Ethan Brown, "Web Development with Node and Express", Oreilly Publishers, First Edition, 2014.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1235: Full Stack Web Development Lab

Credits : 1

LTP 002

Course Objectives:

The course aims to equip the students to knowledge of Web development to build a Web Application and Web sites. In this course student will be able to:

1. Understand the language of internet i.e. HTML5 and cascading style sheets3.
2. Learn about the basics of client-side JavaScript and server-side programming constructs.
3. Build the website using various web technologies.
4. Develop the Skills and project-based experience entering the carrier in Web application development.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Analyze a web page and identify its elements and attributes.

CO2: Develop elegant and responsive Front-end by leveraging latest technologies.

CO3: Create web pages using HTML and Cascading Style Sheets.

CO4: Develop a simple web application using Nodejs, Angular JS and Express.

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following:

Maximum 10 experiments can be framed on the following Concepts:

1. Basic HTML text formatting tags, fonts, tables, external hyperlinks, and internal hyperlinks, on image insertion.
2. Create a simple HTML page to demonstrate the use of different tags.
3. Web page creation using CSS3.
4. Demonstrate a login page using HTML5 and validate the username and password using JavaScript.
5. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems: a. Parameter: A string Output: The position in the string of the leftmost vowel b. Parameter: A number Output: The number with its digits in the reverse order.
6. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
7. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
8. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXTSHRINKING” in BLUE color. Then the font size decreases to 5pt.
9. DOM Manipulation with jQuery.
10. Events in JQuery.
11. Animation in jQuery.
12. AJAX with jQuery.
13. Creating & Integrating Plug-ins with jQuery.
14. Using jQuery Frameworks.
15. Develop a Form and validate using Angular JS.
16. Create and implement modules and controllers in Angular JS.
17. Implement Error Handling in Angular JS.
18. Create and implement Custom directives.
19. Create a simple web application using Express, Node JS and Angular JS.
20. Mini Project: Build a website using the latest web technologies such as Online Personal Counselling, Smart Health Consulting Project and so on.

Note: Software Required: Notepad ++.

Lab Assessment Evaluation Pattern

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks

	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1204: Java Programming

Credits :3

LTP 300

Course Objectives:

The course aims to equip the students with JAVA programming language concepts with object-oriented programming principles. In this course student will be able to:

1. Learn about the basics of JAVA and concepts of Object-Oriented programming.
2. Understand the concept and implementation of basic OOPS features.
3. Implement of interface and inheritance.
4. Understand exceptional handling and multi-threading concepts and implementation using Applets.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain of the principles and practice of object-oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements.

CO2: Identify classes, objects, members of a class and relationships among them needed for a specific problem.

CO3: Design, write, compile, test and execute straightforward programs using a high-level language.

CO4: Describe the concept of package, interface, multithreading, collections in java.

Course Content

Unit I

Object Oriented Programming: Introduction to OOP, Need for OOPs paradigm, Characteristics of OOPs, Difference between OOPs, and Procedure Oriented Programming.

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

Unit II

Inheritance: Classes, Super classes & Subclasses, Object-The Universal Super class, Object Wrappers, vectors, Enumeration Classes.

Packages and Interfaces: Defining, Creating and Accessing a Package, Understanding CLASS PATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

Unit III

Exception handling: 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.

Applets: Applets basics, Applets HTML tags and attributes, Inter-applet communication.

Multithreading: Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, interthread communication, thread groups, daemon threads. Enumerations, autoboxing, annotations, generics.

Unit IV

Networking with Java.net: Networking fundamentals, The Networking classes and Interfaces, The Inet Address class, The Socket Class, The URL class, The URL Connection Class, The Http URL Connection Class.

Collections Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Why Generic Collections, The legacy Classes and Interfaces, Parting Thoughts on Collections.

Recommended Books / Suggested Readings:

1. Programming with Java: A Primer, 5th Ed, E Balagurusamy, TMH.
2. Object Oriented Programming with JAVA: Wu, TMH.
3. Core Java, Volume I & II: Cays Horstmann, Gary Cornell, Pearson Publication, 7th Edition.
4. Complete Reference for JAVA: Herbert Schildt.
5. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John wiley & sons.
6. An Introduction to OOP, third edition, T. Budd, Pearson education.
7. Introduction to Java programming, Y. Daniel Liang, Pearson education.
8. An introduction to Java programming and object-oriented application development, R.A. Johnson-Thomson.
9. Core Java 2, Vol 1, Fundamentals, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education.
10. Core Java 2, Vol 2, Advanced Features, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education.
11. Object Oriented Programming with Java, R. Buyya, S.T. Selvi, X. Chu, TMH.
12. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.
13. Maurach's Beginning Java2 JDK 5, SPD.
14. Programming and Problem Solving with Java, JM Slack, B S Publications.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1224: Java Programming Lab

Credits :2

LTP 004

Course Objectives:

The course aims to equip the students to understand the basic concepts of Java. It enables them to gain practical knowledge in java programming using OOPs. In this course student will be able to:

1. Develop Software development skills using java programming for real world applications.
2. Understand basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
3. Study about Object-oriented paradigm in the Java programming language.
4. Understand the principles of inheritance, packages and interfaces and Swing.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Write Java application programs using OOP principles and proper program structuring.

CO2: Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.

CO3: Apply OOPs skills in Java programming in problem solving.

CO4: Write Java programs to implement error handling techniques using exception handling and advanced Java features using Swing.

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following –

1. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers.
2. Write a Java program to illustrate the concept of class with method overloading.
3. Write a Java program to illustrate the concept of Single level and Multi level Inheritance.
4. Write a Java program to illustrate the concept of Dynamic Polymorphism.
5. Write a Java program to demonstrate the Interfaces & Abstract Classes.
6. Write a Java program to implement the concept of exception handling.
7. Write a Java program to illustrate the concept of threading using Thread Class and runnable Interface.
8. Write a Java program to illustrate the concept of multi-threading that creates three threads. First thread displays “Good Morning” every one second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.
9. Write a Java program to implement serialization concept.
10. Write a Java program to illustrate the concept of Thread synchronization.
11. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
12. Write a Java program to paint like paint brush in applet.
13. Write a Java program to display analog clock using Applet.
14. Write a Java program to create different shapes and fill colors using Applet.
15. Write a Java program to illustrate collection classes like Array List, Iterator, Hash map etc.
16. Write a Java Program in java networking.

Note: Software Required: Notepad ++.

Lab Assessment Evaluation Pattern

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks

External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1301: Theory of Computation

Credits : 3

LTP 300

Course Objectives:

TThe course aims to equip the students to learn theory of computation such as Turing machines, theory of programming languages, including grammars, syntax, and semantics. In this course student will be able to:

1. Understand the mathematical foundations of computation including automata theory,
2. Learn about the theory of formal languages and grammars.
3. Study about the notions of algorithm, decidability, complexity, and computability.
4. Examine Mathematical proofs for computation and algorithms.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the theoretical development of computer science.

CO2: Distinguish between different types of grammars.

CO3: Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.

CO4: Solve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

Course Content

Unit I

Operations on Languages

Mathematical Operations: Closure Properties of Language Classes. Context Free Languages: The Chomsky Greibach Normal Forms. Linear Grammars and Regular Languages. Regular Expressions. Context Sensitive Languages: The Kuroda Normal Form, One-sided Context Sensitive Grammars.

Automata and Operations: Finite Automata Types of Finite Automata, Deterministic and Non-Deterministic Automata, Regular languages, Non-deterministic FA, Conversion of DFA into NFA and vice-versa, Non-Deterministic Finite Automata with ϵ transitions, minimization of DFA. Finite Automata with output- Moore & Mealy machine and its Conversion.

Unit II

Regular Languages: Regular sets; Regular expressions, Arden's theorem, Construction of finite Automata for a given regular expression, pumping lemma for regular sets. Closure properties of regular sets. Grammar Formalism: right linear and left linear grammars; Equivalence between regular linear grammar and FA; Context free grammar; Derivation trees, sentential forms. Ambiguity in context free grammars; Normal forms: Chomsky normal form and Greibach normal form; Pumping Lemma for Context Free Languages, Closure property of CFL.

Unit III

Derivation Languages: Rewriting Systems, Algebraic properties, Canonical Derivations, Context Sensitivity.

Push Down Automata: Push down automata, definition; Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence; Equivalence of CFL and PDA; Introduction to DCFL and DPDA.

Unit IV

Turing Machine: Definition, model, Design of TM, Computable functions Church's hypothesis, Types of Turing machines: Universal Turing Machine, Halting problem, Properties of recursive and recursively enumerable languages, unsolvable decision problem, un decidability of Post correspondence problem.

Recommended Books / Suggested Readings:

1. G.E. Reevsz, Introduction to Formal Languages, McGraw Hill 1983.
2. M.H. Harrison, Formal Language Theory Wesley 1978.
3. Wolfman Theory and Applications of Cellular Automata, World Scientific, Singapore, 1986.
4. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science (Automata Languages and Computation), 2nd Edition, Prentice Hall of India, 2006.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1313: Data Analytics Using R

Credits : 3

LTP 300

Course Objectives:

The course aims to equip the students to learn computer programming via R programming language. In this course student will be able to:

1. Understand and use basic R programming concepts.
2. Understand data analysis.
3. Understand the working collaboratively and openly on code.
4. Understand the statistics in R Programming.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the Exploratory Data Analytics.

CO2: Describe the basics in R programming in terms of constructs, control statements.

CO3: Apply the R programming from a statistical perspective.

CO4: Create various graphics.

Course Content:

Unit I

Introduction to Data Analysis: Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.

Introduction to R Programming : Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations, Control structures, Array, Matrix, Vectors, Factors, scoping rules, dates and times, functions, R Data Structures, Character Strings, Lists, Classes.

Unit II

Data Frames: Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, applying functions to Data frames, Factors and Tables, factors and levels, Common functions used with factors, working with tables, Other factors and table related, Recursion, Replacement functions, Tools for composing function code, Math and Simulations in R.

Unit III

Data Visualization using R Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files.

Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts.

Recommended Books / Suggested Readings:

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16).
2. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2013.
3. R Programming for Data Science by Roger D. Peng.
4. The Art of R Programming by Prashanth Singh, Vivek Mourya, Cengage Learning India.
5. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press, 2011.
6. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.
7. Mark Gardener, "Beginning R –The Statistical Programming Language", Wiley, 2013.
8. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.
9. Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall, 2000.
10. G Casella and R.L. Berger, Statistical Inference, Thomson Learning 2002.
11. P. Dalgaard. Introductory Statistics with R, 2nd Edition. (Springer 2008).
12. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
13. Hastie, Trevor, et al. The elements of statistical learning.Vol. 2. No. 1. New York: springer, 2009.

14. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley &Sons, 2010.
15. Joseph F Hair, William C Black et al, "Multivariate Data Analysis", Pearson Education, 7th edition, 2013.
16. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
17. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1333: Data Analytics Using R Lab

Credits : 1

LTP 002

Course Objectives:

The course aims to equip the students to gain practical experience with basic coding concepts using R programming such as conditional statements, iteration, strings, functions etc. In this course students will be able to:

1. Write, test, and debug simple R programs.
2. Implement R programs with conditionals and loops.
3. Implement Matrices, functions, Vectors for structuring R programs.
4. Build Programs using List, Data frames.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Create various graphics

CO2: Develop applications to real time problems.

CO3: Use functions, vector, list and data frames for solving problems..

CO4: Use R for statistical Analysis and predictive Analysis.

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following – .

1. Install and configuration of R programming environment.
2. Built-in Functions in R Programming.
3. Operators
4. Control Structures
5. Matrices
6. Functions
7. Vector
8. Operations on List
9. Operations on Data Frames

10. Graphics and visualization
11. Data Import Techniques
12. Exploratory Data Analysis
13. Statistical simulation.
14. Predictive Analysis & Simulation
15. Mini Project

Software Required: R Studio.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1314: Advanced Operating Systems

Credits :3

LTP 300

Course Objectives:

The course aims to equip the students to introduce the core concepts of operating systems, such as processes and threads, scheduling, synchronization, Distributed Operating Systems and Database Operating System.

. In this course, student will be able to:

1. Learn about the basics of operating systems like types and views of operating systems.
2. Study about Threads in Distributed Systems.
3. Understand the concepts in Distributed Operating Systems and Database Operating System.
4. Understand various features of multiprocessor OS.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Illustrate the fundamentals of operating system components.

CO2: Apply process synchronization techniques within uniprocessor/ Multiprocessor environment

CO3: Describe the concepts of Virtualization, Types of Hypervisors.

CO4: Describe the different advanced operating System.

Course Content

Unit I

Introduction: Functions of Operating System, Design Approaches, History of Operating Systems, Operating System Concepts, Functions, Characteristics, Operating Systems Structure- Simple Batch, Multi programmed, timeshared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System Calls, Virtual Machines.

Multiprocessor Operating Systems: Basic Multiprocessor System Architectures, Interconnection Networks, Structures of OS, OS design issues, Threads, Process synchronization, Process Scheduling and Allocation, Types of Hypervisors.

Unit II

Process: Threads: Threads in Distributed Systems. Client- User interfaces, Client-Side Software for distribution transparency. Servers-General design issues, Object servers. Code Migration Approaches to code migration, migration and local resources, Migration in Heterogeneous systems. Software agents- Software agents in Distributed Systems, Agent Technology.

Unit III

Distributed Operating Systems: Distributed System Goals, Types of Distributed Systems, Styles & Architecture of Distributed Systems, Threads, Virtualization, Clients, Servers, Code Migration, and Communication in Distributed Systems.

Database Operating System: Concurrence Control, Distributed Databases, and Concurrency Control Algorithms.

Unit IV

Virtualization Concepts: Virtual machines; supporting multiple operating systems simultaneously on a single hardware platform; running one operating system on top of another. True or pure virtualization.

Recommended Books / Suggested Readings:

1. Silberschatz A, Galvin P and Gagne G, "Operating Systems Concepts", John Wiley and Sons, New York, 2013.
2. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, New Delhi, 2014.3.
3. Deitel H M, "Operating System", Pearson Education, New Delhi, 2011.4.
4. Andrew S Tanenbaum, Albert S Woodhull, "Operating Systems Design and Implementation", Pearson Education, New Delhi, 2006.
5. Charles Crowley, "Operating systems: A Design Oriented Approach", Tata McGraw Hill, New Delhi, 2009.
6. Daniel P Bovet, Marco Cesati, "Understanding the Linux Kernel", O'Reilly Publishers, USA, 2006.
7. M Singhal and NG Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001.
8. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010.
9. Singhal M, Shivaratri N.G, Advanced Concepts in Operating Systems, McGraw-Hill Intl.,1994.
10. Pradeep K Sinha, Distributed Operating Systems Concepts and Design, PHI, First Edition, 2002.
11. Andrew S. Tanenbaum, Distributed Operating Systems, Pearson Education India, First Edition, 2011.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1334: Advanced Operating Systems Lab

Credits: 1

LTP 002

Course Objectives:

The course aims to equip the students present in the OS like Virtualization, Linux and shell commands. In this course student will be able to:

1. Provide necessary skills for developing the Operating System.
2. Gain practical experience with designing and implementing concepts of advanced operating systems
3. Understand LINUX shell and its commands.
4. Understand virtualization concept.

Course Outcomes (CO):

Upon the successful completion of the course, student will be able to:

CO1: Describe the various commands for files & directories

CO2: Analyze and simulate Linux Kernel programming.

CO3: Acquire a detailed understanding of one aspect of the Linux commands.

CO4: Demonstrate the concept of Virtualization.

Lab Work:

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following:

1. Installation Process of various operating systems
2. Virtualization, Installation of Virtual Machine Software, and installation of Operating System on Virtual Machine /Write a Program for file operations.
3. Study of Advance commands and filters of Linux.
4. Implement Semaphores
5. Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case statements, parameter passing and arguments, shell variables, shell keywords, creating shell programs for automate system tasks, report printing.
6. Introduction to Linux Kernel programming

i. To write a hello world module

ii. To display pid and other parameters of current process

iii. To display process tree of system with various parameters of process.

7. Display the contents of an inode using kernel programming.
8. Run multiple Operating Systems Concurrently Using VMware.

Software Required: **VM Software.**

Operating System: Window 10, Linux OS.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given) Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	15 Marks
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1315: Computer Graphics

Credits:3

LTP 300

Course Objectives:

The course aims to introduce students to all aspects of computer graphics and some algorithms. In this course students will be able to:

1. Comprehend the fundamental concepts of graphics.
2. Gain and apply the acquired knowledge pertaining to 2D and 3D concepts.
3. Understand the theory of 2D and 3D transformations,
4. Realize the importance of multimedia towards building the virtual environment.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the concepts of computer graphics.

CO2: Design and demonstrate the 2D and 3D objects using graphics algorithms.

CO3: Apply the knowledge, techniques, skills and modern tools to become successful professionals in graphics industries.

CO4: Explain various AR/VR devices.

Course Content

Unit I

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms; Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood-Fill

Unit II

2-D Geometrical Transforms and Viewing: Translation, Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates; Composite Transforms, Transformations Between Coordinate Systems, Viewing Pipeline, Viewing Coordinate Reference Frame, Window to View-Port Coordinate Transformation, Viewing Functions, Line and Polygon Clipping Algorithms, Cohen Sutherland line Clipping Algorithm, Liang-Barsky line clipping Algorithm.

Unit III

3-D Object Representation, Geometric Transformations and Viewing: Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier, and B-Spline Curves; Bezier and B-Spline Surfaces; Illumination Models, Polygon Rendering Methods, Viewing Pipeline and Coordinates; General Projection Transforms and Clipping.

Unit IV

Augmented and Virtual Reality: Understanding the Human Senses and their relationship to Output / Input Devices -Component Technologies of Head-Mounted Displays. Google Glass and Related Augmenting Displays, Sensors for Tracking Position, Orientation and Motion, Devices to Enable Interaction with Data.

Advance topics: visible surface detection concepts, back-face detection, depth buffer method, illumination, light sources, illumination methods (ambient, diffuse reflection, specular reflection), Color models: properties of light, XYZ, RGB, YIQ and CMY color models.

Recommended Books / Suggested Readings:

1. Donald Hearn, Pauline Baker, "Computer Graphics with OPENGL -C Version", 4th Edition, Pearson Education.
2. J. Vince, “Mathematics for Computer Graphics, Undergraduate Topics in Computer Science ", DOI 10.1007/978-1-84996-023-6 14, Springer-Verlag.
3. F.S. Hill, Computer Graphics using OPENGL, Second edition, Pearson Education, 2009.
4. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, "Computer Graphics-Principles andpractice", 2nd Edition, Pearson Education, 2007.
5. John F. Hughes, Andries Van Dam, Morgan Mc Guire, David F. Sklar, James D. Foley, Steven K. Feiner and Kurt Akeley, “Computer Graphics: Principles and Practice”, 3rd Edition, Addison Wesley Professional, 2013.
6. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Steve Aukstakalnis, Addison-Wesley Professional, 2016, ISBN 0134094352, 9780134094359.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the

compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1335: Computer Graphics Lab

Credits:1

LTP 002

Course Objectives:

The course aims to equip the students to introduce to the students the concepts of computer graphics. In this course student will be able to:

. In this course, student will be able to:

1. Understand the OpenGL.
2. Understand the need of developing graphics application.
3. Learn algorithmic development of graphics primitives like line, circle, polygon etc.
4. Learn the representation and transformation of graphical images and pictures.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Draw Geometric primitives using OpenGL.

CO2: Execute scan line polygon filling using OpenGL.

CO3: Implement basic transformations on objects using OpenGL.

CO4: Implement clipping algorithm on lines using OpenGL.

Course Content

Lab Work

Students should be made to practice the various concepts learned in classroom by implementing them in the form of programs. Various programs should be practiced in the lab based on each of the following –

1. A basic Open GL window.
2. Write a program to create a cube in OpenGL.
3. Write a program to horizontal and vertical line in OpenGL.
4. Write a program to draw points on a plane in OpenGL.
5. Write a program to draw a line on plane in OpenGL.
6. Write a program to draw circle on plane in OpenGL.
7. Write a program draw a white rectangle on a black background in OpenGL.
8. Write a program to draw a square when we click on the mouse button in OpenCL.

9. Write a program to draw a color cube and spin it using open GL transformation matrices in OpenGL.

10. Write a program to create a house like figure and rotate it about a given fixed point using OpenGL functions in OpenGL.

11. Implement Bresenham's line drawing algorithm for all types of slopes.

12. Write a program to implement the Cohen-Sutherland line clipping algorithm. Make provision to specify the input line, window for clipping and viewport for displaying the clipped image in OpenGL.

13. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral, respectively. Allow the user to specify the circle and the quadrilateral.

14. Write a program to fill any given polygon using scan line area filling algorithm in OpenGL.

15. Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.

16. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.

Lab Assessment Evaluation Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Lab Evaluation (Five times a semester): Based on following criteria: Problem solving (Based on difficulty level, one or more questions may be given)	15 Marks
	Flowchart / Algorithm / Structured description of problem to explain how theproblem can be solved / Interface Design	
	Internal viva	5 Marks
	Attendance	5 Marks
	Practical File	5 Marks
External Assessment (Summative)	External Viva	20 Marks
Total		50 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1316: Soft Skills

Credits: 2

LTP 200

Course Description: The course aims to equip the students to provide knowledge about various skills such as Oral, Presentation and interview skills. In this course student will be able to:

1. Study about orientation in soft skills, technical writing, and Theories of personality.
2. Learn about English that you know appropriately in discussions and speeches-that is, to build your confidence.
3. Develop Presentation skills in planning, organizing, and executing presentations to small groups.
4. Develop Various interview skills.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify the importance of soft Skills, technical writing, and Personality Development.

CO2: Describe the impact on the presentation.

CO3: Demonstrate the mock interview.

CO4: Develop the skills of body language and its impact on the interview.

Course Content:

Unit I

Introduction: Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development.

Technical Writing: Differences between technical and literary style, Elements of style; Common Errors, Letter Writing: Formal, Informal and Semi formal letters; business letters, Job Application: Cover letter, Differences between bio-data, CV and Resume, Report Writing: Basics of Report Writing; Structure of a report; Types of reports.

Unit II

Pronunciation. A basic overview of the sounds of English and stress, rhythm, and intonation.

Presentation skills: Overview of the process of developing a presentation, Analysis of speakers and speaking styles, parts of a presentation: introduction, body, and conclusion, Practice with common presentation types, Using visuals (e.g., PowerPoint) effectively.

Unit III

SWOT & Creative Thinking: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.

Group Discussion: Introduction, how it different from debate, four major areas of evaluation in selection GDs, each student must be participated in GD, some topics for Group Discussion: Terrorism in India, Morals & Values among Indians is Degenerating, and so on.

Unit IV

Interview Skills: Interview Preparation, opening strategies, answering, strategies, what employers want, Attitude and Effort, Body Language, Research, The Mock Interview, Phone Interviews, Behavioural Interviews, Closing the Interview.

Recommended Books / Suggested Readings:

1. Nair.V. Rajasenan, (2010). Life Skills, Personality and Leadership, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
2. Hurlock, B. Elizabeth, (2007). Personality Development, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
4. Shalini Verma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company.
5. Managing Soft Skills for Personality Development – edited by B.N.Ghosh,McGraw Hill India, 2012.
6. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearson Education India, 2011.
7. English and Soft Skills – S.P. Dhanavel, Orient Blackswan India, 2010.

Evaluation Pattern:

This course will be evaluated internally. Some of Evaluation parameters are:

1. Group Discussion- Create groups of about 2 or 3 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows:

(i) Communication Skills - 10 marks

(ii) Subject Clarity -10 marks

(iii) Group Dynamics - 10 marks

(iv) Behaviors & Mannerisms - 10 marks

2. Presentation Skills-Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation) for about 10 minutes. Parameters to be used for evaluation is as follows:

(i) Communication Skills- 10 marks

(ii) Platform Skills* - 10 marks

(iii) Subject Clarity/Knowledge - 10 marks

Platform Skills*: Postures/Gestures, Smiles/Expressions, Movements, usage of floor area.

3. Sample Letter writing or report writing following the guidelines and procedures. Parameters to be used for evaluation is as follows:

(i) Usage of English & Grammar - 10 marks

(ii) Following the format - 10 marks

(iii) Content clarity - 10 marks

MCA 1350: Capstone Project

Credits: 2

LTP 004

Course Objectives:

The course aims to equip the students with the opportunity for a more in-depth study of an area of computer science is typically offered in CS courses. In this course, students will be able to:

1. Apply problem solving skills to formalize general problem statements into precise algorithmic solutions.
2. Demonstrate adequate competency in theory, systems, and applications, the three main areas of the computer science curriculum.
3. Get exposure to the latest computer technologies.
4. Apply the computational and algorithmic problem-solving skills learned in computer science across many disciplines.

Course Outcomes (CO):

After completing this course, students will be able to:

CO1: Identify emerging areas of interest feasible to the project group.

CO2: Formulate the problem and perform analysis of it by the team.

CO3: Develop and implement cost effective design methods to solve the problem.

CO4: Write technical report and deliver presentation.

Course Content

Project Guidelines:

The project should be based on the latest technology. The project must be done in a group not exceeding **two students.**

The candidate is expected to select the project, do the requirements analysis, and carry out the necessary design procedure.

The candidate will submit project report to **Project Coordinator** and head of the department.

Guidelines for completing the Project:

Weekly report of students work for finalization of his area of work and topic of project should be submitted to the faculty during designated hours.

- Project Area and Project Groups by 1ST week
- Tentative project problem statements by 2nd week
- Project Synopsis by 3rd week
- Submit Final Presentation and Project Report by end of the semester

Assessment criteria for term work assessment should be viva voce examination by two examiners appointed by the Head of department.

Term Work:

The assessments of the term work should be done by two internal examiners, one of which will be the guide and the other will be HOD or senior staff member from the department.

Guidelines for the term work and assessment shall be as described in the Project of the same program.

Practical Examination:

Practical Examination will consist of a presentation along with actual demonstration of the project. The practical examination will be conducted by an external examiner).

Evaluation Pattern for the Project:

Internal: 60 Marks will be awarded by internal examiners on the bases of:

Presentation /communication (20 Marks)

Concept & Design of the Project (20 Marks)

Demonstration of the Project (20 Marks).

External: 40 Marks will be awarded by external examiner on the bases of:

Project Report (15 Marks)

External Viva-Voice (25 Marks).

Guidelines for Preparing the Report of Capstone Project Work

Arrangement of Contents:

1. The sequence in which the project report material should be arranged and bound should be as follows:

a) Cover Page & Title Page

b) Bonafide Certificate

c) Abstract

d) Table of Contents

e) List of Tables

f) List of Figures

g) List of Symbols, Abbreviations and Nomenclature Chapters

h) Appendices

i) References

The table and figures shall be introduced at appropriate places.

2. Page Dimension and Binding Specifications: The dimension of the project report should be in A4 size. The project report should be bound using flexible cover of the thick white art paper. The cover should be printed in black letters and the text for printing should be identical.

3. Preparation Format:

3.1. Cover Page & Title Page –A specimen copy of the Cover page & Title page of the project report are given in Appendix 1.

3.2. Bonafide Certificate –The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14, as per the format in Appendix 2. The certificate shall carry the supervisor's signature and shall be followed by the supervisor's name, academic designation (not any other responsibilities of administrative nature), department and full address of the institution where the supervisor has guided the student. The term 'SUPERVISOR' must be typed in capital letters between the supervisor's name and academic designation.

3.3. Abstract –Abstract should be one-page synopsis of the project report typed one and half line spacing, Font Style Times New Roman and Font Size 12.

3.4. Table of Contents –The table of contents should list all material following it as well as any material which precedes it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents but the page numbers of which are in lower case Roman letters. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents of the project report is given in Appendix 3.

3.5. List of Tables –The list should use the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

3.6. List of Figures –The list should use the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

3.7. List of Symbols, Abbreviations and Nomenclature –One and a half spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.

3.8. Chapters –The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) and Conclusion. The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions.

- Each chapter should be given an appropriate title.
- Tables and figures in a chapter should be placed in the immediate vicinity of the reference
- where they are cited.
- Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page, which refers to the material they annotate.

3.9. Appendices –Appendices are provided to give supplementary information, which is included in the main text may serve as a distraction and cloud the central theme.

- Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc. Appendices, Tables and References appearing in appendices should be numbered and referred to at appropriate places just as in the case of chapters.
- Appendices shall carry the title of the work reported and the same title shall be made in the contents page also.

3.10. List of References –The listing of references should be typed 4 spaces below the heading "REFERENCES" in alphabetical order in single spacing left –justified. The reference material should be listed in the alphabetical order of the first author. The name of the author/authors should be immediately followed by the year and other details. A typical illustrative list given below relates to the citation example quoted above.

REFERENCES:

1. Barnard, R.W. and Kellogg, C. (1980) Applications of Convolution Operators to Problems in Univalent Function Theory, Michigan Mach, J., Vol.27, pp.81–94.

2. Shin, K.G. and Mckay, N.D. (1984) Open Loop Minimum Time Control of Mechanical Manipulations and its Applications, Proc. Amer.Contr.Conf., San Diego, CA, pp. 1231-1236.

3. Typing Instructions: The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style Times New Roman and Font size 12.

MCA 1340: Summer Industry Training

Credits: 2

Course Objectives:

The course aims to equip the students to explore the real working environment of IT companies and get acquainted with the organizational structure, business operations. In this course, students will be able to:

1. Develop skills in application of theory to practical work situations.
2. Develop skills and techniques directly applicable to their careers.
3. Develop and enhance employment opportunities.
4. Facilitate their transition from college/university to full-time employment.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Build skills to work in actual working environment.

CO2: Use technical resources.

CO3: Acquire industrial experience of developing software or web-based applications to solve real time problems of customers.

CO4: Write technical documents and give oral presentations related to the work completed.

Course Content:

Four to Six weeks of work at industry site. Supervised by an expert at the industry.

Evaluation Pattern for the Professional Training:

Internal: 60 Marks will be awarded by internal examiner on the bases of:

Presentation/communication: 20 Marks

Project Analysis: 10 Marks

Project Designing and Technical Aspects: 10 Marks

Demonstration of the Project (20 Marks).

External: 40 Marks will be awarded by external examiner on the bases of:

Project Report: 15 Marks

External Viva-Voice: 25 Marks.

Note: The Summer Industry Training will be evaluated by two faculty members, which comprises one internal examiner and one external examiner. Internal/External examiners will be appointed by respective Dean or HOD of the department.

MCA 1440: Industrial Training and Project

Credits: 28

Course Objectives:

This training also gives the knowledge about to acquire the latest techniques, skills, methodologies and to build a strong foundation for their career growth and help in boosting career of students, since by the end of this training; students are turned into professionals in their specialized area. In this training students will be able to:

1. Provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
2. Enhance students' knowledge in one technology.
3. Increase self-confidence of students and helps in finding their own proficiency.
4. provide learners hands on practice within a real job situation.

Course Outcomes (CO):

After completing this course, students will be able to:

CO1: Acquire and apply fundamental principles of computer Science.

CO2: Improve technical knowledge, management, leadership, and entrepreneurship skills.

CO3: Identify, formulate, and model problems and find engineering solution based on a systems approach.

CO4: Write technical documents and give oral presentations related to the work completed.

Guidelines:

Project Guidelines:

The student will undertake an Industry training program of six months in this semester. The student must submit a synopsis report of the project, which should be approved by the company project Guide/Supervisor, in a specified format submitting to the HOD or Dean of the department within a month. The students will have to present the progress report of the work through seminars and progress reports within the stipulated time. For Six Month Training program, a student should go for an IT company.

Industrial Training Project Work Evaluation:

During Industrial project work, the evaluation process will be divided into number of phases to assess the continuous progress.

Project Synopsis Evaluation based on the following parameters: 50 marks (Internal Component)

Sr. No.	Parameters	Allocated marks
1.	Identification of Problem Domain and Detailed Analysis	15
2.	Study of the existing system and Feasibility of the project proposal	15
3.	Objectives and Methodology of the proposed work	20

Mid Term Project Evaluation based on the following parameters: 70 Marks (Internal Component)

Sr. No.	Parameters	Allocated marks
1.	Design Methodology	25
2.	Usage of System Design Diagrams (ER, Use Case diagram so on)	25
3.	Incorporation of suggestions	20

End-Semester Project Evaluation based on the following parameters: 80 marks (Internal Component)

Sr. No.	Parameters	Allocated marks
1.	Test Cases & Screen Shots of the Design and Coding	30
2.	Conclusion and Discussion	20
3.	Organization & development of Report	30

End-Semester Project Evaluation based on the following parameters: 100 marks (Internal Component)

Sr. No.	Parameters	Allocated marks
1.	Description of concepts and Technical Details/Project Analysis	30
2.	Technical report/ Daily diary	30
3.	Project Report	40

Evaluation by Company Project Guide/Supervisor: 100 Marks (External Component)

External Evaluation based on the following parameters: 400 (External Component)

Sr. No.	Parameters	Allocated marks
1.	Identification of Problem Domain, Objectives and Methodology of the proposed work	50
2.	Design Methodology	50
3.	Usage of System Design Diagrams (ER, Use Case diagram so on)	50
4.	Project Demonstration	100
5.	Viva-Voice	80
6.	Project Communication / Presentation / Interaction	70
	Total	400

Note: In 2nd year (Four semester) the student must develop one major project, which will be evaluated by the one internal examiner and one external examiners. Internal/External examiners will be appointed by respective department's Dean or HOD.

Completion of Industrial Training: At completion of a training period, a confirmation letter must be obtained from your employer. Industrial Training certificate is to be submitted to the department within 7 days after the completion of Industrial Training. Upon approval of Dean or HOD of the department, the industrial certificate will be included in your Project report, as evidence of a successfully completed the industrial Training.

Some Mandatory forms for six months' industry training evaluation:

5. Evaluation Performa is filled by Industry Supervisor/ Guide

EVALUATION PERFORMA			
		Roll No.	
Institute Name			
Internship/Training Project Title			
Industry Supervisor/ Guide Name		Organization Name	
Internship/Training From (Start Date)		Internship/Training To (End Date)	
Parameters			Marks Obtained (Out of 5)
Behaviors			.....
Performs in a dependable manner			.....
Cooperates with co-workers and supervisors			.....
Shows interest in work			.....
Learns quickly			.....
Shows initiative			.....
Produces high quality work			.....
Accepts responsibility			.....
Accepts criticism			.....
Demonstrates organizational skills			.....
Uses technical knowledge and expertise			.....
Shows good judgment			.....
Demonstrates creativity/originality			.....
Analyzes problems effectively			.....

5. Evaluation Performa is filled by Industry Supervisor/ Guide

Communicates well		
Writes effectively		
Has a professional attitude		
Gives a professional appearance		
Is punctual		
Uses time effectively		
Total Marks		
Industry Supervisor Name	Signature	.....
Signature of Industry Supervisor		.....

6. Student's Daily Diary/ Daily Log

Date		Time of arrival		Time of Departure	
Dept./Division		Project Title			
Main points of the day (Include Figures, if any)					

5. Evaluation Performa is filled by Industry Supervisor/ Guide

PERFORMANCE REPORT OF THE STUDENT			
Name of the Student			
Roll no. of the Student			
Total Hours Devoted for Internship/Training	90		
Marks Obtained (Out of 100)	..../100		
Date		Place	
Industry Supervisor Name		Signature	

The performance report of the student must be forwarded to the Faculty Mentor of the student on completion of training in sealed envelope or to through email to Faculty Mentor. Performance Report should preferably be printed with Organization Header.

8. Students Feedback Form

STUDENT FEEDBACK FORM		
Student Name	Roll No.	
Institute Name		
Faculty Mentor Name	Faculty's Designation	
Internship/ Training Project Title		
Industry Supervisor Name	Supervisor's Designation	
Organization Name		
Internship From (Start Date)	Internship To (End Date)	
Give a brief description of Internship Work		

Was your internship experience related to your major area of study	Yes, to a large degree	Yes, to a slight degree		Not related at all	
This experience has:	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Given me the opportunity to explore a career field					
Allowed me to apply classroom theory to practice					
Helped me develop my decision-making and problem-solving skills					
Provided a chance to use leadership skills (influence others, develop ideas with others, stimulate decision-making and action)					
Expanded my sensitivity to the ethical					
implications of the work involved					
Made it possible for me to be more confident in new situations					
Given me a chance to improve my interpersonal skills					
Helped me discover new aspects of myself that I didn't know existed before					
Helped me develop new interests and abilities					
Helped me clarify my career goals					
Provided me with contacts which may lead to future employment					
Allowed me to acquire information and/ or use equipment not available at my Institute					
In the Institute internship program, faculty members are expected to be mentors for students. Do you feel that your faculty coordinator served such a function? Why or why not?					
How well were you able to accomplish the initial goals, tasks and new skills that were set down in your learning contract? In what ways were you able to take a new direction or expand beyond your contract? Why were some goals not accomplished adequately?					
In what areas did you most develop and improve?					

In the Institute internship program, faculty members are expected to be mentors for students. Do you feel that your faculty coordinator served such a function? Why or why not?			
How well were you able to accomplish the initial goals, tasks and new skills that were set down in your learning contract? In what ways were you able to take a new direction or expand beyond your contract? Why were some goals not accomplished adequately?			
In what areas did you most develop and improve?			
What did you dislike about the internship?			
Considering your overall experience, how would you rate this internship? (Tick One)			
Satisfactory	*Good*	*Excellent*	
Give suggestions as to how your internship experience could have been improved.			
Student Signature		*Date*	

8. Attendance Sheet

Name of Student	
Roll. No	
Name of Course	
Date of Commencement of Internship/Training	
Date of Completion of Training	
Organization Name	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Month & Year																															

Note:

Attendance Sheet should remain affixed in Daily Training Diary. Do not remove or tear it off.
Student should sign/initial in the attendance column. Do not mark 'P'.
Holidays should be marked in Red Ink in attendance column. Absent should be marked as 'A' in Red Ink.
Signature of Company Internship/Training supervisor with company stamp/ seal.

Industry Training Supervisor/Guide Name:
Industry Training Supervisor/Guide Designation:
Contact Number:
E-mail ID:

Supervisor/Guide Signature:

MCA1450: Research /Technical Seminar

Credits: 2

Course Objectives:

The course aims to equip the students with the opportunity for a more in-depth study of an area of computer science is typically offered in CS courses. In this course, students will be able to:

1. Develop skills in doing literature survey, technical presentation and report presentation.
2. Demonstrate adequate competency in theory, systems, and applications, the main areas of the computer Applications.
3. Get exposure to the latest research in computer Science.
4. Apply the skills learned in computer science across many disciplines.

Course Outcomes (CO):

After completing this course, students will be able to:

CO1: Acquired the basic skills to for performing literature survey and paper presentation

CO2: Provide students better communication skills.

CO3: Describe the current topics in computer Applications domain.

CO4: Write technical report and deliver presentation.

Research /Technical Seminar Guidelines:

1. Selection of topic/area: Select a research paper according to the specialization of students. Research Papers from any other approved journals can also be selected.

2. Approval to the selected topic: After selecting the paper, get approval from the concerned faculty in charge.

3. Each student will identify a current topic of computer science. The project should be based on the latest technology.

4. Study of topic: Students are requested to acquire a thorough knowledge on the subject by referring previous papers and reference books (These may be included as references at the end of the paper) on the corresponding area.

5. Preparation of slides for presentation: Slides may be presented in MS power point. Time allowed for presentation is 20 minutes for presentation and 5 minutes for discussions. So, number of slides may be around 20 - 25 to adhere the time limit.

6. Organization of slides:

The first slide will be a title page showing the title, name of author (presenter), roll no. and Class. 2nd page will contain overview of the seminar

Successive pages will contain

a. Objectives of the paper

b. Introduction

c. Body of the paper includes system dynamics, methodology, graphs, block diagrams etc. arranged in a logical sequence depending on the problem.

d. Results and discussions

e. Conclusion

7. Last page will contain references and bibliography. References must be presented in IEEE format.

8. Each slide consists of 4 or 5 lines with enough space between lines.

9. All equations must be typed using equation editor (available with MS office/other office suite).

10. Each slide will have a title and each figure have a caption.

11. An abstract of the work (seminar) is to be circulated among the faculty and fellow students before presentation of the seminar. The abstract is prepared as follows. The seminar abstract is an important record of the coverage of topic and provides a valuable source of leading references for students and faculty alike. Accordingly, the abstract must serve as an introduction to your seminar topic. It will include the key hypotheses, the major scientific findings and a brief conclusion. The abstract will be limited to 500 words, excluding figures and tables. The abstract must contain references to the research articles upon which the seminar is based as well as research articles that have served as key background material. The references should be listed using a standard format (IEEE format). The abstract must be submitted to the faculty in charge and get approval before the presentation.

12. Draft copy of the Seminar report should also be submitted before the presentation

The candidate will submit Research /Technical Seminar report to **Coordinator and Head of the department.** Evaluation Performa:

Student Name and Roll no: .....

S. No.	Parameters					
1.	Understand problems and select topic from reputed journals					
2.	Societal/ environmental/ Ethical relevance of the topic					
3.	Literature Survey					
4.	Ability to select papers with latest technical knowledge and tools					
5.	Relevance of the topic					
6.	Knowledge on the topic					
7.	Resources from which the seminar have been based					
8.	Question answer session					
9.	Lay out, and content of Presentation					
10.	Report					
	Total Marks(100)					

Seminar Co-Ordinator HOD/Dean

MCA 1216: Data Mining and Warehousing

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to provide the knowledge in the field of data mining and Warehousing It focuses on fundamental data mining concepts and techniques for discovering interesting patterns from data in various applications. It emphasizes techniques for developing effective, efficient, and scalable data mining tools. In this course students will be able to:

1. Understand the basic concepts of data mining and Warehousing.
2. Understand what Is Data Mining, what kinds of data can be mined, what kinds of patterns can be mined, and what kinds of applications are targeted.
3. Understand various data mining techniques.
4. Understand the concepts of web Mining.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate knowledge of Data Mining and Warehousing.

CO2: Discuss standard data mining methods and techniques such as data clustering and classification.

CO3: Explain the various process of Data Mining and decide best according to type of data.

CO4: Apply these techniques on datasets of realistic sizes using modern data analysis frameworks.

Course Content:

Unit I

Data Warehouse: What is it, Who Need It, and Why? Things to Consider, Managing the Data Warehouse, Data Warehouse Design Methodology, Data Marts and Start Schema Design, Fundamentals of ETL Architecture, Partitioning Data, Indexing Data.

Introduction to data mining: The motivation, learning from past mistake, Data mining, measuring data mining effectiveness, Embedded data mining into business process, what is decision tree, Business score card, where to use decision tree, the general idea, How the decision tree works.

Unit II

Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms.

Unit III

Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method -Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.

Unit IV

Web Mining: Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining, Spatial Mining and Temporal Mining.

Recommended Books / Suggested Readings:

1. I. Singh, "Data Mining and Warehousing", Khanna Publishing House.
2. Margaret H. Dunham, S. Sridhar, "Data Mining: Introductory and Advanced Topics" Pearson Education
3. Arun K. Pujari, "Data Mining Techniques" Universities Press.
4. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1209: Data Sciences

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students with basic knowledge of data Science. In this course student will be able to:

1. Learn the basic concepts of Data science and data pre-processing.
2. Understand Data using Statistics and Probability techniques.
3. Study about the basic concepts of clustering techniques.
4. Understand the key techniques and theory used in Social networks, visualization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain data science and its fundamentals.

CO2: Demonstrate proficiency with statistical analysis of data.

CO3: Develop the ability to build and assess data-based models.

CO4: Analyze the data and follow of ethics.

Course Content

Unit I

Introduction: What is Data Science? Big Data and Data Science hype and getting past the hype, why now?- Datafication , Facets of data , Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management , data science process, Data pre-processing: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Needed Statistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, Introduction to R Programming.

Unit II

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs, and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online real estate firm). Machine Learning Algorithms: Linear Regression, Logistic Regression, k-Nearest Neighbors (k-NN), k-means, Reinforcement Learning, Deep Learning and Feature Representation Learning.

Unit III

Cluster Analysis: Basic Concept and Methods Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering, Clustering High-Dimensional Data, Clustering Graph and Network Data.

Unit IV

Mining Social Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas, and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists.

Recommended Books / Suggested Readings:

1. Doing Data Science Cathy O'Neil and Rachel Schutt Straight Talk from The Frontline.O'Reilly2014.
2. Mining of Massive Datasets. v2.1Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Cambridge University Press2014.
3. Machine Learning: A Probabilistic Perspective Kevin P. Murphy2013.
4. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Third Edition 2012.
5. Davy Cielen Arno D. B. Meysman Mohamed Ali “Introducing data Science.
6. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to DataMining”, Person Education, 2007.
7. K.P. Soman, Shyam Diwakar and V. Ajay “, Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2016.
8. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV.

Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1305: Data Visualization

Credits:3

LTP 300

Course Objectives:

The course aims to equip the students to learn the basics of Data Visualization and tools and techniques. The course is ideal for gaining a broad understanding of the Data Visualization techniques and tools. In this course students will be able to:

1. Understand underlying principles of visualization design.
2. Learn the importance of the domain of data visualization.
3. Understand the various techniques in data visualization.
4. Apply the applications of data visualization.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Compare data mining and visualization.

CO2: Explain the different visualization models.

CO3: Classify the basic visualization and clustering techniques.

CO4: Apply these techniques to mine real-life situations.

Course Content:

Unit I

Data Visualization and Data Mining: Definition, Data preparation, Stages in data mining, visualization, clustering, predictive analysis relationship, Visualization design principles, Graphics design, Anatomy of a graph.

Unit II

Data Visualization Techniques: Univariate data visualization: Bar chart, histograms, frequency polygram, boxplots, dot plots, Bivariate data visualization, Multivariate data visualization: Histogram matrix, scatterplot matrix, multiple box plot and trellis plot, Visualizing groups, Dynamic techniques.

Unit III

Clustering: Distance measures, Agglomerative hierarchical clustering, Partition based clustering, Fuzzy clustering.

Unit IV

Visualization Tools: Decision trees, Linear regression, Logistical regression, Association rules, Clustering, SOM.

Case Studies: Industry specific data mining- Data analysis case study, Credit scoring case study.

Recommended Books / Suggested Readings:

1. Glenn J Myatt, Wayne P. Johnson, "Making sense of Data - A practical guide to data visualization, advanced mining methods and applications", 1st Edition, Wiley, 2009.

2. Tom Soukup and Ian Davidson, "Visual Data Mining: Techniques and Toolsfor Data Visualization and Mining", 1st Edition, John Wiley & Sons, 2002.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1319: Data Science with Python

Credits:3

LTP 300

Course Objectives:

The course aims to equip the students with basic knowledge of Data Science with Python. In this course, student will be able to:

1. Introduce the important data science modules NumPy, SciPy and Matplotlib
2. Introduce the input/output with files in Python and statistical processing of a data using Pandas Study about the basic concepts of clustering techniques.
3. Understand the Data Science and Python.
4. Explore various steps of data science pipeline with role of Python.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Apply various Python data structures to effectively manage various types of data.

CO2: Demonstrate proficiency with statistical analysis of data.

CO3: Use various data visualization tools for effective interpretations and insights of data.

CO4: Perform data Wrangling with Scikit-learn applying exploratory data analysis.

Course Content:

Unit I

Data Science and Python: Considering the emergence of data science, Outlining the core competencies of a data scientist, Linking data science, big data, and AI , Understanding the role of programming, Creating the Data Science Pipeline, Preparing the data, Performing exploratory data analysis, Learning from data, Visualizing, Obtaining insights and data products, Understanding Python's Role in Data Science, Considering the shifting profile of data scientists, Working with a multipurpose, simple, and efficient language, Learning to Use Python Fast ,Loading data, Training a model, Viewing a result.

Unit II

NumPy arrays 1-d, multidimensional arrays and matrices; Mathematical operations with arrays; Slicing and addressing arrays; Boolean masks; Difference between lists and arrays SciPy, Scientific Computing library of Python-Introduction, Basic functions, Special functions, SciPy. Integrate, SciPy. Optimize, SciPy. Interpolate.

Unit III

Python Plotting: PyPlot Basic Plotting; Logarithmic Plots; Plots with multiple axes; Matplotlib-interactive functions 3d plotting; Pandas-Introduction, Data Frame, Reading and writing CSV, XLS files, Working with missing data, categorical data, data visualization with pandas.

Unit IV

Wrangling Data: Playing with Scikit-learn, Understanding classes in Scikit-learn, Defining applications for data science, Performing the Hashing Trick, Using hash functions, Demonstrating the hashing trick, Working with deterministic selection, Considering Timing and Performance, Benchmarkin, timeit, Working with the memory profiler, Running in Parallel on Multiple Cores, Performing multicore parallelism, Demonstrating multiprocessing.

Recommended Books / Suggested Readings:

1. Python for data science for dummies 2nd Edition, John Paul Mueller, Luca Massaron, Wiley.
2. Programming through Python, M. T. Savaliya, R. K. Maurya, G. M. Magar, STAREDU Solutions.
3. Pandas for everyone :Python Data Analysis, Daniel Y. Chen, Pearson.
4. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, Arno D.B. Meysman, et al., Minning.
5. Applied Data Science with Python and Jupyter: Use powerful industry-standard tools to unlock new, actionable insights from your data, , Packt.
6. Data Analytics, Anil Maheshwari , McGrawHill.
7. Data Science From Scratch: First Principles with Python, Joel Grus , SPD.
8. Star Data Science Specialist, STAR CERTIFICATION

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1217: Machine Learning and Pattern Recognition

Credits: 3

LTP 300

Course Description: The course aims to equip the students to introduce the concept of Machine Learning, Pattern Recognition and different techniques of machine learning. In this course students will be able to:

1. Understand an overview of Machine Learning.
2. Learn to use various techniques for Machine Learning.
3. Apply the algorithms to solve problems of complexity.
4. Understand the mathematical relationships within and across Machine Learning algorithms.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe about Machine Learning and their perspectives.

CO2: Apply the concepts of Machine Learning Algorithms.

CO3: Design and implement supervised, Unsupervised and Reinforcement Learning.

CO4: Solve real life problems by implementing machine learning.

CO5: Understand and make use of unsupervised learning and Clustering in Pattern recognition.

Course Content

Unit I

Introduction to Machine Learning: Introduction, Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning- supervised, unsupervised and reinforcement learning, inductive learning, deductive learning; Applications of Machine Learning, Tools in Machine Learning, Issues in Machine Learning.

Unit II

Supervised Learning: Introduction, Example, Classification Model, Classification Learning Steps, Common Classification Algorithms (k- Nearest Neighbour, Decision Tree, Random Forest Model, Support Vector Machines).

Unit III

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Applications of Unsupervised Learning, Clustering, Finding Patterns using Association Rule.

Unit IV

Reinforcement learning: Elements of Reinforcement Learning, Characteristics of reinforcement learning, various techniques used in reinforcement, Model-Based Learning, Temporal Difference Learning, Markov decision process, Deep Learning.

Pattern Recognition: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

Recommended Books / Suggested Readings:

1. Saikat Dutt, SubramanianChandramouli, Amit Kumar Das, “Machine Learning”, Pearson Education.
2. E. Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India.
3.Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited.
4. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press.
5. Hadoop in Practice, Alex Holmes Dreamtech Press.
6. Duda R. O., Hart P. E. and Stork D. G., “Pattern Classification”, John Wiley.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1219: Natural Language Processing

Credits:3

LTP 300

Course Description: The course aims to equip the students to introduce the concept of Natural Language Processing. In this course students will be able to:

1. Introduce the fundamental concepts and techniques of natural language processing.
2. Understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
3. Develop systems for various NLP problems with moderate complexity.
4. Understand the language modelling and Parts-of-speech Tagging.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Understand the fundamentals of Natural Language Processing.

CO2: Develop systems for various NLP problems with moderate complexity.

CO3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, parts-of-speech

CO4: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.

Course Content:

Unit I

Introduction to NLP: Introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

Unit II

Text Representations and Embeddings: One-hot encoding, Bag-of-Words (BoW) Dictionary: Term Frequency – Inverse Document Frequency (TFIDF), N-gram. Word Embedding: Word2vec, Glove, and FastText. Text categorization: Basic supervised text categorization algorithms, including Naive Bayes, k Nearest Neighbor (kNN), and Logistic Regression. Sequences and sequential data

Unit III

Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development

Unit IV

Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

Recommended Books / Suggested Readings:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.
2. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
3. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing".Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press.
4. Hobson Lane, Cole Howard, Hannes Hapke Natural Language Processing in Action 2019.
5. Jacob Eisenstein Introduction to Natural Language Processing 2019.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1317: Deep Learning

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to learn the basics of Data Learning. The course is ideal for gaining a broad understanding of the Deep Learning techniques and applications. In this course students will be able to:

1. Understand underlying principles of Deep Learning.
2. Learn the importance of the domain of data visualization.
3. Understand the various techniques in data learning.
4. Apply the applications of data learning.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explore the essentials of Deep Learning and Deep Network architectures.

CO2: Describe the feed forward and deep networks.

CO3: Design single and multi-layer feed-forward deep networks and tune various hyper-parameters.

CO4: Use deep learning methodology in real world applications.

Course Content

Unit I

Introduction to deep learning: Difference between neural network and deep neural networks, Deep Neural Networks: Multilayer Perceptron (MLP), Recurrent neural networks (RNN), Long short term memory (LSTM), Applications: Automatic speech recognition, image recognition, Natural language processing, Bioinformatics, Mobile advertising, Financial fraud detection, Military. Techniques to improve deep networks: DNN Optimization, Regularization.

Unit II

Neural Networks: Feedforward neural networks, deep networks, regularizing a deep network, model exploration, and hyperparameter tuning.

Unit III

Convolution Neural Networks: Introduction to convolution neural networks: stacking, striding and pooling, applications like image, and text classification.

Unit IV

Sequence Modeling: Recurrent Nets: Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks

Recommended Books / Suggested Readings:

1. Ian Goodfellow, Deep Learning, MIT Press, 2016.
2. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
3. Mindy L Hall, Deep Learning, VDM Verlag, 2011.
4. Li Deng (Author), Dong Yu, Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing), Now Publishers Inc, 2009.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, the examiner will set questions according on the Course Outcomes of the syllabus. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions.questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1320: Soft Computing

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to learn the basics of Soft Computing techniques. The course is ideal for understanding the concepts of soft computing techniques such as neural networks, fuzzy systems, genetic algorithms. In this course students will be able to:

1. Understand underlying principles of Soft Computing.
2. Learn the importance of the Soft Computing.
3. Understand the various techniques in Soft Computing.
4. Apply the applications of GA in Machine Learning.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Recognize the need of soft computing and study basic concepts and techniques of soft computing.

CO2: Understand the basic concepts of artificial neural network to analyze widely used neural networks.

CO3: Apply fuzzy logic to handle uncertainty in various real-world problems.

CO4: Apply hybrid techniques in applications of soft computing.

Course Content

Unit I

Introduction to Soft Computing: Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications of soft computing.

Artificial Neural Networks: Basic concepts of neural networks, Human brain, Biological neural network, History of artificial neural networks, Basic building blocks of an artificial neuron, Neural network architectures, Activation functions, Characteristics and limitation of neural networks.

Unit II

Fuzzy Sets and Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning.

Fuzzy Inference Systems: Fuzzy Logic, Fuzzy Expert Systems, Fuzzy Decision Making.

Unit III

Genetic Algorithm: Introduction, Traditional optimization and search techniques, Comparison with traditional algorithms, Operations- Encoding, Selection, Crossover and Mutation, Classification of Genetic algorithm.

Applications of GA in Machine Learning, Support Vector Machines for Learning, Linear Learning Machines, Support Vector Classification, Support Vector Regression.

Unit IV

Hybrid Soft Computing Techniques: Introduction, Classification of hybrid systems, Neuro-fuzzy hybrid systems, Neuro-genetic hybrid systems, Fuzzy genetic hybrid systems.

Other Soft Computing Techniques: Tabu Search, Ant colony-based optimization, Swarm Intelligence.

Recommended Books / Suggested Readings:

1. Sivanandam S.N. and Deepa S.N., "Principles of Soft Computing", Wiley-India.
2. Rajasekaran S. and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications", PHI Learning.
3. Chakraverty S., Sahoo D.M. and Mahato N. R., "Concepts of Soft Computing- Fuzzy and ANN with Programming", Springer.
4. Kaushik S. and Tiwari S., "Soft Computing – Fundamentals, Techniques and Applications', McGrawHill Education.
5. Jang J.-S.R., Sun C.-T. and Mizutani E., "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.
6. Karray F. O. and Silva C. D., "Soft Computing and Intelligent Systems Design – Theory, Tools and Applications", Pearson Education.
7. Freeman J. A. and Skapura D. M., "Neural Networks: Algorithms, Applications and Programming Techniques", Pearson.
8. Siman H., "Neural Netowrks", Prentice Hall of India.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV.

MCA 1211: Network Security

Credits:3

LTP 300

Course Objectives:

The course aims to equip the students with theory and practice of network security, focusing on the security aspects of IP, Email, and system. In this course students will be able to:

1. Impart knowledge on Network security.
2. Introduce the working of classical, symmetric, and asymmetric techniques, and public key algorithms.
3. Familiarize design issues and working principles of various secure communication standards covering Kerberos, certificate & standards, HTTPS and SSH.
4. Enhance the knowledge on implementation of different intrusion detection principles and firewall implementations.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Define and illustrate network security concepts and principles.

CO2: Classify the symmetric encryption techniques.

CO3: Apply appropriate techniques to solve network security threats.

CO4: Evaluate system security using network security controls.

Course Content:

Unit I

Introduction: Computer Security Concepts, the OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, a Model for Network Security.

Cryptography: Symmetric Encryption, Message Confidentiality, Public-Key Cryptography and Message Authentication Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation. Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures.

Unit II

Key Distribution and User Authentication, Transport Level Security, HTTPS and SSH Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure. Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH).

Unit III

Wireless Network Security: Overview of IEEE 802.11 WLAN, IEEE 802.11i Wireless LAN Security.

E-MAIL & IP Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations.

Unit IV

System Security and Malicious Software Intruders, Intrusion Detection, Password Management, Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks, The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations.

Recommended Books / Suggested Readings:

1. William Stallings, Network Security Essentials: Applications and Standards", 4th Edition, Pearson Education, 2011.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security: Private communication in a public world", Second Edition, Pearson India Education, 2017.
3. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
4. Nina Godbole, "Information Systems Security", Wiley Publication, 2009.
5. Nirbhay Chaubey, "Securing AODV Routing Protocol in Design of Mobile Ad-Hoc Networks: LAP Lambert Academic Publishing,2015
6. Bruce Schneier "Applied Cryptography: Protocols, Algorithms, and Source Code in C", Wiley India,1996

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1220: Cyber Security Fundamentals

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to learn about Cyber security. In this course, students will be able to:

1. Learn foundations of Cyber Security and Ethical Hacking.
2. Understand Technical and legal aspects of computer crime investigations.
3. Aware of fundamentals of cyber security Laws, and computer evidence.
4. Identify insights on how to apply Cyber Security, Ethical Hacking to solve an interdisciplinary problem.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the major concepts of Cyber Security.

CO2: Understand, appreciate, employ, design, and implement appropriate security technologies and policies to protect computers and digital information.

CO3: Discuss technical and legal aspects of computer crime investigations

CO4: Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection and learn the procedures of recovering computer evidence

Course Content

Unit I

Essential Terminologies: CIA, Risks, Breaches, Threats, Attacks, Exploits. Information Gathering (Social Engineering, Foot Printing & Scanning). Open Source Tools: Nmap, Zen map, Port Scanners, Network scanners .

Unit II

Identity theft and identity fraud: Typologies of internet theft, virtual identity, credit identity. Prevalence and victimology, physical methods, of identity theft, phishing, spyware, trojans, Zombies, Ransomwares, insurance and loan fraud, immigration fraud. Terrorism and organized crime: Terror online, E-cash problems, criminal activities, organized crime as cyber

gangs., technology used in organized crime. Data piracy.

Unit III

Cybercrimes and Cyber Laws: The Legal Perspectives Introduction, Why Do We Need Cyber claws: The Indian Context, Information Technology Act, 2000, Challenges to Indian Law and Cybercrime Scenario in India, Amendments to the Indian IT Act.

Computer Evidence: Forensic Terminologies and Developing forensic capabilities, Searching and seizing computer related evidence, Processing of evidence and report preparation.

Unit IV

Ethical Hacking: System Hacking and Hacking Wireless Networks: Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing. Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

Recommended Books / Suggested Readings:

1. Nina Godbole, Sunita Belapur, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Publications, April 2011.
2. James Graham, Richard Howard, Ryan Olson, "Cyber Security Essentials", CRC Press, Tailor and Francis Group, 2011
3. Robert Jones, "Internet Forensics: Using Digital Evidence to Solve Computer Crime", O'Reilly Media, October 2005
4. Computer Forensics and Cyber Crime by M.T.Britz, Pearson Education, First Impression,2012.
5. Chad Steel, "Windows Forensics: The field guide for conducting corporate computer investigations", Wiley India Publications, December 2006.
6. Bothra Harsh, "Hacking", Khanna Publishing House, Delhi.
7. The basic of Hacking and Penetration testing, second edition on ethical hacking and penetration by Patrick Engebretson.
8. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.
9.Ankit Fadia; An Unofficial Guide to Ethical Hacking 2nd Edition; Macmillan India,2006.
10. Nina Godbole, "Information System Security", Wiley.
11. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
12. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004).

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1318: Fundamentals of Ethical Hacking

Credits:3

LTP 300

Course Objectives: The course aims to equip the students to learn about ethical hacking and defense related security. The course includes fundamentals of ethical hacking, foot printing and social engineering, data recovery, Web Based Password Cracking Techniques. In this course students will be able to:

1. Understand the fundamentals of Ethical Hacking.
2. Gain the knowledge of the use and availability of tools to support an ethical hack
3. Gain the knowledge of interpreting the results of a controlled attack.
4. Understand various Web Based Password Cracking Techniques.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Apply the principles of computer forensics for security.

CO2: Implement the data recovery methods

CO3: Escalate privileges by an intruder and what steps can be taken to secure a system.

CO4: Describe Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, and Buffer Overflows.

Course Content:

Unit I

Ethical hacking: information gathering methodology, Hacking Tools, Scanning- Definition, Types of Scanning, Objectives of Scanning, Scanning Methodology, Counter measures; Enumeration- NetBIOS Null Sessions, hacking tools - Enumerating User Accounts, Active Directory Enumeration and Countermeasures; System Hacking- Administrator password guessing, Password Cracking Algorithm, Automated Password Cracking, Types of Password Attacks, Hacking tools.

Unit II

Computer Forensics Fundamentals: Types of Computer Forensics Technology – Types of Vendor and Computer Forensics Services. Foot printing and social Engineering: using web tools for foot printing, conducting competitive intelligence, using domain system zone transfers, introduction to social engineering.

Unit III

Data Recovery: Evidence Collection and Data Seizure, Duplication and Preservation of Digital Evidence, Computer Image Verification and Authentication.

Electronic Evidence: Discover of Electronic Evidence, Identification of Data. Reconstructing Past Events, Networks.

Unit IV

Foot printing and social Engineering: using web tools for foot printing, conducting competitive intelligence, using domain system zone transfers, introduction to social engineering.

Recommended Books / Suggested Readings:

1. Micheal T. Simpson, Kent Backman and James E. Corley, “Hands on ethical hacking and Network Defense”, Cengage Learning, 2013.
2. John R. Vacca, “Computer Forensics”, Firewall Media, 2004.
3. Manish Kumar; the Secret of Hacking; Third Edition; Publisher Leo Impact Security Services.
4. Ankit Fadia; An Unofficial Guide to Ethical Hacking 2nd Edition; Macmillan India;2006
5. Majid Yar, “Cybercrime and Society”, Sage Publications, 2006.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, the examiner will set questions according on the Course Outcomes of the syllabus. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1311: Block chain Technology

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to provide with the insights and deep understanding of the various components of blockchain technology. In this course students will be able to:

1. Understand what Blockchain is and why it is used.
2. Explain the different components involved within Blockchain.
3. Know when and why you may want to use Blockchain within your environment.
4. Integrate ideas from blockchain technology into their own projects.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate the basics of Block chain concepts using modern tools/technologies.

CO2: Analyze the role of block chain applications in different domains including cybersecurity.

CO3: Evaluate the usage of Block chain implementation/features for the given problem.

CO4: Exemplify the usage of bitcoins and its impact on the economy.

Course Content

Unit I

Introduction: Introduction to Blockchain, Types of Blockchain (Public, Consortium, and Private), How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros, and cons of Blockchain, Myths about Bitcoin.

Unit II

Blockchain: Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.

Unit III

Introduction to Bitcoin: key concepts of Bitcoin, Transfer Bitcoin by using BTC.com, Understand how Bitcoin works, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.

Unit IV

Introduction to Ethereum: Advantages and Disadvantages, Ethereum vs Bitcoin,

Introduction to Smart contracts, usage, application, working principle, Law and Regulations.

Use Case of Blockchain: Cryptocurrency, International Money Transfer, Asset management, Insurance, IoT, Smart Grid, Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems.

Recommended Books / Suggested Readings:

1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Arshdeep Bikramaditya Signal, Gautam Dhameja (Priyansu Sekhar Panda., A Press.
2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti.
3. Blockchain by Melanie Swan, O Reilly.
4. Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, Princeton.
5. Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu. T Books.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1218: Professional Ethics

Credits: 3

LTP 300

Course Objectives:

This course introduction to the Professional Ethics. In this course students will be able to:

1. Understand the behavior in a professional environment as employees.
2. Understand that mind and desire control is needed for being ethical.
3. Distinguish among morals, values, ethics, and the law.
4. Understand the values of humans in Business.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Identify and describe relevant theoretical concepts related to professional ethics.

CO2: Discuss the basic perception of profession, professional ethics, various moral issues & uses of ethical theories.

CO3: Realize the importance of human values.

CO4: Apply learning from Indian history and ethos to ethical practices.

Course Content

Unit I

Introduction to Terminology in Ethics: Integrity, Honesty, Courage, Empathy, Personality, Character, Self-Confidence, Respect for Others -Work culture, Social responsibility, Responsibilities as a citizen, Cooperation and commitment- Religion vs. Spirituality, Philosophy, Customs and practices -Self-interest, Fear, Deception, Ignorance, Ego, Uncritical acceptance of authority

Unit II

Mind and Its Mysteries: What is Mind? Mind and body, Mind and food- Mental faculties - Theory of perception, Memory, Imagination, Thought-Culture, Desires - Cultivation of Virtues, Control of Senses and Mind - Concentration, Meditation and Enlightenment.

Unit III

Individual factors: Moral Philosophies and values - Moral Philosophy defined, Moral philosophies, Applying Moral Philosophy to Ethical decision Making, Cognitive moral

Development, White -Collar Crime, Individual factors in Business Ethics.

Unit IV

Human Values for Indian Managers, Lessons from Ancient Indian Education system, The law of Karma, Quality of Working life, Ethics of Vivekananda, Gandhiji, Aurobindo and Tagore.

Recommended Books / Suggested Readings:

1. Charles E Harris, Micheal J Rabins, Engineering Ethics, Cengage Learning Pub.
2. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill Pub.
3. Swami Sivananda, Mind, Its Mysteries and Control, Divine Life Society Pub.
4. Business Ethics by AC Fernando.
5. Business Ethics by Ferrell, Fraedrich and Ferrell.
6. Ethics in Management and Indian Ethos by Biswanath Gosh.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

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Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1212: Accounting and Financial Management

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students to introduce the basic accounting and financial management concepts and principles to enhance the abilities of the participants to understand the nature of financial information. In this course students will be able to:

1. Provide an in-depth view of the process in accounting and financial management.
2. Develop knowledge on the accounting and cost accounting.
3. Understand the Analysis and Interpretation of Financial Management.
4. Understand the concepts of Budgeting and Budgetary Control.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Explain various types of accounting and can prepare statements of financial accounting to ascertain the profit for any trading or manufacturing organization and develop computer models for them.

CO2: Identify various costs and prepare cost sheet and apply the Cost Volume Profit analysis to prepare statements of profit under marginal costing technique.

CO3: Explain the concept of fundamental financial concepts, especially time value of money.

CO4: Integrate the concept and apply the financial concepts in terms of budgeting.

Course Content

Unit I

Accounting: Introduction: Accounting Concepts, Principles and Conventions, basic accounting procedures, Journal and Ledger, Trial Balance.

Final Accounts: Manufacturing and Trading Account, Profit and Loss Account, Balance Sheet. Final accounts with adjustments, working with excel worksheets for automating Final Accounts.

Depreciation: Type: Straight Line Method, Written-Down Value Method, Sinking Fund Method, Preparation of Depreciation Account.

Unit II

Cost Accounting: Methods and Techniques of Cost Accounting, Classification of Cost, Material Cost, Labor Cost, Overheads, Fixed and Variable Costs, Cost-Volume, Profit Analysis, Marginal Costing and Decision Making.

Unit III

Financial Management: Objectives and scope of Financial Management, time-value of money, Analysis and Interpretation of Financial Management, Ratio Analysis, financial system, Working Capital Management, capital investment decision through Pay-back Period Method, Average Rate of Return, Internal Rate of Return, cost of capital, discounted cash flow analysis by using spread sheet.

Unit IV

Budgeting and Budgetary Control: Types of budgets, preparation of various functional budgets, preparation of cash budgets, flexible budgets, advantages of budgeting and budgetary control.

Recommended Books / Suggested Readings:

1. Grewal T S, "Double entry bookkeeping - Financial Accounting", Sultan Chand & Sons, 2012.
2. Sharad K. Maheswari, Maheswari S.N , "Principles of Management Accounting Vol. I & II", Sultan Chand & Sons, 2007.
3. Vinayakam N, Mani P.L., Nagarajan K.L., “Principles of Accountancy”, S.Chand & Co., Ltd., 2008.
4. Jain S.P. & Narang K.L., "Advanced Accountancy Vol 1" Kalyani Publishers, 2012.
5. Sashi K. Gupta & Sharma R.K., "Management Accounting", Kalyani Publishers, 2011.
6. Khan M.Y. and Jain P.K., "Financial Management", Tata McGraw hill, 2007.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1308: Enterprise Management and Computing

Credits: 3

LTP 300

Course Objectives:

This course provides a comprehensive study of Enterprise Management and Computing such as E-commerce, ERP, and Supply chain management. In this course students will be able to:

1. Understand the concepts of E-commerce.
2. Lean about the basic principles of ERP.
3. Understand the Planning Supply and Demand in a Supply Chain.
4. Understand the real time applications of ERP.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Study about business applications & recent trends in the E- commerce.

CO2: Identify the important business functions provided by typical business software such as enterprise resource planning.

CO3: Describe the strategy on the enterprise knowledge and resources across the supply chain activities.

CO4: Design and develop effective enterprise applications.

Course Content:

Unit I

E-Commerce: Introduction, History of E- Commerce, Emergence of Internet, Intranet, World Wide Web, Definition, Advantages- Disadvantages, VPN, Business models for E-Commerce. Transaction Parties, Transaction Types, Software Agents, Types, E-Commerce Opportunities for Industries, Planning E-Commerce Project

Unit II

Enterprise Resource Planning: An Overview, Benefits of ERP, Business Models in an ERP system, ERP Implementation, ERP Related Technologies, Business Process Reengineering, Data Technologies, Data Mining, On-line Analytical Processing.

Unit III

Supply Chain Management: Understanding the Supply Chain, Strategic Fit and Scope, Supply Chain Drivers and Obstacles, Demand, Forecasting, Aggregate Planning, Planning Supply and Demand in a Supply Chain, Managing Economics of Scale, Managing Uncertainty, Determining Optimal Level of Product Availability.

Unit IV

Case Study: Development of Enterprise Software for Hospital, University and Manufacturing Firm, Usage of Popular Frameworks for Software Development.

Recommended Books / Suggested Readings:

1. P.T. Joseph, S.J "E-Commerce - An Indian Perspective". Second edition, prentice Hall of India 2005.
2. Alexis Leon "ERP Demystified" Tata McGraw - Hill , 2003.
3. Sunil Chopra , Peter Meindl, "Supply Chain Management" Strategy, Planning and Operation, Prentice, Hall of India. Second Edition, 2004.
4. Sarika Kulkarni , Ashok Sharma , "Supply Chain Management ", Tata McGraw Hill Publishing Company Ltd, 2000.
5. Kogen T Solutions Inc. "Java Server Programming" Dereamtech Press 2007.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA 1312: Entrepreneurship Development

Credits: 3

LTP 300

Course Objectives:

This course also gives the knowledge about Concepts and Overview of Entrepreneurship, Framework of Entrepreneurship and Emerging Trends in Entrepreneurship Development. In this course student will be able to:

1. Understand the concept and overview of entrepreneurship with a view to enhance entrepreneurial talent.
2. Impart knowledge on the basics of entrepreneurial skills and competencies to provide the participants with necessary inputs for creation of new ventures.
3. Explore new vistas of entrepreneurship in 21st century environment to generate innovative business ideas.
4. Understand significance of a business plan

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Describe the importance of embarking on self-employment and has developed the confidence and personal skills for the same.

CO2: Identify business opportunities in chosen sector / sub-sector and plan and market and sell products / services.

CO3: Create a small business enterprise by liaising with different stake holders.

CO4: Demonstrate effectively manage small business enterprise.

Course Content:

Unit I

Introduction to Entrepreneurship: Entrepreneurship Essentials, Concepts and Overview of Entrepreneurship, Evolution and Growth of Entrepreneurship in India, Role of Entrepreneurship in Economic Development.

Unit II

Theories and Models of Entrepreneurship: Framework of Entrepreneurship Theories, Models of Entrepreneurship, Emerging Models of Corporate Entrepreneurship.

Unit III

Dimensions of Entrepreneurship: Entrepreneurial Culture, Entrepreneurial Society, Women Entrepreneurship, Rural Entrepreneurship.

Unit IV

Emerging Trends and Social Entrepreneurship: Emerging Trends in Entrepreneurship Development, Entrepreneurial Potential and Potential Entrepreneur, Evaluation of Social Entrepreneurship in India.

Preparing a Business Plan: Meaning and significance of a business plan, components of a business plan, and feasibility study.

Recommended Books / Suggested Readings:

1. Entrepreneurship: Strategies and Resources, 3/E -: Marc Dollinger; Prentice Hall.
2. Bringing New Technology to Market- Kathleen R. Allen, Prentice Hall.
3. Entrepreneurship in Action, 2/E - Mary Coulter; Prentice Hall.

Note: Examiner will be required to set NINE questions in all. Question Number 1 will be mandatory (10 short-answer type questions), covering the entire syllabus. In addition to the compulsory question, Examiner will set two questions from each Unit i.e. Unit-I to Unit-IV. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit.

Course Assessment Pattern:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Semester Exam (MSE)	20 Marks
	Assignment	5 Marks
	Continuous Assessment Test	10 Marks
	Attendance	5 Marks
End Term Exam (Summative)	End Term Examination (ESE)	60 Marks
Total		100 Marks
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

MCA1107: Computer Fundamentals and Programming in C

Credits: 3

LTP 300

Course Objectives:

The course aims to equip the students with basic concepts and elements of computer systems. The course includes Fundamentals of computer, logical programming skills using conditional and iterative control structures of functions. In this course, student will be able to:

1. Describe the basic principles of computer fundamentals.
2. Understand basic fundamentals of C Programming.
3. Understand the concept of Control structure, functions, and pointer.
4. Familiarize about Structure and File Handling.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.

CO2: Describe C Programming fundamentals, data types, operators used in C programming.

CO3: Design and develop Computer programs, analyzes, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.

CO4: Use the concept of array of structures and file handling.

Course Content:

Unit I

Computer Fundamentals: Concept of data and information, Components of Computer, Input and Output Device, Components of CPU, Memory and Storage Devices, Computer Software: System and Application Software, Overview of Operating System. Programming Languages Machine, Assembly, High Level Language, 4GL. Language Translator, Linker, Loader; Classification of Computers, Advantages and Limitations of Computer, Applications of IT and Impact of Internet on Society: Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Internet of Things (IoT).

Unit II

Problem Solving: Problem Identification, Analysis, Algorithms, Flowcharts, Pseudo codes, Decision Tables, Program Coding, Program Testing and Execution. C Programming Fundamentals: Keywords, Variables and Constants, Structure of a C program, Operators & Expressions: Arithmetic, Unary, Logical, Bit-wise, Assignment & Conditional Operators, Library Functions, Decision making using if…else, Else If Ladder; Switch, break, Continue and Goto statements, Control Statements: Looping using while, do…while, for statements, Nested loops.

Unit III

Arrays & Functions: Declaration and Initialization, Multidimensional Arrays, String: Operations of Strings, Functions: Defining & Accessing User defined functions, Function Prototype, Passing Arguments, passing array as argument, Recursion, Use of Library Functions, Macro vs. Functions. Pointers: Declarations, Operations on Pointers, passing to a function, Pointers & Arrays, Array of Pointers, Array accessing through pointers, Pointer to functions, Function returning pointers, Dynamic Memory Allocations.

Unit IV

Structures and Union: Defining and Initializing Structure, Array within Structure, Array of Structure, Nesting of Structure, Pointer to Structure, Passing structure and its pointer to Functions, Unions: Introduction to Unions and its Utilities. File Handling: Opening and closing file in C, Create, Read and Write data to a file, Modes of Files, Operations on file using C Library Functions, Working with Command Line Arguments, Program Debugging and types of errors.

Recommended Books / Suggested Readings:

1. Computers Today, D. H. Sanders, Fourth Edition, McGraw Hill, 1988
2. Information Technology Inside and Outside, David Cyganski, John A. Orr, Paperback Edition, Pearson Education 2002.
3. Computer Fundamentals, B. Ram, Third Edition, Wiley, 1997.
4. E. Balaguruswamy: Programming in C, Tata McGraw Hill.
5. H. Schildt: C-The Complete Reference, Tata McGraw Hill.
6. Y. Kanetkar: Let us C, BPB Publication.
7. Fundamentals of Computers, V. Rajaraman, Second Edition, Prentice Hall of India, New

Delhi, 1996. 3. “Information Technology”, Satish Jain, Paperback Edition, BPB 1999.

8. Infosys Campus Connect Foundation Program Volume: 1 – 3, Education & Research Department, Infosys Technologies Ltd, Bangalore.

MCA1108: OOPS using C++

Credits: 3

LTP 300

Course Objectives:

The course aims to familiarize the students with basic concepts and developer tools and teach students how to design, write and execute a Program in 'C ++'. In this course, student will be able to:

1. Learn Object-oriented programming using C++.
2. Understand the basic concept and syntax of the language.
3. Learn more advanced C++ features such as classes and objects, operator overloading, inheritance and polymorphism, file I/O, exception handling, templates etc.
4. Improve the problem-solving skills.

Course Outcomes (CO):

Upon successful completion of the course, the students should be able to:

CO1: Relate and recall object oriented and structured programming concepts.

CO2: Demonstrate competency in object-oriented concepts.

CO3: Utilize object-oriented concepts and develop solutions using C++ programming language

CO4: Apply the object-oriented concepts to the real-world problems.

Course Content

Unit I

Principles of OOP: What is object-oriented programming? Why do we need object-oriented Programming, characteristics of object-oriented languages? Overview of C++, basic data types, type casting, type modifiers, operators and control structures, input, and output statements in C++, Arrays-one dimensional and multi-dimensional arrays, array initialization; Structures-referencing structure elements, arrays of structures, initializing structures, assigning structures, nested structures.

Unit II

Functions: Function prototyping, function components, Returning values from functions. passing parameters, call by reference, return by reference, inline functions, default

arguments, overloaded function.

Pointers: Array of objects, pointers to objects, this pointer, dynamic allocation operators, dynamic objects.

Classes and objects: class specification, member function specification, scope resolution operator, access qualifiers, instance creation. Structure union versus class in C++.

Unit III

Constructors: Constructors, parameterized constructors, overloaded constructors, constructors with default arguments, copy constructors, static class members and static objects.

Operator overloading: Overloading unary and binary operator, overloading the operator using friend function, stream operator overloading and data conversion.

Unit IV

Inheritance: Introduction, types of inheritance.

File Handling in C++: File concepts; files and streams; opening and closing of files -functions get(), getline(), put() etc., opening files using function open(); reading and writing blocks and objects into the files; detecting end of file (eof).

Recommended Books / Suggested Readings:

1. Complete Reference of C++ by Herbert Schilde
2. Object Oriented Programming with C++ By E. Balaguruswamy.
3. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
4. Object Oriented Programming in Turbo C++ by Robert Lafore ,1994, The WAITE Group Press.
5. Programming with C++ By D Ravichandran, 2003, T.M.H.
6. Computing Concepts with C++ Essentials by Horstmann, 2003, John Wiley.
7. Stanley B. Lippman, Josee Lajoie, “C++ Primer”, Pearson Education, 2002.