श्रीचन्द्रशेखरेन्द्रसरस्वतीविश्वमहाविद्यालयः

SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA

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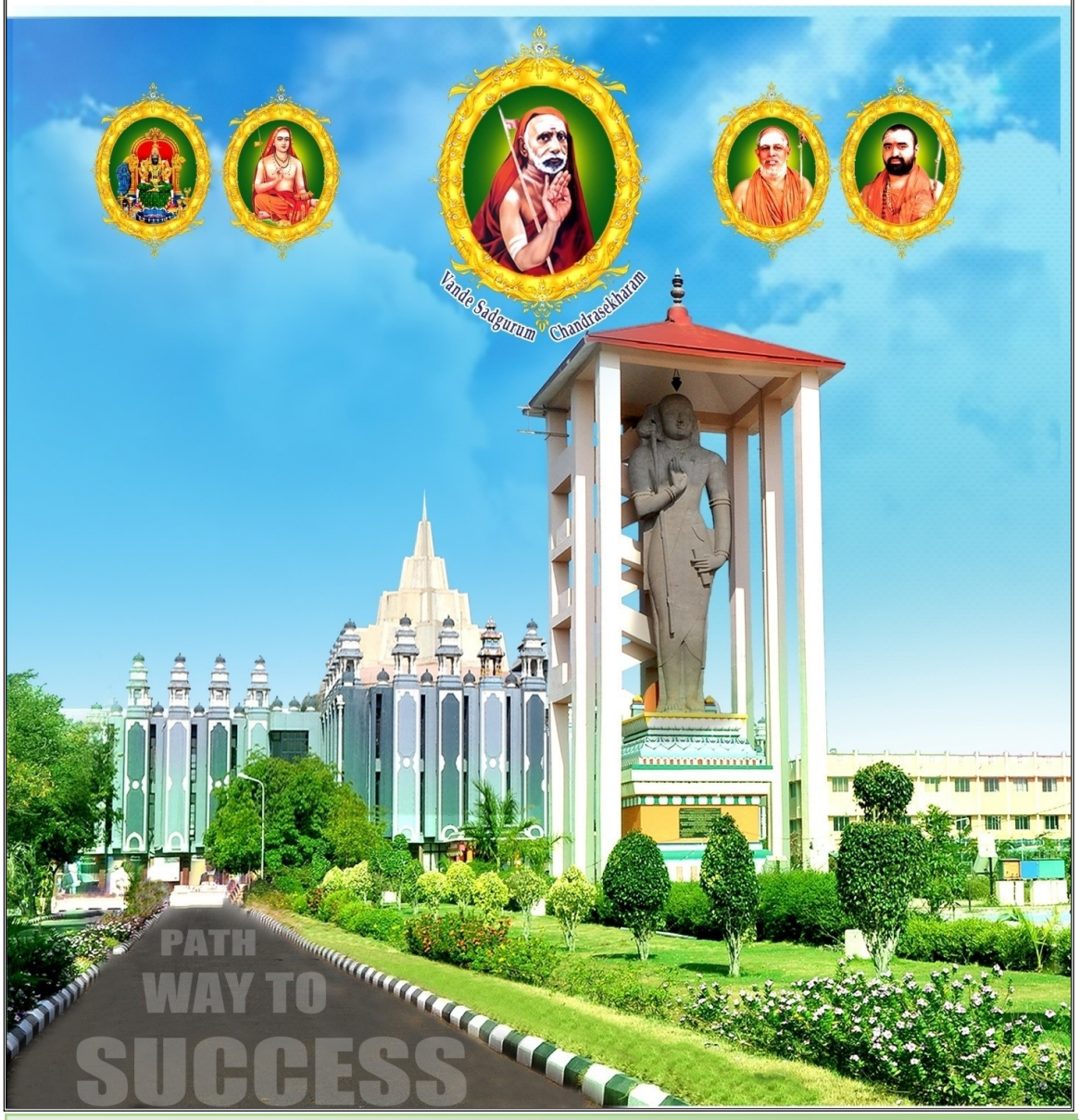

CURRICULUM AND SYLLABUS

M.C.A (MASTER OF COMPUTER APPLICATIONS)

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

(For students admitted from 2025-2026 onwards)

SRI CHANDRASEKHARANEDRA SARASWATHI VISWA MAHA VIDYALAYA

(Deemed to be University), KANCHIPURAM

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

DEGREE OF MASTER OF COMPUTER APPLICATIONS (M.C.A)

REGULATIONS: MCA-R2025

M.C.A. Degree (4 –Semester / Regular) Full-Time Programme (w.e.f. 2025 – 2026)

CHOICE BASED CREDIT SYSTEM (CBCS)

DEPARTMENT VISION

Empower every student to be innovative, creative and productive in the field of Computer Science by imparting quality education, developing skills and inculcating human values.

DEPARTMENT MISSION

To provide an education of the highest quality for both Under Graduate and Post Graduate students.

- To provide continuous help to students, to develop and enhance their overall personality skills and excel themselves in the challenging environment.
- To enable the students to be knowledgeable and creative by developing state–of-the-art curriculum and through innovative teaching methodologies.
- Providing training programs that bridges the gap between academia and industry to produce competitive software professionals.
- To inculcate values and ethics in the students enabling them to become socially committed professionals.
- To enhance the research quality and productivity, by providing required facilities and industry collaboration.

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
Graduates from the Master of Computer Applications are expected to achieve the following PEOs	
PEO1	To prepare graduates to be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.
PEO2	To provide students various computing skills like the analysis, design and development of innovative software products to meet the industry needs.
PEO3	To motivate the students to pursue lifelong learning to fulfill their goals.
PEO4	To prepare graduates to contribute to society, as broadly educated, expressive, ethicaland responsible citizens with proven expertise.

2. PROGRAMME LEARNING OUTCOMES (PLOs)

II. PROGRAMME LEARNING OUTCOMES (PLOs)	
The graduates of Master of Computer Applications will be able to :	
PLO1	**Engineering Knowledge**: Apply knowledge of computing fundamentals, computing specialization and domain knowledge for the abstraction and conceptualization of computing models from defined problems and requirements
PLO2	**Problem Analysis**: Identify, formulate, analyze and interpret data by applying critical thinking to solve complex problems in relevant domain disciplines.
PLO3	**Design and development solutions**: Design and evaluate solutions for computing systems to meet the industry requirement as per needs and specification which undergoes various phases of software development.
PLO4	**Conduct of investigations of complex problems**: Use research based knowledge and apply research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PLO5	**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
PLO6	**Professional Ethics**: Understand and commit to professional ethics and cyber regulations, responsibilities and norms of professional computing practice.
PLO7	**Life Long learning**: Recognize the need of independent learning for the continual development as a computing professional in the context of technological change.
PLO8	**Project management and finance**: Master fundamental project management skills, concepts and techniques, set attainable objectives and ensure positive results, meeting scope, time and budget constraints.

PLO9	**Communication Efficiency**: Communicate technical information effectively, both orally and in writing.
PLO10	**Societal and Environmental concern**: Recognize the social, cultural, and ethical issues involved in the use of computer technology and give them due consideration in developing software systems.
PLO11	**Individual and Team Work:** Work collaboratively as a member or leader in multidisciplinary teams.
PLO12	**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.

3. PROGRAMME SPECIFIC OUTCOMES (PSOs)

III. PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	Enable the students to select the suitable data models, appropriate architecture and platform to implement a system with good performance
PSO2	Enable the students to design and integrate various system based components toprovide user interactive solutions for various challenges

MAPPING OF PEOs TO PLOs

	PEO1	**PEO2**	**PEO3**	**PEO4**
PLO1	3	2	2	3
PLO2	3	2	2	2
PLO3	2	3	3	2
PLO4	2	3	3	3
PLO5	3	2	2	3
PLO6	2	3	3	2
PLO7	3	2	3	3
PLO8	2	3	3	2
PLO9	2	3	3	3
PLO10	3	2	2	2
PLO11	3	2	2	2
PLO12	2	2	3	2

MAPPING OF PEOs TO PSOs

	PSO1	**PSO2**
PEO1	**3**	**2**
PEO2	**2**	**2**
PEO3	**2**	**3**
PEO4	**3**	**3**

3 – Strong, 2 – Medium, 1 – Low

4. ELIGIBILITY FOR ADMISSION

Candidates for the admission to the first year course leading to the degree of Master of Computer Application (M.C.A) will be required to possess:

- Passed BCA / Bachelor Degree in Computer Science Engineering or equivalent Degree.

(OR)

- Passed B.Sc./B.Com./B.A. with Mathematics at 10 + 2 Level or at Graduation Level (with additional bridge courses as per the norms of the University).
- Obtained at least 50% marks (45% marks in case of candidates belonging to reservedcategory) in qualifying Examination.
- Notwithstanding the above, actual Admissions will also be based on the rules andregulations of the UGC / AICTE / Competent authorities.

5. ENTRANCE EXAMINATION

MCA entrance examination shall consist of 30 objective type and five descriptive type questions to be solved in 2 hours. Selection is based on both merit and entrance examination.

6. DURATION OF THE COURSE

- Bridge courses is organized before the commencement of the first semester.
- Nurturing and evaluation process of bridge courses is left to the Department of ComputerScience and Applications.

The Course duration shall be for TWO years consisting of FOUR semesters. In order to beeligible for the award of the degree the candidate shall successfully complete the course in a maximum period of FOUR years from the date of enrolment for the first semester of the course.

7. MODE OF STUDY

Candidates admitted under this Full-time Programme should be available in the Institution during the entire duration of working hours (From Morning to Evening on Full- Time basis) for the curricular, co-curricular and extra-curricular activities. The candidates should not attend any other Full-time programme(s) / course(s) or take up any Full-Time job / Part-Time job in any Institution or company during the period of full time programme. Violation of the above rules will result in cancellation of admission to the M.C.A. programme.

8. CURRICULUM STRUCTURE OF A SEMESTER

SEM	Core Theory Course (CTC)	Core Theory with Practical Course (CTPC)	Allied Theory Course (ATC)	Elective Theory Course (ETC)	Mandatory Course (MC)	Employability Skill Development Course (ESDC)	TOTAL COURSES	TOTAL CREDITS
I	**2**	2	**1**	-	1	1	**7**	**24**
II	2	2	**-**	1	1	1	**7**	**24**
III	1	2	**-**	2	1	1	**7**	**24**
IV	-	-	**-**	1	-	1	**2**	**15**
TOTAL	**5**	**6**	**1**	**4**	**3**	**4**	**23**	**87**

- Core Theory Course-(CTC) means the Theory Courses which is core to MCA Programme.
- Core Practical Course-(CPC) means the Practical Courses which is core to MCA programme.
- Core Theory with Practical Course-(CTPC)" means Laboratory based Core Theory Course
- Allied Theory Course-(ATC) means the Theory course which is allied/ancillary to MCA Programme.
- Elective Theory Course-(ETC) means the Theory course which is as Elective to MCA Programme. A student can register a maximum of 9 credits as online courses during the entire program of study.
- Employability Skill Development Course (ESDC) means a course that will be offered by the department to bridge the gap between the curriculum and the requirements of the industry.
- Internship" (IS) or Fellowship means a period of time that the student would be deputed to undergo in-house training in reputed Industries or R & D organizations.
- New courses may be introduced by the department / institution at any time depending upon the requirement after getting approval from the concerned Board of Studies, Academic Council and Governing Body.

- **Mandatory Courses:** The students shall study the mandatory courses prescribed by the university and it will be mentioned in the grade sheet. However, it will not be considered for computation of CGPA.

9. EXAMINATIONS

The University follows the 'Choice Based Credit System (CBCS)' for all its programmes. Each course is normally assigned one credit per lecture per week and one creditfor two periods of tutorials or part thereof for laboratory or practical per week.

Structure of the Course and Evaluation Pattern

Internal Marks: 40.

External Marks: 60

The duration of University examination for both theory and practical subjects shall be 3 hours. The maximum marks for each theory and practical course is 100. Continuous Internal Assessment (CIA) will be for 40 marks. The university theory examination will be conducted for 100 marks, which will be then converted to 60 in ordered to add with continuous internal assessment to make 100 marks for the course. The university Practical examination will beconducted for 60 marks.

Evaluation shall be through continuous assessments and end semester examination. Continuous assessment shall have the weightage of 40% & End semester examination shall have the weightage of 60%. Details of weightage for theory and practical component with respect to credits are presented below:

S.No.	L-T-P	Credits	Continuous Assessments (40 marks)			End Semester Examinations (60 marks)	
			Theory	Practical	**Assignments & Attendance**	Theory	Practical
1	3-1-4	6	20 marks	10 marks	10 marks	40 marks	20 marks
2	3-1-2	5	24 marks	6 marks	10 marks	50 marks	10 marks
3	4-1-0	5	30 marks	--	10 marks	60 marks	--
4	3-1-0	4	30 marks	--	10 marks	60 marks	--
5	2-0-0	2	100 marks	--	--	--	--

9.1. INTERNAL EXAMINATIONS

Procedures for Awarding Marks for Internal Assessment

The break-up of assessment and examination marks for theory subjects is as follows.

First Assessment (Test)	:	15 Marks
Second Assessment (Test)	:	15 Marks
Assignment & Attendance	:	10 Marks

Internal Assessment	:	40 Marks

University Examination	:	60 Marks

Total	:	100 Marks

The break-up of assessment and examination marks for theory cum practical subjects with 6 credits (3-1-4) is as follows.

First Assessment (Test for Theory)	:	10 Marks
Second Assessment (Test for Theory)	:	10 Marks
Model Practical Examination	:	10 Marks
Assignment & Attendance	:	10 Marks

Internal Assessment	:	40 Marks

University Examination (Theory)	:	40 Marks
University Examination (Practical)	:	20 Marks

Total	:	100 Marks

The break-up of assessment and examination marks for theory cum practical subjects with 5 credits (3-1-2) is as follows.

First Assessment (Test for Theory)	:	12 Marks
Second Assessment (Test for Theory)	:	12 Marks
Model Practical Examination	:	6 Marks
Assignment & Attendance	:	10 Marks

Internal Assessment	:	40 Marks

University Examination (Theory)	:	40 Marks
University Examination (Practical)	:	20 Marks

Total	:	100 Marks

The break-up of assessment (**Internal Assessment Only**) for all Internal subjects is as follows:

Assignment	:	10	Marks
First Internal Test	:	30	Marks
Second Internal Test	:	30	Marks
Seminar	:	10	Marks
Quiz/Objective type test	:	10	Marks
Attendance	:	10	Marks
Total	:	100	Marks

9.2 SUBSTITUTE ASSESSMENT

A student who has missed one or more of assessment tests of a course other than the examinations for genuine reasons as accepted by the Head of the Department may take a substitute assessment for any one of the missed assessment. A student who wishes to have a substitute assessment for missed assessment must apply to the Head of the Department within two **weeks** from the date of the missed assessment.

9.3. EXTERNAL EXAMINATIONS

- The end semester examinations will ordinarily be conducted during November / December in the odd semesters and during April / May in the even semesters. For all the theory courses question papers will be set by external examiners and valued by external and/or internal examiners.
- All practical examinations including the mini project will be conducted by External & Internal examiners appointed by the University.
- The final year project work report will be evaluated by the External examiner and viva voce will be conducted by the Board consists of HOD, Internal Examiner (Guide), and External Examiner**.**

9.4. PROJECT WORK – FINAL SEMESTER

There shall be three assessments (10 marks each and 10 marks for documentation) for the project work during the IV semester by a Review Committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute the review committee for the project work. There shall be a minimum of three members in the review

committee. The guide will be an additional member of the Review Committee and he/she should be present during the presentation of his/her student. The candidate is expected to submit the project report on or before the last working day of the semester.

- The Project work can be either carried out in any Industry/University.
- A Coordinator will be appointed by the HOD to coordinate the Project Work.
- Internal guides from the department will be assigned by the Head of the Department to thestudents.
- As soon as a student gets the project work, he/she has to send the contact details of the organization and the external guide to the department along with the Project title.
- Periodically the students should submit project Task Report to their internal guide.
- The Project work should be an independent one; if the project is a part of a bigger project, the student's work should have a few independent modules.
- If more than one student is working on parts of the same project (big enough to share) thereport of each student should be different and not two copies of the same report.

9.5. EVALUATION SCHEME

An External Examiner will evaluate the Project document for 30 marks conduct the viva voce along with the review committee for 30 marks. If a student fails in final semester project, then the student has to perform the set of activities required for it. The student has to appear for the review fixed by the department and should also appear for the semester exam viva voce.

9.6. INTERNSHIP:

- Internship scheme is designed specifically for students in the IV semester to take up their major projects in reputed organizations.
- Students can go for internship during the IV semester and complete the Project Work in well reputed companies / organizations offering Placement to the students / R & D organizations/ Premier Institutions both in India and Abroad, as part of their internship.

- This is possible only if the companies / organizations offering Placement to the students / R & D organizations / Premier Institutions allows Internship program with Project and the internship/placement coordinator of the Department concerned are notified well in advance.

9.6.1. ELIGIBILITY

- Final year MCA Students who are selected for Internship, with/without stipend by reputedcompanies / organizations are eligible.

9.6.2. APPLICATION TO THE INTERNSHIP SCHEME

- Students eligible / selected for Internship scheme should apply for the scheme to their HOD within the date mentioned by the HOD / Project Coordinator, during the III semester.

9.6.3. GUIDELINES TO BE FOLLOWED

- Students doing the internship should attend the Project Reviews in the scheduled dates. Aftercompletion of the internship cum project, the final summative evaluation will be conducted with a view to assign the final score.

9.6.4.TERMS AND CONDITIONS FOR INTERNSHIP

- The internship should be carried out at a single organization.
- It should be completed within one semester.
- All arrangements should be specified in the internship agreement.
- During long leave period and closure of Industries/R&D organization/Premier Institutions for any reason, during the internship period, the students concerned should continue the work only in the college.
- Students should adhere to the rules and regulations of the college and Industries / R&D organization / Premier Institutions during the Internship cum Project period.

9.6.5. TERMINATION OF THE INTERNSHIP

- In the event of prolonged absence of student during the internship (or)
- If the student has to discontinue the internship due to unforeseen circumstances during that period (or)
- If the performance of the work done by the student in the Industries / R&D organization / Premier Institutions is not satisfactory during the Project Review (or)
- If the student violates the college rules & regulations during the Internship/Project period, Then the Internship cum Project will be terminated for these students, after due intimation to the company. In such a situation, the IV Semester Project will be in jeopardy, i.e. these students have to repeat their IV Semester project in the next academic year.

9.7. REQUIREMENTS FOR THE COMPLETION OF THE SEMESTER

The candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for the completion of the semester.

1. He/ She secures not less than 80% of overall attendance in that semester taking into account the total no of periods in all courses put together attended by the candidate as against the total no of periods in all courses offered during that semester. Condonation of attendance up to 10% is permitted on medical grounds. Relaxation in attendance is permitted up to 10% for the student who represents the university in sports and games. The above two relaxations cannot be taken concurrently.
2. He / She earn a progress certificate from the head of the institution for having satisfactorily completed all the courses pertaining to that semester as judged by Internal Assessment.
3. His / Her conduct has been satisfactory throughout the semester. Candidates who do not complete the semester will not be permitted to write the end semester Examination and are not permitted to go to the next semester. They are required to repeat the incomplete semester in the next academic year.

9.8. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

1. Candidates shall register for the First Semester Examination after the admission in the P.G.course.
2. Candidates shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester examinations subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subsequent) semester subjects.
3. Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed thereof by the University from time to time.

9.9. PASSING AND DECLARATION OF EXAMINATION

RESULTS: PASSING MINIMUM

1. A candidate shall be declared to have passed in each Paper / Practical / Mini Project and Viva-voce, if he / she secures not less than 50% of marks in the continuous internal assessment (CIA) and the University examinations (External) put together, provided a minimum of 45% of marks is secured in the University examination.

   For Theory cum Practical courses, the student must secure a minimum of 45% of marks in Theory and 45% of Marks in practical in the end semester examination and also obtain a 50% of total marks (continuous assessments +End semester examination), in a particular course.
2. If a candidate fails to secure a pass in a particular course, it is mandatory that he / she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. He / She should continue to register and reappear for the examination till he/she secures a pass. However, the internal assessment marks obtained by the candidate in the first attempt shall be retained and considered valid for all subsequent attempts.
3. Assessments of all the courses on absolute marks basis will be considered and passed by the Results – Passing - Board in accordance with the rules of the University. Thereafter, the Controller of Examinations shall convert the marks of each course to the corresponding letter grade as

given below, compute the grade point average and the cumulative grade pointaverage, and prepare the grade cards.

90 to 100	:	Grade "S"
80 to 89	:	Grade "A"
70 to 79	:	Grade "B"
60 to 69	:	Grade "C"
56 to 59	:	Grade "D"
50 to 55	:	Grade "E"
Less than 50 marks	:	Grade "F"

4. A Student who obtains less than 50 marks out of 100 in the examination OR is absent for the examination will be awarded the "F" grade. A Student who earns a grade of S, A, B, C, D orE in a course is declared to have successfully completed that course and earned the respective credits for that course. Such a course cannot be repeated by the student. A Student who obtains a letter grade "F" in a course has to reappear for the examinations in that course.
5. The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

   S – 10; A – 09; B – 08; C – 07; D – 06; E – 05; F – 00

Grading for NPTEL Courses

Type of Certificate	Score	Equivalent Grade (SCSVMV)
Elite with Gold	>=90	S
Elite with Silver	75 – 89	A
Elite	>=60	B
Successfully completed	40 – 59	C
No certificate	<=40	No Grade

6. After the results are declared, grade cards will be issued to the student. The grade cards will contain the list of courses registered during the year/ semester, the grades scored and the grade point average (GPA) for the year/ semester.
7. GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the course for the year/semester, divided by the sum of the number of credits for all courses taken in that year/semester. CGPA is similarly calculated by considering all the courses taken from the time of admission.

8. After successful completion of the course, the degree will be awarded with the following classification based on CGPA.
   - For the first class with distinction, the student must earn 95 credits within TWO years from the time of admission, pass all the courses in the first attempt and obtained a minimum CGPA of 8.25.
   - For the first class, the student must earn 95 credits within THREE years from the time of admission, obtain a minimum CGPA of 6.5.
   - For second class, the student must earn 95 credits within FOUR years from the time of admission.

10. ELIGIBILITY FOR THE AWARD OF THE DEGREE

- A Student shall be declared to be eligible for the award of the Degree provided if, The student has successfully completed the course requirements and has passed all the prescribed examinations in all the **four semesters** within a maximum period of **FOUR years** reckoned from the commencement of the first semester to which the candidate was admitted.
- No disciplinary action is pending against him / her.

11. PATTERN OF UNIVERSITY EXAMINATION QUESTION PAPER (THEORY)

Time 3 hours **Max Marks: 100**

Part – A (10 * 2 = 20 Marks)

(2 Question from each unit)

Part – B (5 * 16 = 80 Marks)

(1 Set from each Unit (Either or Pattern))

Marks secured by the candidate will be converted to 60 to make the aggregate 100, while adding with Continuous Internal Assessment of 40 marks.

11.1 PATTERN OF QUESTION PAPER (PRACTICAL)

Time: 3 Hours **Max: 100 Marks**

Program exercise (may contain subdivisions) to be solved within 3 hours. The External Examiner will set a question paper on the spot with the help of the question bank or list of exercises.

12. STUDENT MENTOR

To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a member of the faculty who shall function as student Mentor for those students throughout their period of study. Such student Mentor shall advise the students, given preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Head of the Department.

13. CLASS COMMITTEE

A class committee consists of teachers of the class concerned, student representatives and a Senior Advisor, i.e. faculty member who does not handle any subject for the class. It is like the 'Quality Circle' (more commonly used in industries), with the overall goal of improving the teaching-learning process. The functions of the class committee include:

i. Solving the problems experienced by students in the classroom and in the laboratories in consultation with Head of the Department / Dean.
ii. Clarifying the Regulations of the degree programme and the details of rules therein.
iii. Informing the student representatives, the academic schedule including the mode and dates of assessments and the syllabus coverage for each assessment.
iv. Informing the student representatives, the details of Regulations regarding weightage used for each assessment.
v. Analyzing the performance of the students of the class after each periodic test and finding ways and means of improving the performance of the students.
vi. Identifying the slow learners and helping them to come up by guidance and/or by providing additional coaching.

The class committee is normally constituted by the Head of the Department. The class committee shall be constituted within a week from the date of commencement of a semester. At least 4 student-representatives from the respective class (typically 2 boys and 2 girls) shall be included in the class committee. The Chairperson of the class committee normally Class In-charge may invite the Head of the Department, Senior Advisor, course teachers and students to

the meeting of the class committee. The chairperson of the class committee is required to prepare the minutes of every meeting, submit the same to the Head of the Department and then to the DEAN within three working days of the meeting and arrange to circulate the same among concerned students and teachers.

The first meeting of the class committee shall be held within fifteen days from the date of commencement of the semester. The nature and weightage of continuous assessments shall be informed in the first meeting, and the same shall be communicated to the students. Two or three subsequent meetings in a semester may be held at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express their opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

14. DISCIPLINE

Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University.

15. REVISION OF REGULATION AND CURRICULUM

The University may from time to time revise, amend or change the regulations, scheme of examinations and syllabi as found necessary.

16. AUTHORITY OF BOARD OF STUDIES

The Board of Studies has the full authority to change the syllabus any time according to IT trend and industry needs.

BRIDGE COURSE									
Course Code	**Course Title**	**Total Hours**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CIA**	**EA**	**Total**	
MCA25BC1	Principles of IT & Computer Architecture	10	0	0					BTC
MCA25BC2	Programming in C & C++	10	0	0					BTC
MCA25BC3	Programming in C & C++ Lab.	0	0	20					BTC
SEMESTER – I									
Course Code	**Course Title**	**Total Hours**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CIA**	**EA**	**Total**	
Theory									
MCAF251T10	Applied Probability and Statistics	3	1	0	4	40	60	100	ATC
MCAF251T20	Object Oriented Software Engineering	3	1	0	3	40	60	100	CTC
MCAF251T30	Advanced Data Structures and Algorithms	3	1	0	4	40	60	100	CTC
MCAF251T40	Python Programming	3	1	4	6	40	60	100	TPC
MCAF251T50	Advanced Database Technologies	3	1	4	6	40	60	100	TPC
	Employability Enhancement								
MCAF251LS0	Skill Communication – I	2	0	0	1	100		100	ESDC
	Mandatory Course								
MCAF251M01	Mandatory Course NASSCOM/Spoken Tutorial etc.,	2	0	0	0				MC
	Total	**19**	**5**	**8**	**24**				
SEMESTER – II									
Course Code	**Course Title**	**Total Hours**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CIA**	**EA**	**Total**	
Theory									
MCAF252T10	Advanced Operating System	3	1	0	4	40	60	100	CTC
MCAF252T20	Cloud Computing Techniques	3	1	0	4	40	60	100	CTC
MCAF252T30	Full Stack Development	3	1	4	6	40	60	100	TPC
MCAF252T40	Mobile Application Development	3	1	4	6	40	60	100	TPC
MCAF252E1A	**Elective - I** SWAYAM / SWAYAM PLUS Course *	3	0	0	3		100	100	ETC
	Employability Enhancement								
MCAF252LS0	Skill Communication – II	2	0	0	1	100		100	ESDC
	Mandatory Course								
MCAF252M01	Mandatory Course NASSCOM/Spoken Tutorial etc.,	2	0	0	0				MC
	Total	**19**	**4**	**8**	**24**				

SEMESTER – III									
Course Code	**Course Title**	**Total Hours**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CIA**	**EA**	**L**	
Theory									
MCAF253T10	Machine Learning	3	1	4	6	40	60	100	TPC
MCAF253T20	Internet of Things	3	1	4	6	40	60	100	TPC
MCAF253T30	Big Data Analytics	3	1	0	3	40	60	100	CTC
MCAF253E2A MCAF253E2B MCAF253E2C MCAF253E2D MCAF253E2E MCAF253E2F	**Elective – II** a. Data Communication and Networking b. Devops and Micro services c. Cyber Security and Ethical Hacking d. Natural Language Processing e. Digital Marketing f. Agile Software Engineering	3	1	0	3	40	60	100	ETC
MCAF253E3A	**Elective – III** NPTEL / SWAYAM / SWAYAM PLUS Course *	3	0	0	3		100	100	ETC
	Employability Enhancement								
MCAF253P80	Mini Project	0	0	5	3	40	60	100	ESDC
	Mandatory Course								
MCAF253M01	Mandatory Course NASSCOM/Spoken Tutorial etc.,	1	0	0	0				MC
Total		**16**	**4**	**13**	**24**				

SEMESTER – IV									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CIA**	**EA**	**Total**	
	Employability Enhancement								
MCA254Z10	Project Work			24	12	40	60	100	ESDC
MCAF254E4A	**Elective - IV** NPTEL / SWAYAM / SWAYAM PLUS Course *				3		100	100	ETC
Total		**0**	**0**	**24**	**15**				
Total Credits					**87**				

***LIST OF SWAYAM / SWAYAM PLUS COURSES FOR ELECTIVES**

SNO	NPTEL_CODE	BRANCH	COURSE	DURATION	CREDITS
1		Computer Science and Engineering	Programming in Java	12 Weeks	3
2	253	Computer Science and Engineering	Reinforcement Learning	12 Weeks	3
3	261	Computer Science and Engineering	Social Network Analysis	12 Weeks	3
4	270	Computer Science and Engineering	Software Project Management	12 Weeks	3
5	274	Computer Science and Engineering	Software Testing	12 Weeks	3
6	267	Computer Science and Engineering	Deep Learning	12 Weeks	3
7		Computer Science and Engineering	Foundations of Virtual Reality	12 Weeks	3
8	322	Computer Science and Engineering Electrical, Electronics and Communications Engineering Information Technology	Introduction to Large Language Models (LLMs)	12 Weeks	3
9	387	Electrical and Electronics Engineering	Digital Image Processing	12 Weeks	3
10	**583**	Management	Organizational Behaviour	12 Weeks	3
11	654	Management / Finance / Data Science Computer Science and Engineering	Advanced R Programming for Data Analytics in Business	12 Weeks	3

** Any other Swayam courses recommend by the department.

SEMESTER - I

MCAF251T10	APPLIED PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

- Statistical knowledge helps to collect data and employ it for correct analysis
- To understand about descriptive, analytical, inductive, inferential, applied for final analysis and interpretation
- To make students with consequently requisite quantitative skills
- To make students to solve some practical engineering problems

COURSE OUTCOMES

- Understand Baye's theorem and also summarize discrete and continuous probability distributions
- Analyze statistical data using measures of central tendency and dispersion.
- Compute and interpret the results of Bivariate Regression and Correlation Analysis, for forecasting and also apply the appropriate Chi-Squared test for independence and goodness of fit
- Perform hypotheses tests of means, proportions and variances using both one-and two-sample data sets.
- Design experiments by choosing the experimental units, treatments, factors, randomization and blocking.

SYLLABUS

UNIT – I: Probability and Random Variable:

Sample Spaces and Events – Probability – Axioms of Probability – Some Elementary Theorems – Conditional Probability – Baye's Theorem - Random Variable: Discrete Random Variable - Continuous Random Variable - Distribution Function - Mathematical Expectation - Binomial Distribution - Poisson Distribution - Normal Distribution (only simple problems).

12

UNIT – II: Descriptive statistics:

Statistical Averages - Arithmetic Mean - Properties of Arithmetic Mean - Merits and Demerits of Arithmetic Mean - Median - Merits and Demerits of Median - Mode - Merits and Demerits of Mode - Dispersion: Range - Quartile Deviations - Mean Deviation - Standard Deviation - Coefficient of Variance - Skewness: Karl Pearson Coefficient of Skewness

12

UNIT – III: Multivariate Analysis:

Correlation: Bivariate Data - Correlation between Two Variables - Covariance between Two Variables - Karl Pearson's Coefficient of Correlation - Rank Correlation. Regression Analysis: Simple Linear Regression - Regression Equations. Attributes - Coefficient of Association - χ^2test for Goodness of Fit - Test for Independence

12

UNIT – IV: Inference Concerning Means and Variances:

Test of Hypothesis – Null Hypothesis – Hypothesis Concerning One Mean – Relation between Tests and Confidence Intervals – Inference Concerning Two Means - Hypothesis Concerning One Variance – Hypothesis Concerning Two Variances

12

UNIT – V : Analysis of Variance:

Some General Principles – Completely Randomized Designs – Randomized – Block Designs – Some Further Experimental Design.

12

TOTAL : 60

REFERENCES:

1. Erwin Miller and John E.Freund, "Probability and Statistics for Engineers", 7th Edition, Pearson Education, India, 2017. (Unit I, IV,V)
2. James T. McClave and Terry Sincich, "Statistics", 12th Edition, Pearson Education, India, 2013. (Unit II, III)
3. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11th Edition, Sultan Chand & Sons, India, 2007.

MCAF251T20	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	1	0	4

Course Objectives:

- To understand the various models in object oriented software development
- To gain fundamental concepts of requirements engineering and analysis
- To learn about object oriented methodologies
- To know about the different approach for object oriented design and its methods
- To know about how to perform software testing and how to maintain software

Course Outcomes:

- Design object oriented software using appropriate process models
- Able to create clear and concise documentation for software systems, including requirements specifications, design documents, and user manuals. Utilize knowledge of different object oriented methodologies to identify and apply the appropriate techniques in problem solving.
- Design and Develop UML diagrams for software projects
- Categorize testing methods and compare different testing tools for software processes

UNIT – I SOFTWARE DEVELOPMENT LIFE CYCLE MODELS

Software Engineering - Conventional Life Cycle Models-Object Oriented Life Cycle Models – Selection of Software Life Cycle Models-Object Modeling Techniques Models – Agile Processes.

12

UNIT – II SOFTWARE REQUIREMENTS ELICITATION AND ANALYSIS

Software Requirement – Requirements Elicitation Techniques – Use Case Approach – Characteristics of a Good Requirement - Software Requirements Specification Document – Requirements Change Management - Unified Modeling Language and Tools.

12

UNIT – III OBJECT ORIENTED METHODOLOGIES

Coad and Yourdan Methodology – Booch Methodology -Rumbaugh Methodology-Jacobson Methodology - Object Oriented Modeling – Some Terminologies

12

UNIT – IV OBJECT ORIENTED ANALYSIS AND DESIGN

Identification of Classes-Identification of Relationships – Identifying State and Behavior - Interaction Diagrams–Sequence Diagrams– Collaboration Diagrams-Generating Test Cases from Use Cases–Object Oriented Design Principles for Improving Software Quality

12

UNIT – V TESTING OBJECT ORIENTED APPLICATIONS

Broadering the view of Testing – Testing OOA and OOD models – Object Oriented Testing Strategies – Object Oriented Testing Methods – Testing Methods Applicable at the Class Level.

12

TOTAL: 60 Hrs.

REFERENCES:

1. Yogesh Singh, Ruchika Malhotra, "Object Oriented Software Engineering", PHI Learning Private Limited, 2012.
2. Ivar Jacobson, Magnus Christerson, PatrikJonsson, Gunnar Overgaard, "Object Oriented Software Engineering, A Use Case Driven Approach", Pearson Education, Seventh Impression, 2009
3. Roger S. Pressman, "Software Engineering: A Practitioner's Approach" , Tata McGraw-Hill Education, 9th Edition, 2019.

E- REFERENCES:

1. https://www.geeksforgeeks.org/object-oriented-software-engineering/
2. https://www.tutorialspoint.com/object_oriented_analysis_design/index.htm
3. https://www.javatpoint.com/object-oriented-analysis-and-design

MCAF251T30	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	1	2	5

COURSE OBJECTIVES

- To Understand and apply linear data Structures-List, Stack and Queue.
- To Understand the concept of nonlinear data structures
- To know the concept of various sorting and searching techniques
- To Learn different algorithm analysis techniques.
- To know to Apply data structures and algorithms in real time applications

COURSE OUTCOMES

- Describe, explain and use abstract data types including stacks, queues and lists
- Design and Implement Tree data structures
- Able to understand and implement nonlinear data structures - graphs.
- Able to understand various algorithm design and implementation.
- Able to analyze the efficiency of algorithm.

SYLLABUS

UNIT – I LINEAR DATA STRUCTURES

Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Applications of Stack – Linked Lists - Singly Linked List - Doubly Linked lists.

12

UNIT – II NON-LINEAR TREE STRUCTURES

Tree - Binary Tree – Binary Tree Representation - Binary Tree Traversals – Binary Search Tree – Application of Tree - Balanced Trees - AVL Tree.

12

UNIT – III GRAPHS

Representation of graph - Graph Traversals - Depth-first search and Breadth-first search traversal - Shortest-path algorithms - Dijkstra‟s algorithm – Bellman-Ford algorithm – Floyd's Algorithm.

12

UNIT – IV ALGORITHM DESIGN AND ANALYSIS

Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem.

12

UNIT – V ADVANCED ALGORITHM DESIGN AND ANALYSIS

Backtracking – N-Queen's Problem - Branch and Bound – Assignment Problem - P& NP problems – NP-complete problems – Traveling salesman problem.

12

TOTAL: 60 Hrs.

REFERENCES:

1. Abirami, A., “Advanced data structures and algorithms”, BPB Publications,1st ed., 2023.
2. Brass, P., “Advanced Data Structures”, (South Asian ed.). Cambridge University Press, 2019.
3. Levitin, A., “Introduction to the design and analysis of algorithms”, Pearson Education, 3rd ed., 2015.
4. Horowitz, E., Sahni, S., & Mehta, D., “Fundamentals of data structures in C”, Silicon Press, 2nd ed., 2007.
5. Brassard, G., & Bratley, P., “Fundamentals of algorithms”, Pearson Education, 1st ed., 2015.
6. Bhasin, H., “Algorithms: Design and analysis”, Oxford University Press, 1st ed., 2015

E-REFERENCES:

1. https://www.geeksforgeeks.org/advanced-data-structures/
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

MCAF251T40	PYTHON PROGRAMMING	L	T	P	C
		3	1	4	6

(For Students admitted from 2025 onwards)

OBJECTIVES

- To learn the fundamentals of writing Python scripts
- To learn and python control structures and loops.
- To define python functions and use function calls to solve problems.
- To use python data structures – lists, tuples, dictionaries to represent complex data.
- To do input / output with files in python.

OUTCOMES

- Understand the basic concepts of various operating systems and data types.
- Illustrate the concept of strings and its manipulation.
- Illustrate python for file handling in databases.
- Understand the various graphic methods to solve different problems.
- Interpret data exploration and data munging

SYLLABUS

UNIT – I – PYTHON BASICS

Introduction to Python – Installing in various Operating Systems –Data Types – Operators – Input and output statements - Conditional Statements – if-if-else-nested if – Looping – for-while-nested loops– Control Statements - break-continue-pass.

12

UNIT – II – FUNCTIONS AND DATA STRUCTURES

Arrays - String and characters– Functions –calling a function – types of function – function arguments – lamda function - Lists – Tuples – Dictionaries – Set - Exception Handling – Modules.

12

UNIT–III – OOPS AND DATABASES

Object Oriented Programming – Classes – Objects – Attributes – Inheritance – Overloading – Polymorphism - Files – working with files containing strings – working with binary files - Regular Expressions. Interacting with Databases – Introduction to MySQL – interacting with MySQL – Database connection – creating database table, insert operation, read operation, update operation, delete operation.

12

UNIT – IV – INTRODUCTION TO WEB AND GUI PROGRAMMING

Introduction to Graphics programming – canvas – frames – widgets – Label – Message – Text – Scrollbar – Check button – Radio button – entry -list box – menu – spinbox – creating table - Networking – Protocol – sockets – URL – TCP/IP Server and client – File server – File Clients. **12**

UNIT – V – WORKING WITH LIBRARIES

Exploratory Data Analysis - Libraries – Numpy – one dimensional arrays – multi dimensional arrays- Pandas for data processing – Matplotlib library for visualization – scipy for statistics.

12

TOTAL: 60 Hrs.

TEXT BOOKS

1. Dr.R.Nageswara Rao, "Core Python Programming" , dreamtech Press , 3rd Edition 2021.
2. Bharti Motwani, Wiley, "Data Analytics using Python", Wiley India PVT Ltd., 2020.
3. Anurag Gupta , GP Biswas, "Python Programming" ,McGraw Hill Education (India) PVT. Ltd., 2020.

REFERENCES:

1. Martin C Brown , "Python the Complete Reference",Tata Mcgraw Hill, India.
2. Ashok Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", Tata Mcgraw Hill, India.
3. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press.
4. John V Guttag., "Introduction to Computation and Programming Using Python", Prentice Hall of India.

E-REFERENCES:

1. www.nptel.ac.in
2. https://docs.python.org/3/tutorial/
3. https://www.coursera.org/
4. https://books.goalkicker.com/PythonBook
5. www.cpu-world.com

LIST OF EXPERIMENTS

1. Explore the concept of control statement and functions in simple python programs.
2. Perform various operations in tuple and list
3. Perform various operations in dictionary and sets.
4. Perform object oriented concepts: method overloading, method overriding, inheritance.
5. Perform exception handling in python.
6. Perform file handing in python.
7. Perform GUI operation using canvas and frames.
8. Develop a python code to interact with Databases.
9. Perform indexing and slicing operations on Numpy array.
10. Create a simple line chart using Matplotlib to visualize a dataset.

MCAF251T50	ADVANCED DATABASE TECHNOLOGIES	L	T	P	C
		3	1	4	6

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To Introduce fundamental concepts of data models, relational databases, and normalization techniques.
- To Explore the architecture and operational principles of parallel and distributed database systems.
- To Familiarize students with web-based databases and XML technologies.
- To Introduce NoSQL databases with a focus on MongoDB, its architecture, and basic operations.
- To Equip students with the ability to use advanced MongoDB features for building scalable, secure database applications.

COURSE OUTCOMES

- Design and implement relational databases using ER models, SQL, and normalization techniques.
- Explain and analyze the working of parallel and distributed database systems, including transaction management and concurrency control.
- Utilize XML and web database technologies for data representation and querying.
- Compare and contrast NoSQL and SQL databases, and identify appropriate use cases for NoSQL solutions.
- Implement and optimize MongoDB operations including aggregation, indexing, sharding, and replication for real-world applications.

SYLLABUS

UNIT – I RELATIONAL MODEL

Data Model – Types of Data Models: Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Structured Query Language – Database Normalization.

12

UNIT – II PARALLEL AND DISTRIBUTED DATABASES.

Centralized and Client-Server Architectures – Parallel Databases – I/O Parallelism – Inter- and Intra-Query Parallelism – Inter- and Intra-Operation Parallelism – Distributed Database Concepts: – Architecture - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control.

12

UNIT – III DATABASES ON THE WEB

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.

12

UNIT – IV INTRODUCTION TO NOSQL AND MONGODB BASICS

NoSQL – Introduction – Features – NoSQL Vs SQL - Types – MongoDB – Introduction – Installation – Architecture- Basic Queries –MongoDB Data Modeling - CRUD Operations.

12

UNIT – V ADVANCED MONGODB OPERATIONS AND USE CASES

Advanced MongoDB Queries and Aggregation Framework - Indexes - Sharding - Replication - Security and Authentication.

12

TOTAL: 60 Hrs.

REFERENCES:

1. Elmasri, R., & Navathe, S. B., "Fundamentals of Database Systems", Pearson, 7th ed., 2016.
2. Ramakrishnan, R., & Gehrke, "Database Management Systems", McGraw-Hill, 3rd ed., 2003.
3. Silberschatz, A., Korth, H. F., & Sudarshan, S., "Database System Concepts", McGraw-Hill, 7th ed., 2019
4. Rob, P., & Coronel, C., "Database Systems: Design, implementation, and management", Cengage Learning, 12th ed., 2012.
5. Date, C. J., & Longman, A., "Introduction to Database Systems", Pearson, 8th ed.,2003.
6. Chodorow,K., "MongoDB: The Definitive Guide", O'Reilly Media, 2020.
7. Bradshaw, S., Brazil, E., & Chodorow, K., "MongoDB: The definitive guide – Powerful and scalable data storage", O'Reilly Media, 3rd ed., 2019.

E-REFERENCES

1. https://www.geeksforgeeks.org/advanced-database-concepts/
2. https://www.tutorialspoint.com/dbms/dbms_advanced_topics.htm

LIST OF EXPERIMENTS

1. Tables Creation with various Constraints
2. Select, Insert, Update, and Delete Operations
3. SQL Queries using WHERE, ORDER BY, and Aggregate Functions
4. SQL Queries using Joins and GROUP BY
5. Query Performance with and without Index
6. Create XML File, Write and Validate DTD on XML File
7. Install MongoDB, Insert Documents and Use of Basic MongoDB Queries
8. Use of Aggregation Framework in MongoDB
9. Creation of Indexes and Search
10. Demonstration of Sharding and Replication

MCAF251LS0	SKILL COMMUNICATION – I	L	T	P	C
		2	0	0	1

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To inculcate reading habit and develop effective reading skills.
- To improve basics of grammar.
- To help students to spot common errors in English.
- To familiarize students with vocabulary and their application in context.
- To improve aptitude skills, problem solving skills and reasoning ability.

COURSE OUTCOMES

At the end of the course, students will be

- Able to understand the fundaments of grammar also helps to apply and analyze in spotting the errors.
- Able to understand and apply the concept of vocabulary and verbal logic with examples.
- Able to understand and solve the number problems.
- Able to understand and solve the problems through analytical and logical reasoning methods.

SYLLABUS

UNIT I - READING SKILLS &GRAMMAR

Reading Comprehension - Fundamentals of Grammar – Parts of Speech I - Fundamentals of Grammar – Parts of Speech II -Fundamentals of Grammar – Articles, Modifiers & Determiners - Fundamentals of Spotting Errors Grammar – Concord Rule - Fundamentals of Grammar – Tenses-Sentence Correction.

UNIT II - VOCABULARY & VERBAL LOGIC

Synonyms – Antonyms - Examples – Case study - Sentence Completion - Word Analogy - Examples – Case study - Critical Reasoning - Examples – Case study.

UNIT III - NUMBERS AND MODERN MATHEMATICS

Numbers I - Numbers II – Logarithm -Simple Equations- Ratio & Proportion - Percentage, Profit & Loss - Venn Diagram- Permutation –Combinations - Probability

UNIT IV - REASONING

Analytical Reasoning I - Analytical Reasoning II- Logical Reasoning –Blood Relations / Directions - Logical Reasoning – Number series - Logical Reasoning – Coding /Decoding/ Odd man out.

WEEKLY 2 HOURS

REFERENCES

1. Thomson A.J. & Martinet A.V, "A Practical English Grammar", Oxford University Press, 4th Edition (For 1 to 2 units), 1986.
2. Wren & Martin, "High School English Grammar and Composition", Faber &Faber, First Canadian Edition, (For 1 to 2 units), 1991.
3. Agrawal R.S. (2012), "Quantitative Aptitude for Competitive Examination", S.Chand Publishing, New Delhi (For 3 to 4 units), 2012.
4. Dinesh Khattar (2013), "Quantitative Aptitude for Competitive Examinations", Pearson Education, 2nd Edition (For 3 to 4), 2013.

E-REFERENCES

1. https://www.talkenglish.com/grammar/grammar.aspx
2. https://www.english-at-home.com/grammar/
3. https://www.grammarly.com/blog/definitions-of-key-grammar-concepts/#:~:text=In%20English%20grammar%2C%20the%20eight,preposition%2C%20conjunction%2C%20and%20interjection.
4. https://grammar.yourdictionary.com/grammar-rules-and-tips/basic-english-grammar-rules.html
5. https://www.hitbullseye.com/Logical-Reasoning.php
6. https://www.indiabix.com/logical-reasoning/questions-and-answers/

SEMESTER - II

MCAF252T10	ADVANCED OPERATING SYSTEMS	L	T	P	C
		3	1	0	4

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To study the characteristics of OS for Multiprocessor and Multicomputer.
- To learn the issues related to designing OS.
- To learn the latest trends in building Mobile OS
- To learn concurrency control algorithms
- To understand kernel structure

COURSE OUTCOMES:

- Knowledge about advanced concepts in OS
- Ability to develop OS for distributed systems
- Ability to develop modules for mobile devices
- Able to understand concurrency control algorithms
- Ability to understand kernel structure.

SYLLABUS

UNIT I - INTRODUCTION

Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- memory management.

12

UNIT II – DISTIRBUTED OPERATING SYSTEMS

Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms.

12

UNIT III – DISTRIBUTED FILE SYSTEMS

Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement.

12

UNIT IV – DATABASE OPERATING SYSTEMS

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms

12

UNIT V- MOBILE OPERATING SYSTEM

Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues.

12

TOTAL: 60 Hrs.

REFERENCE BOOKS

1. M Singhal and NG Shivaratri , "Advanced Concepts in Operating Systems", Tata McGraw Hill Inc, 2012.
2. A S Tanenbaum, "Distributed Operating Systems", Pearson Education, Asia, 2013.

E-REFERENCES

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating-system-engineering-fall-2012/
2. https://nptel.ac.in/courses/106/105/106105192/

MCAF252T20	CLOUD COMPUTING TECHNIQUES	L	T	P	C
		3	1	0	4

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To introduce the fundamental concepts and evolution of cloud computing, highlighting its benefits, limitations, and key vendors.
- To explain cloud computing architecture, including comparisons with grid computing, deployment models, and service models.
- To examine the role of data centers and virtualization technologies in enabling cloud services and improving resource utilization.
- To analyze cloud computing security challenges and explore secure design principles and services.
- To explore emerging technologies and real-world applications of cloud computing in various domains like mobile computing, IoT, and big data.

COURSE OUTCOMES:

- Describe the essential features, needs, and history of cloud computing, and evaluate its benefits and limitations.
- Differentiate between cloud and grid computing architectures, and explain various cloud service and deployment models.
- Demonstrate understanding of virtualization technologies and how they support efficient cloud data center operations.
- Identify and assess cloud computing security threats, and apply security principles and services for safe cloud usage.
- Apply cloud computing concepts to modern applications, including healthcare, education, transportation, IoT, and live video streaming.

SYLLABUS

UNIT I – OVERVIEW OF CLOUD COMPUTING

Overview of Cloud Computing: Introduction – Essentials of Cloud Computing – Needs of Cloud Computing- History of Cloud Computing- Benefits of Cloud Computing – Limitations of Cloud Computing- Vendors of Cloud Computing.

12

UNIT II – CLOUD COMPUTING ARCHITECTURE

Cloud Computing Architecture: Introduction- Grid architecture- Cloud Computing Architecture –Similarities and differences between grid and cloud computing Characteristics of Cloud Computing. Models of cloud computing – Cloud service models – cloud computing sub services models- cloud deployment models

12

UNIT III – CLOUD DATA CENTER AND VIRTUALIZATION

Cloud data center: Introduction – Cloud data center elements – storage network technologies. Virtualization Technology: Introduction – virtualization reference model – advantages of virtualization- server/compute virtualization – Need and advantage of Server/compute virtualization- Techniques of server/compute virtualization- types of virtualization.

12

UNIT IV – SECURITY IN CLOUD COMPUTING

Security issues of cloud computing: Introduction – security concerns of cloud computing – cloud information security objectives- cloud security design principles – cloud security services – secure cloud software testing.

12

UNIT V- ADVANCED CLOUD TECHNOLOGIES

Advanced technologies in cloud computing: Mobile cloud computing – Green Computing – Bigtable – cloud usage for big data analytics and IoT. Case Studies: Cloud for Healthcare – Cloud for Education - cloud for transportation systems- Live video streaming APP.

12

TOTAL: 60 Hrs.

REFERENCE BOOKS:

1. Shailendra Singh, “Cloud Computing”, Oxford University Press,2018.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
3. Barrie Sosinsky, “Cloud Computing Bible”, Wiley Publishing Inc, 2013.
4. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
5. Borko Furht · Armando Escalante, “Handbook of Cloud Computing”, Springer, e-ISBN 978-1-4419-6524-0, DOI 10.1007/978-1-4419-6524-0.

E-REFERENCES

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.html .

		L	T	P	C
MCAF252T30	FULL STACK DEVELOPMENT	3	1	4	6

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To understand the fundamentals of full stack development.
- To learn mean architecture and development environment.
- To learn various techniques of node, express and mongoDB.
- To develop web application forms of REST API.
- To develop dynamic front end with angular JS.

COURSE OUTCOMES:

- understand the fundamentals of full stack development
- interpret the components of mean architecture and development environment
- employ the various techniques of node, express and mongoDB
- prioritize the different forms of REST API in the web application development
- make use of the advanced techniques to develop dynamic front end with angular

SYLLABUS

UNIT – I FULL-STACK DEVELOPMENT OVERVIEW

Introducing Full-Stack Development : The Web Server/platform – Express Framework – MongoDB Database – Angular Front-end Framework : jQuery Vs Angular – Two-Way Data Binding – Load New Pages – Developing in TypeScript - Supporting Cast: Twitter Bootstrap – Git for Source Control – Hosting – Mean Stack Components Work Together

12

UNIT – II MEAN STACK ARCHITECTURE AND BUILDING A NODE WEB APPLICATION

MEAN Stack Architecture – Beyond SPAs – Flexible MEAN Architecture –Planning a Real Application – Development into stages – Hardware Architecture – Creating and Setting up a MEAN Project : Look at Express, Node and npm – Creating an Express Project – Modifying Express for MVC.

12

UNIT – III NODE, EXPRESS, MONGODB AND MONGOOSE

Building a Static Site: Defining the routes in Express – Building Basic controllers – Views – Adding the rest of the Views – Taking the Data Out of the Views – Building a Datamodel with MongoDB and Mongoose: Connecting the Express Application to MongoDB–Model the Data - Mongoose Schemas – MongoDB Shell – Database Live.

12

UNIT – IV REST API

Writing a REST API: The Rules of a REST API – Setting up the API in Express - Reading Data from MongoDB – Adding Data to MongoDB – Updating Data in MongoDB – Delete Method – Consuming a REST API: Call an API from Express – Lists of Data from an API – Single Documents from an API – Adding Data to the Database via the API

12

UNIT – V DYNAMIC FRONT END WITH ANGULAR

Angular Application with TypeScript: Getting up and Running with Angular – Angular Components – Getting Data from an API – Angular Application into Production – Building a Single-age Application with Angular:Foundations – Adding Navigation – Multiple Nested Components – Adding Geolocation– Binding HTML Content -Building a Single-Page Application with Angular: The Next Level – Authenticating Users, Managing Sessions and Securing APIs.

12

REFERENCES:

1. SmonHolmoes, Clive Harber, "Getting MEAN with Mongo,Express, Angular and Node", Manning Publications, 2nd Edition, 2019
2. Colin Ihrig, Adam Bretz, “Full Stack Javascript Development with Mean: MongoDB, Express, AngularJS, and Node.JS”, SitePoint, 1st Edition, 2015
3. Ravi Kant Soni, "Full Stack AngularJS for Java Developers", Apress, 1st Edition, 2018

E-REFERENCES:

1. https://learning.oreilly.com/library/view/full-stack-development/9781788997861/
2. https://www.coursera.org/specializations/full-stack-mobile-app-development

LIST OF EXPERIMENTS

1. Create a NodeJS server that serves static HTML and CSS files to the user without using Express.
2. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars
3. Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form
4. Create a counter using AngularJS
5. Create a Todo application using AngularJSStore the data to a JSON file using a simpleNodeJS server and retrieve the information from the same during page reloads.
6. Create a simple Sign up and Login mechanism and authenticate the user using cookies.The user information can be stored in either MongoDB or MySQL and the server shouldbe built using NodeJS and Express Framework.
7. Create a docker container that will deploy a NodeJS ping server using the NodeJSimage.
8. Build a simple calculator app with AngularJS. The user should be able to add numbers and operations to the app by clicking on buttons, just like you would do in a mobile phone. The moment the operation and the two operations are defined, the answer should be displayed
9. Create a Simple Login form using React JS
10. Write a program to create and Build a star rating system using Jquery.

MCAF252T40	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	1	4	6

COURSE OBJECTIVES

- To understand mobile application development trends and Android platform.
- To analyze the need of simple applications,
- To understand Location map based services.
- To enable the learner for aspiring careers in Android Mobile application development areas.
- To learn internal and external packages of flutter framework.

COURSE OUTCOMES

- Understand Android & flutter architecture, activities and their life cycle.
- Use View Groups comprising layouts and Views in application.
- Manage data binding, user interface events, maps
- Work with graphics, animation, still images and video.
- Publish and distribute Android Application

SYLLABUS

UNIT – I INTRODUCTION TO ANDROID DEVELOPMENT

Overview of Android: Introducing Android, The Android Application Components, the manifest file, Downloading and Installing Android, Exploring the Development Environment, Developing and Executing the first Android Application. Using Activities, Fragments, and Intents in Android: Working with activities, Using Intents, Fragments, Using the Intent Object to Invoke Built –in Application

12

UNIT – II – USER INTERFACE DESIGN

Working with the User Interface Using View and ViewGroups: Working with View Groups, building data with the AdapterView Class, Designing AutoTextCompleteView, Implementing Screen Orientation, Designing the views programmatically, Handling UI events, Creating Menus.

12

UNIT–III – PERSISTENT DATA STORAGE

Storing the Data Persistently: Introducing the Data Storage Options, Using the internal storage, Using the external storage, Using the SQLite Database, Working with content Providers.

12

UNIT – IV MULTIMEDIA, MAPS AND APPS PUBLISHING

Working with Location Services and Maps: Working with Google Maps, Working with Geocoding and Reverse Geocoding. Use Media Player, Recording and Playing sound, creating a sound pool, Using Camera, Recording Video.

Working with Graphics and Animation: Working with Graphics, Using the Drawable Object, Using the Shape Drawable object, Hardware Acceleration, Working with Animation. Signing the Android Application, Versioning the Android Application, Publishing the Android Application

12

UNIT – V – INTRODUCTION TO FLUTTER AND DART

Introduction to flutter: Introduction Dart & Flutter, how to install flutter on android studio. The flutter user interface, widgets. Flutter: Handling user input & Routing: Input widgets, validating input, custom input, Theming & styling, Routing: navigating between screens

12

TOTAL: 60 Hrs.

REFERENCES:

1. Marco L. Napoli "Beginning Flutter A Hands On Guide To App Development", 1stEdition, John Wiley & Sons, 2020.
2. Alessandro Biessek "Flutter for beginners", Packt publication,2019.
3. Pradeep Kothari ,"Android Application Development Black Book" by, DreamTech 2014.
4. Android Wireless Application Development by Lauren Darcey, Shane Conder, Pearson . 3e,2013.
5. Wei Meng Lee, "Beginning Android 4 Application Development" Wrox ,2012.

E-REFERENCES

1. https://developer.android.com/
2. https://flutter.dev/

LIST OF EXPERIMENTS

1. Develop an android application that uses GUI components, Font and Colors.
2. Develop a standard calculator android application to perform basic calculations like addition, subtraction, multiplication, and division.
3. To illustrate the alert dialog box in android application.
4. Create ab android application that write data to the internal storage.
5. Create an android application that writes data to SD Card.
6. Develop an android application that create, save, update, and delete data in database.
7. Develop an android application that uses GPS location information.
8. Develop an android application that draws basic graphical primitives (Rectangle, circle etc.) on the screen.
9. Develop a flutter application that uses GUI components, Font, and Colors.
10. Develop login signup application using flutter

MCAF252LS0	SKILL COMMUNICATION –II	L	T	P	C
		2	0	0	1

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To make them prepare and give professional presentations
- To introduce students to the nuances of vocabulary
- To enable students the art of writing resumes and give interviews
- To improve the ability of the students to solve aptitude problems in arithmetic and menstruation

COURSE OUTCOMES

At the end of the course, students will be

- Able to understand and develop the presentation skills.
- Able to understand, apply and develop the reading and interview skills.
- Able to understand and solve the number problems.
- Able to understand and solve the aptitude problems in arithmetic and menstruation.

SYLLABUS

UNIT I: PRESENTATION SKILLS

Extempore - Company Profile/Area of Interest/Recent Developments.

UNIT II: ANALYTICAL READING & INTERVIEW SKILLS

Reading Comprehension & Critical Reasoning - CV Writing - Self Profiling –Mock Interview - One Word Substitution – Homonyms – Idioms - Phrasal Verbs - Odd Word.

UNIT III: ARITHMETIC

Averages - Mixtures & Solutions - Time & Work - Pipes & Cisterns - Time, Speed & Distance.

UNIT IV: MODERN MATHEMATICS & MENSRUATION

Data Sufficiency - Data Interpretation - Cubes - Menstruation – Clocks – Calendars.

WEEKLY HOURS **2**

REFERENCES

1. Dinesh Khattar, "Quantitative Aptitude for Competitive Examinations", Pearson Education, 2nd Edition (For 1 to 2 Units), 2013.
2. Agrawal, R.S., "Quantitative Aptitude for Competitive Examination", S.Chand Publishing, (For 1 to 2 Units), 2012.
3. ArunSharma "Logical Reasoning", Tata McGraw Hill, 2012.
4. Edgar Thorpe, "Test of Reasoning", Tata McGraw Hill, 4th Edition, 2007.
5. Agarwal R.S., "Verbal & Non Verbal Reasoning", S.Chand Publishing, New Delhi.

E-REFERENCES

1. https://www.skillsyouneed.com/presentation-skills.html
2. https://edwardlowe.org/how-to-develop-powerful-presentation-skills/
3. https://www.skillsyouneed.com/ips/interview-skills.html
4. https://hbr.org/1964/01/strategies-of-effective-interviewing
5. https://www.hitbullseye.com/Arithmetic-Reasoning-Concepts.php
6. https://www.onlinemathlearning.com/math-problem-solving-strategies.html.
7. https://www.examsbook.com/very-important-arithmetical-reasoning-questions-and-answers
8. https://www.indiabix.com/verbal-reasoning/arithmetic-reasoning/

SEMESTER - III

MCAF253T10	MACHINE LEARNING	L	T	P	C
		3	1	4	6

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- Understand the fundamental concepts of Artificial Intelligence and the role of AI techniques in problem-solving.
- Learn the mathematical and statistical foundations that support modern machine learning algorithms.
- Explore and implement various classification, regression, and probabilistic models for supervised learning tasks.
- Understand unsupervised learning methods including clustering and dimensionality reduction techniques.
- Comprehend reinforcement learning approaches and explore real-world applications of AI and ML across different domains.

COURSE OUTCOMES:

- Define core concepts of AI and explain heuristic search strategies and production systems.
- Identify different types of machine learning tasks and explain the components of a learning system.
- Implement supervised learning algorithms like k-NN, decision trees, support vector machines, and Naïve Bayes.
- Evaluate clustering algorithms and perform dimensionality reduction techniques on complex datasets.
- Design and implement end-to-end machine learning workflows for real-life applications in various domains.

SYLLABUS

UNIT – I : INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Defining Artificial Intelligence, Defining AI techniques - Applications of AI - State Space Search and Heuristic Search Techniques - Production systems and characteristics, Hill Climbing, Breadth first and depth first search, Best first search : Introduction to Machine Learning - Applications of Machine Learning – General Architecture of a Machine Learning System - Machine Learning Terminology - Types of Machine Learning Tasks

12

UNIT – II : MATHEMATICAL FOUNDATIONS AND MACHINE LEARNING AND CATEGORIES OF ML TECHNIQUES

Introduction - Linear Algebra – Probability Theory – Information Theory: Data and Representation- Basis of Machine Learning - Issues in Building Machine Learning Models - Underlying Concepts of Machine Learning Algorithms—Parametric and Nonparametric Algorithms - Types of Machine Learning Algorithms – Supervised and Unsupervised Learning

12

UNIT – III: CLASSIFICATION ALGORITHMS AND PROBABILISTIC AND REGRESSION BASED APPROACHES

Introduction - Decision Based Methods: Nonlinear Instance-Based Methods - k-Nearest Neighbor- Decision Tree Algorithm - Linear Models—Support Vector Machines - Use Cases – Probabilistic Methods - Algorithms Based on Bayes Framework - Naïve Bayes Classifier - Regression Methods - Cross-Validation in Machine Learning - Handling Missing and Imbalanced Data.

12

UNIT – IV: UNSUPERVISED LEARNING AND DIMENSIONALITY REDUCTION

Introduction - Applications of Unsupervised Learning – Clustering - Similarity Measures - Methods of Clustering - Agglomerative Algorithm - Partitional Algorithm - k-Means Clustering - Cluster Validity - Dimensionality Reduction - The Process of Dimensionality Reduction - Dimensionality Reduction with Feature Reduction - Association Rule Mining

12

UNIT – V: REINFORCEMENT LEARNING–APPLICATIONS OF ML

Introduction - Action Selection Policies - Finite Markov Decision Processes - Problem Solving Methods - Temporal Difference Learning - Asynchronous Reinforcement Learning - Machine Learning Applications: Approaches - Domain Based Machine Learning Applications

12

TOTAL: 60 Hrs.

REFERENCES:

1. T.V.Geetha, S.Sendhil Kumar, "Machine Learning – Concept ,Techniques and Applications", CRC Press, 2023
2. Rajiv Chopra, "Machine Learning", 2nd Edition, Khanna Books Publishers, New Delhi, 2025.
3. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition,Pearson India, 202

E-REFERENCES:

1. https://www.coursera.org/learn/machine-learning
2. https://ai.google/education/
3. https://www.fast.ai/

LIST OF EXPERIMENTS

1. **Data Preprocessing**
   - Handling missing values
   - Encoding categorical data
   - Feature scaling (Standardization / Normalization)
2. **Supervised Learning Experiments - Regression**
   - Linear Regression (Simple & Multiple)
3. **Supervised Learning Experiments - Classification**
   - k-Nearest Neighbors (k-NN)
   - Support Vector Machines (SVM)
4. **Supervised Learning Experiments - Classification**
   - Decision Trees
5. **Supervised Learning Experiments - Classification**
   - Random Forests
6. **Supervised Learning Experiments - Classification**
   - Naive Bayes Classifier
7. **Unsupervised Learning Experiments**
   - k-Means Clustering
   - Hierarchical Clustering
   - Principal Component Analysis (PCA)
8. **Model Evaluation and Selection**
   - Train/Test Split and Cross-validation
   - Confusion Matrix
   - Precision, Recall, F1-Score
   - ROC Curve and AUC
9. **Ensemble Learning**
   - Bagging (e.g., Random Forest)
   - Boosting (e.g., AdaBoost, Gradient Boosting, XGBoost)
10. **Working with Real-World Datasets**
    - UCI Machine Learning Repository or Kaggle datasets (e.g., Titanic, Iris, Housing Prices)

MCAF253T20	INTERNET OF THINGS	L	T	P	C
		3	1	4	6

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- Introduction to IoT
- IoT and Machine to Machine.
- Network and Communication aspects
- Challenges and Applications of IoT.
- Developing IoT using Python Programming

COURSE OUTCOMES:

- Understand the fundamental concepts, architecture, and ecosystem of the Internet of Things (IoT).
- Analyze the basic protocols used in Wireless Sensor Networks (WSNs) and their relevance to IoT.
- Design IoT applications in various domains (e.g., smart home, healthcare, agriculture) and analyze their performance and feasibility**.**
- Implement basic IoT applications using embedded platforms such as Arduino, Raspberry Pi, or ESP32.
- Develop real-world and industrial IoT applications using Python, integrating sensors, cloud, and data analytics.

SYLLABUS

UNIT I: INTRODUCTION TO IOT

Defining IoT – Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT,Communication models and APIs.

12

UNIT II :IOT&M2M

Machine to Machine, Difference between IoT and M2M, Software define Network Iot Design Methodology , Application Sensors & Actuators - Edge Networking (WSN) Gateways - IoT Communication

12

UNIT III - NETWORK AND COMMUNICATION

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination

12

UNIT IV CHALLENGES AND APPLICATIONS

Design challenges, Development challenges, Security challenges, Other Challenges, Home Automation, Cities and Environment and Health Monitoring

12

UNIT V DEVELOPING IoTS

Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor based application through embedded system platform, Implementing IoT concepts with Python

12

TOTAL: 60

REFERENCES:

1 Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", 1st Edition,VPT, 2023.

2 Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley, 2010.

3 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things:" Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

E-REFERENCES

1. https://www.javatpoint.com/iot-internet-of-things/
2. https://www.guru99.com/iot-tutorial.html
3. https://mindmajix.com/iot

LIST OF EXPERIMENTS

1. Interface Arduino board to read analog and digital values using Light Dependent Resistor and Ultrasonic sensors.
2. Interface Raspberry Pi board to read analog and digital values using temperature and humidity sensors.
3. Construct a Raspberry Pi based system to control the LED using a switch.
4. Interface Arduino/Raspberry Pi with a sensor and LED to read the status in a smartphone using Bluetooth protocol.
5. Interface a PIR sensor with Arduino to detect human motion and activate a buzzer or LED alert system
6. Home Automation using Wi-Fi (ESP8266 or Node MCU) to control an LED or relay through a mobile app or web interface
7. Smart Dustbin using Ultrasonic Sensor with Arduino/Raspberry Pi to automatically open a lid (servo motor) when a person is near
8. Data Logging to Cloud using Thing Speak - Send sensor data to Thing Speak platform for visualization (Interface DHT11 with NodeMCU (ESP8266))
9. To install MYSQL database on Rasberry Pi and perform basic SQL Queries.
10. Write a program to create TCP server on Arudino/ Rasberry Pi and respond with humidity data to TCP client when requested.

MCAF253T30	BIG DATA ANALYTICS	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- Understand the Fundamentals of Big Data and Hadoop
- Learn About File System Configuration in Hadoop (HDFS)
- Learn the Map Reduce Concept for Task Execution in Hadoop
- Learn Queue Processing and Stream Processing of Data
- Learn About Hadoop Frameworks and Ecosystem Components

COURSE OUTCOMES:

- Apply Hadoop to Analyze Large Volumes of Data
- Access, Store, and Perform Operations on Data as Files and Directories
- Implement the Map Reduce Concept for Big Data Analysis
- Implement Event Streaming Using the Kafka API
- Access and Analyze Big Data Using the Hadoop Ecosystem Frameworks

SYLLABUS

UNIT I INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data - Introduction to Big Data - Challenges of conventional systems - Web data – Evolution of Analytic scalability - Analytic Processes and Tools - Analysis vs Reporting -History of Hadoop - Apache Hadoop - Analyzing Data with Hadoop - Hadoop Streaming.

12

UNIT II

HDFS & HADOOP I/O Hadoop Distributed File System :The Design of HDFS- HDFS Concepts- The Command-Line Interface- Hadoop File Systems- Data Flow- Parallel Copying with distcp- Hadoop Archives Hadoop I/O: Data Integrity- Compression- Serialization **12**

UNIT III

MAPREDUCE Analyzing the Data with Hadoop- Hadoop Pipes- Map Reduce Types - Input Formats- Output Formats- Map Reduce Features – Map Reduce Works - Anatomy of a Map Reduce Job Run – Failures - Job Scheduling - Shuffle and Sort - Task Execution.

12

UNIT IV

QUEUEING AND STREAM PROCESSING SYSTEMS: Queueing, Queueing systems, Introduction to kafka, producer consumer, brokers, types of queues - single consumer, multi consumer queue servers. Streaming systems: Stream processing – queues and workers - micro batch streaming processing - introduction to kafka streaming processing API

12

UNIT V

HADOOP FRAMEWORKS Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data

12

TOTAL: 60 Hrs.

REFERENCES

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics”, John Wiley & sons, 2012.
2. David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.
3. Tom White, “Hadoop: The Definitive Guide”, O’Reilly, 2009
4. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007

E-REFERENCES

1. https://www.coursera.org/specializations/big-data
2. https://hadoop.apache.org/docs/stable/hadoop-project-dist/hadoop-hdfs/HdfsDesign.html
3. https://www.tutorialspoint.com/hadoop/hadoop_hdfs.htm

MCAF252E2A	ELECTIVE – II DATA COMMUNICATIONS AND NETWORKING	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- Understand the fundamental concepts and models of data communication and networking.
- Analyze the functions and technologies of each layer in the network protocol stack.
- Explain the principles of data transmission, error handling, and access methods.
- Comprehend network layer addressing, routing, and transport layer protocols.
- Describe common application layer protocols and basic network security concepts.

COURSE OUTCOMES:

- Explain the fundamental concepts of data communication, network topologies, and network types. (Understanding)
- Analyze the functionality of the OSI and TCP/IP network models and the physical layer components. (Analyzing)
- Apply error detection and correction techniques and differentiate between data link control protocols and access methods. (Applying, Understanding)
- Describe network layer addressing and routing principles and compare transport layer protocols (TCP/UDP). (Understanding, Analyzing)
- Explain the operation of common application layer protocols and basic network security concepts. (Understanding)

SYLLABUS

UNIT – I –INTRODUCTION TO DATA COMMUNICATION AND NETWORKING

Introduction to Data Communication and Networking: Definition of data communication, networks, and the internet-Network topologies (bus, star, ring, mesh) -Network types (LAN, WAN, MAN). Network protocols and standards -Communication types (synchronous, asynchronous) -Communication modes (simplex, half-duplex, full-duplex).

12

Unit –II –NETWORK MODELS AND PHYSICAL LAYER

Network Models : The OSI model and its layers (physical, data link, network, transport, session, presentation, application)-The TCP/IP model -Comparison of OSI and TCP/IP models. Physical Layer: Signals (analog and digital)- Transmission impairments- Line coding schemes-Digital and analog transmission techniques-Multiplexing (FDM, WDM, TDM)- Transmission media (twisted pair, coaxial cable, fiber optics, wireless).

12

Unit III –DATA LINK LAYER

Data Link layer Design issues- Error detection and correction (parity checks, CRC).- Data link control protocols (HDLC, PPP)-Access methods (CSMA, TDMA, FDMA)-wireless LAN technologies (Ethernet, Wireless LANs like IEEE 802.11),Bluetooth, and cellular networks.

12

Unit IV-NETWORK AND TRANSPORT LAYERS

Network Layer : Addressing and routing - Network layer protocols (IP, ICMP, ARP) - Routing algorithms (distance vector, link state) - Transport Layer: Process-to-process delivery. Transport protocols (TCP, UDP).Congestion control.

12

Unit – V-NETWORK AND TRANSPORT LAYERS

Application Layer: Client-server model.-Application layer protocols (SMTP, FTP, HTTP, DNS).-Domain Name System (DNS).- Network Security: Basic security concepts (authentication, encryption, firewalls) - Internetworking: Connecting LANs and WANs and Virtual Private Networks (VPNs).

12

TOTAL: 60 Hrs.

REFERENCES:

1. Behrouz A. Forouzan , "Data Communications and Networking", McGraw Hill Education, 5th Edition, 2013.
2. Kurose, J. F., & Ross, K. W., "Computer networking: A top-down approach", Pearson, 8th ed., 2021.
3. Tanenbaum, A. S., Nick Feamster, David J.Wetherall, D. J., "Computer Networks", Pearson, 6th ed., 2021.
4. William Stallings, "Data and Computer Communications", Pearson Education, Edition 10th/11th Edition, 2017

E- REFERENCES:

1. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
2. https://www.coursera.org/learn/data-communication-networks
3. https://www.guru99.com/data-communication-computer-network-tutorial.html

MCAF252E2B	ELECTIVE – II DEVOPS AND MICRO SERVICES	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- Introduce Microservices and Containers
- Understand the Key Concepts and Principles of DevOps
- Familiar with the Most Common DevOps Tools
- Explain the Business Benefits of DevOps and Continuous Delivery
- Recall Specific DevOps Methodologies and Frameworks

COURSE OUTCOMES:

- Select an Appropriate Microservices Design and Apply Its Principles
- Apply Microservices Architecture in a DevOps Environment
- Understand DevOps and Common DevOps Tools
- Develop and Integrate Projects Using DevOps Practices
- Deploy and Monitor Projects Using DevOps

SYLLABUS

UNIT – I – INTRODUCTION TO MICRO SERVICES

Introduction to Micro services: Definition of Micro services – Characteristics- Micro services and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.

12

Unit –II –MICROSERVICES ARCHITECTURE

Micro services Architecture: Monolithic architecture- Micro services architectural style- Benefits - Drawbacks of Micro services architectural style - decomposing monolithic applications into Micro services

12

Unit III- DEVOPS TOOLS

DevOps Tools History of DevOps- DevOps and Software Development Life Cycle – Waterfall Model _Agile Model – DevOps Lifecycle – DevOps Tools: distributed version of control tool Git- Automation testing tools Selenium – report generation –TestNG – User Acceptance Testing – Jenkins.

12

Unit IV-MICROSERVICES IN DEVOPS ENVIRONMENT

Micro services in Devops Environment Evolution of Microservices and DevOps – Benefits of combining DevOps and Micro services- working of DevOps and Micro services in Cloud environment - DevOps Pipeline representation for a NodeJS based Micro services

12

Unit – V-VELOCITY AND CONTINUOUS DELIVERY

Velocity and Continuous Delivery Velocity - Delivery Pipeline- test stack - Small/Unit Test – medium /integration testing – system testing- Job of Development and DevOps - Job of Test and DevOps – Job of Op and Devops Infrastructure and the job of Ops.

12

TOTAL: 60 Hrs.

REFERENCES:

1. Tanasseri, N., & Rai, R. "Microservices with Azure", Packt Publishing, 1st Edition, 2017.
2. Eberhard Wolff, "Microservices: Flexible Software Architecture", Pearson Education, 2nd Edition, 2018
3. James A Scott, "A Practical Guide to Microservices and Containers", MapR Data Technologies.
4. Joseph, J., "DevOps for beginners", Mihails Konoplovs Publishing, 1st ed., 2015
5. Kim, G., Behr, K., & Spafford, G**.**, "The Phoenix Project: A novel about IT, DevOps, and helping your business win", IT Revolution Press, 5th ed., 2018.
6. Michael Hüttermann, DevOps for Developers, APress,[E-book], 1st Edition, 2012.

E- REFERENCES

1. https://github.com/in28minutes/devops-master-class
2. https://www.classcentral.com/course/deploying-microservices-to-kubernetes-using-azure-190615
3. https://www.geeksforgeeks.org/devops-tutorial/

MCAF252E2C	ELECTIVE – II CYBER SECURITY AND ETHICAL HACKING	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- To understand the principles of cybersecurity planning, including security governance, risk management, and key security models such as Bell-LaPadula, Biba Integrity, and the Chinese Wall model.
- To examine various types of security controls involving people, processes, and physical assets, along with the integration of security into the system development life cycle (SDLC).
- To explore cybersecurity challenges in business applications and networks, and to study techniques for securing access, authentication, and communication systems.
- To analyze and implement technical security solutions such as malware protection, cryptographic methods, intrusion detection, and digital rights management.
- To develop the ability to assess and improve an organization's security posture through audits, compliance monitoring, risk reporting, and performance evaluation.

COURSE OUTCOMES:

- Demonstrate understanding of cybersecurity planning by applying risk management techniques and selecting appropriate security models for protecting information assets.
- Identify and implement effective security controls across human resources, information systems, and physical environments, while planning for disaster recovery and incident response.
- Analyze and secure business applications and enterprise networks using authentication mechanisms, access control techniques, and network security tools like firewalls and OWASP ZAP.
- Apply technical security practices, including the use of cryptographic techniques, malware defense, intrusion detection systems, and forensic investigation tools.
- Evaluate and improve organizational security performance through systematic audits, compliance checks, risk assessments, and security monitoring practices.

SYLLABUS

UNIT I -PLANNING FOR CYBER SECURITY

Best Practices-Standards and a plan of Action-Security Governance Principles, components and Approach-Information Risk Management-Asset Identification-Threat Identification-Vulnerability Identification-Risk Assessment Approaches-Likelihood and Impact Assessment-Risk Determination, Evaluation and Treatment-Security Management Function-Security Policy-Acceptable Use PolicySecurity Management Best Practices - Security Models: Bell La Padula model, Biba Integrity Model - Chinese Wall model

UNIT II - SECURITY CONTROLS

People Management-Human Resource Security-Security Awareness and Education-Information Management- Information Classification and handling-Privacy-Documents and Record ManagementPhysical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device SecuritySystem Development-Incorporating Security into SDLC - Disaster management and Incident response planning. **12**

UNIT III - CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS

Business Application Management-Corporate Business Application Security-End user Developed Applications-System Access- Authentication Mechanisms-Access Control-System Management Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security Electronic Communications - Case study on OWASP vulnerabilities using OWASP ZAP tool. **12**

UNIT IV TECHNICAL SECURITY

Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-Intrusion Detection-Digital Rights Management-Cryptographic Techniques-Threat and Incident Management Vulnerability Management-Security Event Management-Forensic Investigations-Local Environment Management-Business Continuity.

12

UNIT V SECURITY ASSESSMENT

Security Monitoring and Improvement-Security Audit-Security Performance-Information Risk Reporting-Information Security Compliance Monitoring-Security Monitoring and Improvement Best Practices.

12

TOTAL: 60 Hrs.

REFERENCES:

1. William Stallings, “Effective Cyber Security - A guide to using Best Practices and Standards”, Addison-Wesley Professional, First Edition, 2019.
2. Adam Shostack, “Threat Modelling - Designing for Security”, Wiley Publications, First Edition, 2014.
3. Gregory J. Touhill and C. Joseph Touhill, “Cyber Security for Executives - A Practical Guide”, Wiley Publications, First Edition, 2014.
4. Raef Meeuwisse, “Cyber Security for Beginners”, Second Edition, Cyber Simplicity Ltd, 2017.
5. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, 2nd Edition, Syngress, 2013.
6. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, “Security in Computing”, Fifth Edition, Prentice Hall, 2015.

E-REFERENCES

1. https://www.coursera.org/specializations/intro-cyber-security
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-ethical-hacking

MCAF252E2D	ELECTIVE – II NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand word level and syntactic analysis.
- To understand the role of semantics of sentences and pragmatics
- To get knowledge about the machine translation.
- To get knowledge about NLG and machine translation

COURSE OUTCOMES:

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To apply NLG and machine translation

UNIT: I INTRODUCTION OF BASIC TEXT PROCESSING Overview: NLP-Language - Basics of Text Processing – Spelling Correction – Weight Edit Distance-other Variations – Noisy Channel Model for spelling correction –N-Gram Language Models – Evaluation of Language models- Basic Smoothing.

12

UNIT: II LANGUAGE MODELLING AND SMOOTHING Language modeling – smoothing models – Computational Morphology – Finite state Methods for morphology – Introduction to POS tagging – Hidden Markov model for POS tagging – Models for sequential parsing – MaxEnt- CRF.

12

UNIT: III SYTAX, PARSING, SEMANTICS Syntax – Parsing – CKY-PCFGs – Inside and outside probabilities - Dependency grammar and parsing – Transition based Parsing – Formulation – Learning. MST Based Parsing - Distributional model for semantics – Word Embeddings - Lexical Semantics-wordNet – Word Sense Disambiguation – Novel word sense detection.

12

UNIT: IV TOPIC MODELS AND INFORMATION EXTRACTION Topic Model- Latent Dirichlet Allocation – Gibbs sampling for LDA – Formulation and Application – LDA Variants- Entity Linking - Information extraction – Relation extractionDistant Supervision.

12

UNIT :V TEXT SUMMARIZATION & TEXT CLASSIFICATION Optimization Based models for summarization – Evaluation- Text classification – sentiment analysis - Affective lexicon -Learning affective lexicons - computing with affective lexicons.

12

TOTAL: 60Hrs.

REFERENCES:

1. Jurafsky, D., & Martin, J. H., *"*Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition"*,* Pearson, 3rd Edition, 2024.
2. S. Bird, E. Klein, and E. Loper, "Natural language processing with Python", O'Reilly Media, 1st ed., 2009.
3. B. Baldwin, "Language processing with Java and LingPipe cookbook", 1st ed. Atlantic Publisher, 2015.
4. R. M. Reese, "Natural language processing with Java", 2nd ed. O'Reilly Media, 2015.
5. N. Indurkhya and F. J. Damerau, "Handbook of natural language processing", 2nd ed. Chapman and Hall/CRC Press, 2010.

E-REFERENCES

1. https://intellipaat.com/academy/course/nlp-free-course/
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-natural-language-processing
3. https://alison.com/course/natural-language-processing-nlp

MCAF252E2E	ELECTIVE – II DIGITAL MARKETING	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- To learn how to take a systematic approach to develop a Digital Marketing strategy
- To designing an online marketing strategy integrated with overall marketing objectives
- To learn an effective marketing channel
- To understand social media marketing
- To learn all the essentials of search engine optimization

COURSE OUTCOMES:

- Able to explain the advantages of digital marketing over traditional marketing.
- Summarize how they can use digital marketing is used to increase sales and grow their business
- Work with a digital marketing tool kit
- Able to understand social media marketing and apply the learning's to create digital media campaigns.
- Able to understand and apply SEO

SYLLABUS

UNIT – I INTRODUCTION TO DIGITAL MARKETING

Digital Marketing – Digital marketing strategy – Digital advertising market in India – Skills required in digital marketing- Digital marketing plan. Display Advertising : Concept of Display Advertising – Types of Display Ads- Buying Models

12

UNIT – II SEARCH ENGINE ADVERTISING

Why Pay for Search Advertising - Understanding Ad placement – Understanding Ad ranks – Google Ads account – Best practice for creating effective Ads –Enhance Ad campaign - performance reports

12

UNIT – III FACEBOOK AND LINKEDIN MARKETING

How to build Successful Strategy – Facebook Marketing :Facebook for Business- Facebook insights-Other Marketing Tools.- LinkedIn : LinkedIn Strategy –LinkedIn Content Strategy-LinkedIn Analytics

12

UNIT – IV TWITTER MARKETING AND MOBILE MARKETING

Twitter Marketing : Building a content strategy – Twitter usage – Twitter Ads – Twitter Analytics – Twitter Tools and Tips for Marketers. Emerging platforms – Instagram and Snapchat –Mobile Marketing: Mobile advertising – Mobile Marketing Toolkit.

12

UNIT –V SEARCH ENGINE OPTIMIZATION

Search Engine – Concept of Search Engine Optimization - SEO phases – On-page optimization – Off page optimization – Social media reach – Maintenance.

12

TOTAL: 60 Hrs.

REFERENCES

1. Seema Gupta, "Digital Marketing", McGraw Hill Education Pvt. Ltd., India,2020.
2. Calvin Jones, "The best digital marketing campaigns in the world, Mastering The Art of Customer Engagement", Kogan Page Limited, 2011.
3. Michelle Krasniak, Jan Zimmerman and Deborah Ng, "Social media marketing all in one for dummies", Wiley, 5th Edition, 2021
4. Dave Chaffey and PR Smith, "EMarketing Excellence: Planning and Optimizing your digital marketing", Routledge, 4th Edition, 2015.
5. Alan Charlesworth, "Digital Marketing: A Practical Approach", Routledge, 4th Edition, 2022.

E-REFERENCES

1. https://learndigital.withgoogle.com/digitalgarage/course/digital-marketing
2. https://skillshop.withgoogle.com/intl/en-GB/course/google-ads-display
3. https://www.facebook.com/business/learn

MCAF252E2F	ELECTIVE – II AGILE SOFTWARE ENGINEERING	L	T	P	C
		3	1	0	3

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To understand the fundamentals and motivation of agile manifesto
- To learn the need and importance of teamwork and stakeholders in a learning environment.
- To study time related issues in software projects
- To understand about measures
- To focus about quality aspects and delivery process with respect to cyclicality

COURSE OUTCOMES

- Able to understand and explain the perspectives on software engineering and agile manifesto.
- Able to remember, understand, apply and evaluate the importance of teamwork with respect to their stakeholders.
- Able to remember, understand, examine and discuss the need and significance of time related problems in software projects.
- Able to remember, analyze and discuss about consequence of measures.
- Able to remember, understand, apply and discuss about quality and delivery process.

SYLLABUS

UNIT – I INTRODUCTION TO AGILE SOFTWARE DEVELOPMENT

Objectives – Three perspectives on software engineering – Agile manifesto – Application of agile software development – Agile software development in learning environment.

12

UNIT – II TEAMWORK AND CUSTOMERS & USERS

Objectives – A role scheme in agile teams – Dilemmas in team work – Teamwork in learning environment – the customer – User – Customers and users in learning environment.

12

UNIT – III TIME

Objectives – Time related problems in software projects – Tightness of software development methods – Sustainable pace – Time management of agile projects – Time in learning environments.

12

UNIT – IV MEASURES

Objectives – Why are measures needed – Who decides what is measured – What should be measured – When are measures taken – How are measures taken – Who takes the measures – How are measures used - Monitoring a large scale project by measures – Measures in learning environments.

12

UNIT – V QUALITY AND DELIVERY & CYCLICALITY

Objectives – The agile approach to quality assurance – Test driven development – Measured TDD – Quality in learning environment – Delivery and Cyclicality in learning environments.

12

TOTAL: 60

REFERENCES

1. Orit Hazzan, Yael Dubinsky, “Agile Software Engineering”, Springer International Edition, 2011.
2. Jim Highsmith, “Agile Software Development Ecosystems”, Addison-Wesley Professional, 1st Edition, 2002.
3. Alistair Cockburn, "Agile Software Development: The Cooperative Game", Addison-Wesley, 2nd Edition, 2007.

E-REFERENCES

1. https://www.tutorialspoint.com/sdlc/sdlc_agile_model.htm
2. https://www.infoworld.com/article/3237508/what-is-agile-methodology-modern-softwaredevelopment-explained.html
3. https://www.agilealliance.org/agile101/
4. https://www.w3schools.in/sdlc-tutorial/agile-model/

MCAF253P80	MINI PROJECT	L	T	P	C
		0	0	2	2

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES

- To provide insights to the process of software development
- To enable student analytical and practical exposure by giving hands on experience with learned knowledge through different courses.
- To make the students to set the industrial exposure
- To implement the knowledge, technology, innovational ideas for solving the industrial problems
- To understand methodologies and professional way of documentation and communication.

COURSE OUTCOMES

- Able to apply and develop modules using latest technologies.
- Able to apply and develop latest technologies
- Exercise team work in developing and integrating into a single project.
- Analyze the system for its productivity and feasibility.
- Exercise team work in developing and integrating into a single project.
- Prepare report on the application of emerging technologies in the selected industry

SYLLABUS

A Possible set of applications may be the following

- Android using Java or Kotlin
- Cryptography using C# or Java
- Data Analytics using Python
- Digital Image Processing using Java or Python
- Natural Language Processing using Java or VB.NET
- Networking using Java
- Web applications using PHP MVC Framework like Laravel or CodeIgniter
- Web applications using Angular, Node JS/ React JS
- Web applications using Java Frameworks like Hibernate, Struts or Spring
- Web applications using MVC, C# and .NET
- Machine Learning and Deep Learning using Python

SEMESTER –IV

MCA254Z10	PROJECT WORK	L	T	P	C
		0	0	24	12

(For Students admitted from 2025 onwards)

COURSE OBJECTIVES:

- To understand the software engineering methodologies for project development.
- To gain knowledge on recent technologies
- To develop software products in various domains
- To improve their communication and presentation skill
- To get training for testing the software products

COURSE OUTCOMES:

- Analyze and design software in an efficient manner
- Understand the features of current technologies
- Implement the applications in various domains
- Create Test Plan and apply various testing methods
- Able to communicate and present the software product

Syllabus:

MCA students have to do projects in an Industry/Research Organization.

The software products will be developed and tested in various domains using current technologies.

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