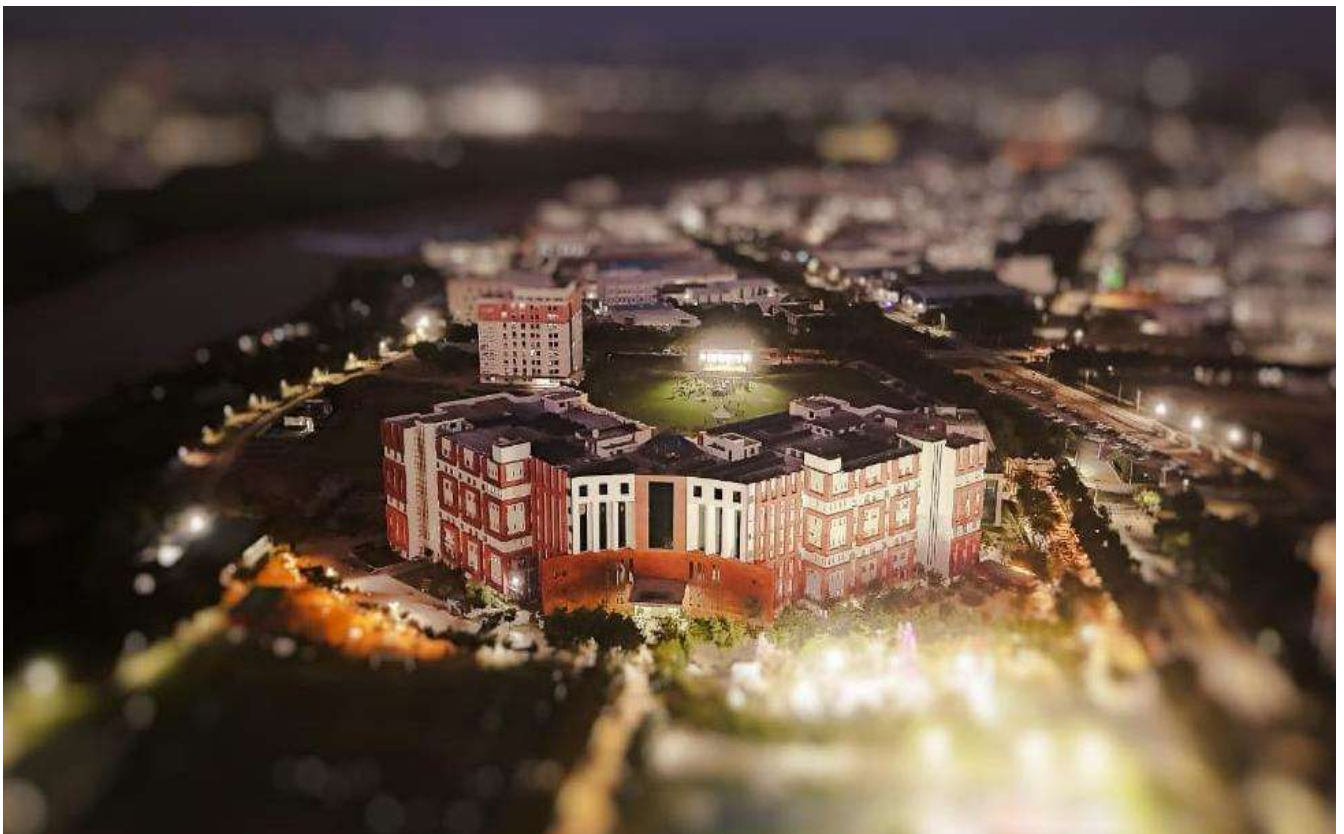




*Your Dreams Our Goal*  
**POORNIMA**  
**UNIVERSITY**

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)



**MASTER OF COMPUTER APPLICATION**

**SCHEME & SYLLABUS**

**BATCH: 2025-27**

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**Disclaimer:** The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

### Student Details

Name of Student:

Name of Program:

Semester:

Year:

Batch:

Faculty of:



# *Your Dreams Our Goal* **POORNIMA** **UNIVERSITY**

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## ***VISION***

To create knowledge based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

## ***Mission***

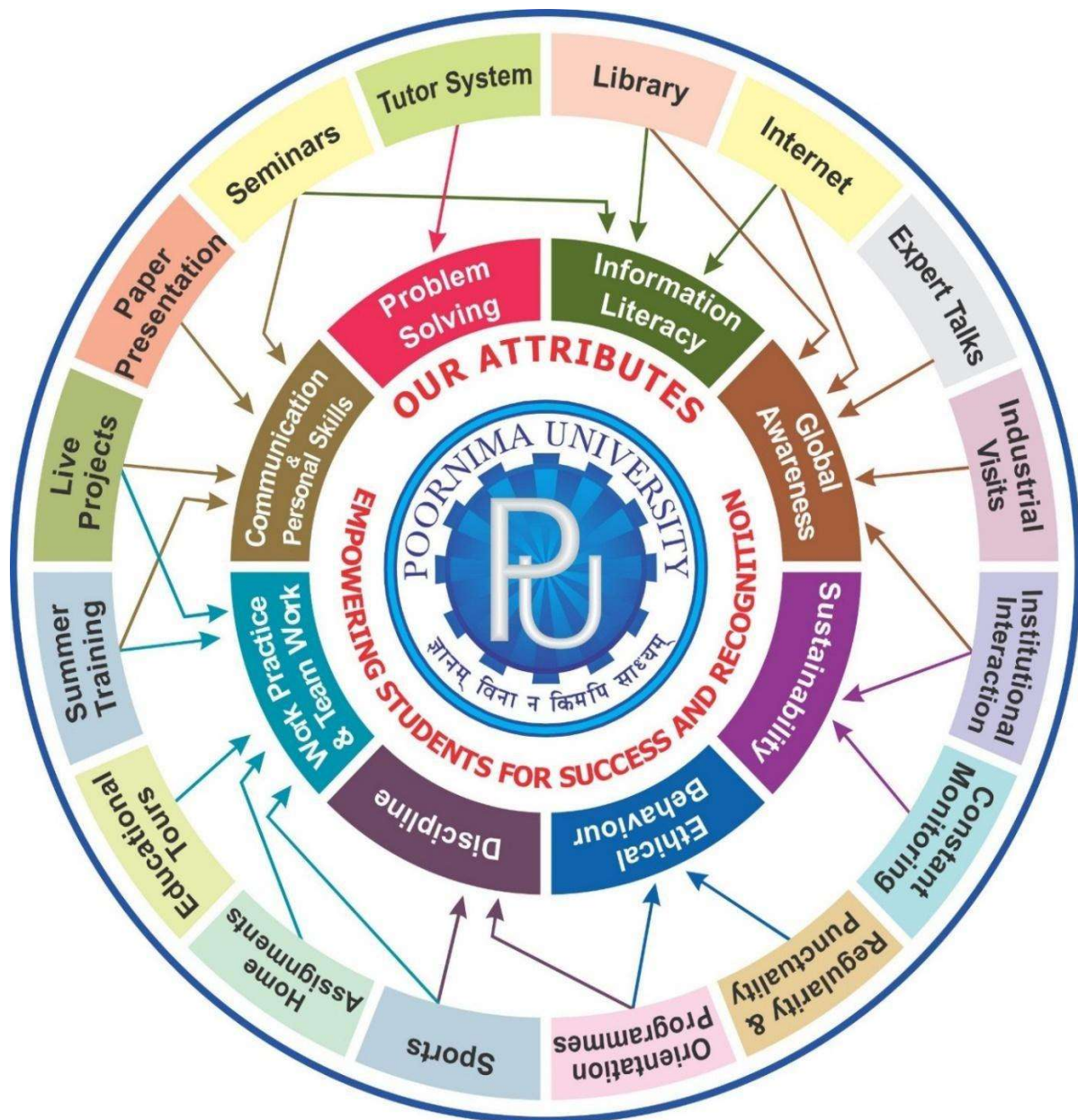
To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

## ***Quality Policy***

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied.

## Knowledge Wheel

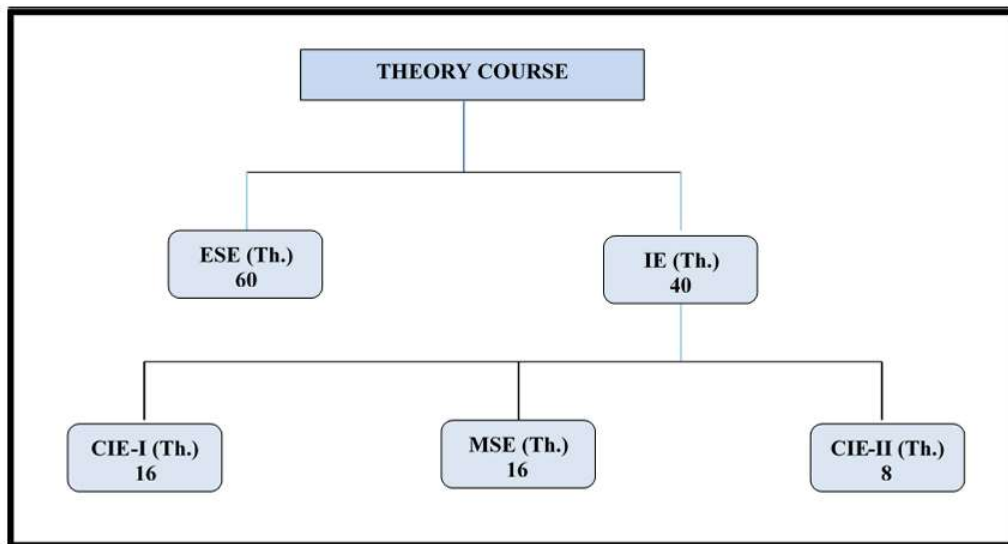
At Poornima, the academic atmosphere is a rare blend of modern technical as well as soft skills and traditional systems of learning processes.



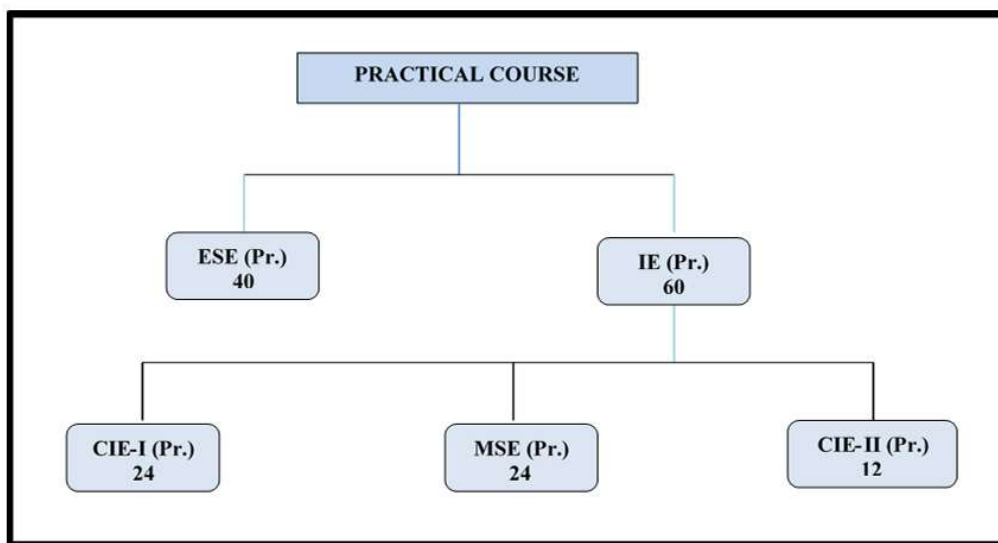
that opportunity to create value and wealth for the betterment of the individual and society at large.

**Examination System :**

**A. Marks Distribution of Theory Course:**



**B. Marks Distribution of Practical courses:**



**CO Wise Marks Distribution:**

**Th.:** Theory, **Pr.:** Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination, **CIE:** Continuous Internal Evaluation.

<b>Exam Entity</b>	<b>Maximum Marks</b>	<b>CO to be Covered</b>	<b>CO to be Covered</b>	<b>Maximum Marks</b>
<b>CIE-I</b>	16 ( 8 + 8)	1 & 2	1 & 2	24 (12 + 12)
<b>MSE</b>	16 ( 8 + 8)	3 & 4	3 & 4	24 (12 + 12)
<b>CIE-II (Activity/ Assignment)</b>	8 (8)	5	5	12 (12)
<b>ESE</b>	60	-	-	40
<b>TOTAL</b>	100	-	-	100

**Minimum Passing Percentage in All Exams:**

<b>S No.</b>	<b>Program Name</b>	<b>Minimum Passing Percentage in</b>		
		<b>IE Component</b>	<b>ESE Component</b>	<b>Total Component</b>
<b>1</b>	Course Work for PhD Registration	-	-	<b>50%</b>
<b>2</b>	B. Arch.	-	<b>45%</b>	<b>50%</b>
<b>3</b>	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	<b>40%</b>	<b>40%</b>
<b>4</b>	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH	-	<b>35%</b>	<b>35%</b>

### SGPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$  is the number of credits of subject  $i$ ,

$G_i$  is the Grade Point for the subject  $i$  and  $i = 1$  to  $n$ ,

$n$  = number of subjects in a course in the semester

### CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \dots + C_nG_n}{C_1 + C_2 + \dots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

$C_i$  is the number of credits of subject  $i$ ,

$G_i$  is the Grade Point for the subject  $i$  and  $i = 1$  to  $n$ ,

$n$  = number of subjects in a course of all the semesters up to which CGPA is computed

### **Grading Table:**

Applicable for B.Arch. & Ph.D. Courses				Applicable for All Courses except B.Arch. & Ph.D.			
Academic Performance	Grade	Grade Point	Marks Range (in %)	Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	$90 \leq x \leq 100$	Outstanding	O	10	$90 \leq x \leq 100$
Excellent	A+	9	$80 \leq x < 90$	Excellent	A+	9	$80 \leq x < 90$
Very Good	A	8	$70 \leq x < 80$	Very Good	A	8	$70 \leq x < 80$
Good	B+	7	$60 \leq x < 70$	Good	B+	7	$60 \leq x < 70$
Above Average	B	6	$50 \leq x < 60$	Above Average	B	6	$50 \leq x < 60$
Fail	F	0	$x < 50$	Average	C	5	$40 \leq x < 50$
Absent	Ab	0	Absent	Pass	P	4	$35 \leq x < 40$
				Fail	F	0	$x < 35$
				Absent	Ab	0	Absent

#### **CGPA to percentage conversion rule:**

**Equivalent % of Marks in the Program =  $CGPA * 10$**

#### **Award of Class**

CGPA	Percentage	Equivalent Division
$7.50 \leq CGPA$	75% or more	First Division with Distinction
$6.00 \leq CGPA < 7.50$	$60\% \leq x < 75\%$	First Division
$5.00 \leq CGPA < 6.00$	$50\% \leq x < 60\%$	Second Division
$4.00 \leq CGPA < 5.00$	$40\% \leq x < 50\%$	Pass Class

## **Guidelines for Massive Open Online Courses (MOOCs)** **(Session 2025-27)**

Poornima University, in its never ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme can be chosen from SWAYAM and NPTEL.

### **1. Introduction of MOOCs: SWAYAM and NPTEL**

#### **About SWAYAM:**

SWAYAM is a program initiated by the Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through a platform that facilitates hosting of all the courses, taught in classrooms to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centers on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if this criteria is matched.

The courses hosted on SWAYAM are in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. They are:

1. AICTE (All India Council for Technical Education) for self-paced and international courses
2. NPTEL (National Program on Technology Enhanced Learning) for Engineering
3. UGC (University Grants Commission) for non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for under-graduate education

5. NCERT (National Council of Educational Research and Training) for school education
6. NIOS (National Institute of Open Schooling) for school education
7. IGNOU (Indira Gandhi National Open University) for out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training program.

Two types of courses are offered on the SWAYAM platform: Credit Courses and Non- Credit Courses. Credit courses are offered for each semester in January and July every year. The list is available on SWAYAM official website: <https://onlinecourses.swayam2.ac.in/> **About NPTEL:**

NPTEL (National Program on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

**Some highlights:**

- Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects
- YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers
- More than 56000 hours of video content, transcribed and subtitled
- Most accessed library of peer-reviewed educational content in the world
- Translation of more than 12000 hrs of English transcripts in regional Indian languages.

**NPTEL Online Certification:**

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in-person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.

Some statistics regarding the open online courses since March 2014 till Dec 2021

Completed courses: 3496;

Enrollments across courses: 1.58 CRORE + Number of exam registrations: 15.1 LAKH +

All the statistics pertaining to completed courses are available at <https://beta.nptel.ac.in/courses>. All courses are completely free to enroll and learn from.

The certification exam is optional and comes at a fee of Rs 1000/course exam.

## **2. MOOCs at Poornima University:**

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

### **(a) Options for MOOCs at Poornima University**

**(For this document, only those MOOCs will be considered which are available on SWAYAM & NPTEL platforms)**

- Credit and Non-credit SWAYAM MOOCs can be opted by anyone, anytime, anywhere and in any language. However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.
- In case of credit courses, there are two ways to opt these courses for the purpose of credit transfer to PU system as given below:

#### **OPTION-I: As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards):**

Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards) are available at University level in offline mode for which relevant booklets are already published. **These courses carries 02 credits.** These category/type of courses (similar/different) are also available as MOOC courses. The respective Deans / HODs shall provide both the options to all the students to either select offline courses or MOOCs as per details given below:

- Deans / HODs shall prepare a list of upto 05 appropriate MOOC courses of 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits (**only 02**) of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.
- If the students are not willing to opt for MOOC Open Elective/ Multidisciplinary course, they can proceed with the current offline practice of opting for Multidisciplinary courses.

The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.

**OR**

### **OPTION–II: As Major / Minor Courses:**

Deans / HODs shall identify a course of **03 credits** for each semester, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.

- After approval, the respective Deans / HODs shall circulate a notice to all their respective students citing that the particular course will be conducted through MOOCs only and is compulsory for all respective students. The credits of this course will be counted against Major/Minor courses pertaining to that particular semester.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.
- This is to be noted that if Deans / HODs decide to conduct any major/minor course in any semester through MOOCs, no offline course will be conducted against that.

#### **(b) Important points related to MOOCs at Poornima University**

- Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.
- No attendance will be taken for MOOC courses.
- Last period of T/T/S shall be taken for MOOC courses which shall be in self-study mode.
- The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no exam will be conducted by the department as well as by the Examination Cell.
- The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.
- SWAYAM will award a certificate to all the students passing the examination along with the credit earned. The center of examination for SWAYAM MOOCs will be finalized by SWAYAM. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.
- The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.
- Any student who would not be able to register/present/clear/pass the MOOC in the stipulated time, it is the choice of the student that he or she may register in next semester (odd or even) with MOOC again or appear as a back exam candidate of the University as per PU norms.
- There will be no provision of re-evaluation of MOOC.
- The scorecard and related certificate of MOOC along with a consolidated list of students with

marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.

- The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

**NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.**

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

**Master of Computer Application (MCA) - 2025-27**

**Program Outcomes (POs)**

<b>PO-01</b>	<b>Computational and Domain Knowledge</b>	Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
<b>PO-02</b>	<b>Problem Analysis and Research</b>	Identify, analyze, and solve complex computing problems by applying appropriate mathematical, scientific, and engineering principles, supported by research and evidence-based methods.
<b>PO-03</b>	<b>Design and Development of Solutions</b>	Design and develop effective computing-based solutions, systems, or processes that address real-world problems while considering societal, environmental, and ethical factors.
<b>PO-04</b>	<b>Modern Tools and Techniques Usage</b>	Select, adapt, and apply modern computing tools, techniques, and resources to analyze and solve complex problems, while recognizing their limitations.
<b>PO-05</b>	<b>Professional Ethics and Legal Awareness</b>	Understand and apply ethical principles, professional standards, and legal frameworks related to computing practices, including cybersecurity and data privacy.
<b>PO-06</b>	<b>Communication and Collaboration</b>	Communicate effectively in professional contexts, including writing technical reports, creating documentation, delivering presentations, and working collaboratively in multidisciplinary teams.
<b>PO-07</b>	<b>Project Management and Financial Acumen</b>	Apply management principles and financial knowledge to plan, execute, and oversee projects effectively as an individual or as part of a team in professional environments.
<b>PO-08</b>	<b>Life-long Learning</b>	Recognize the need for, and engage in, continuous professional development and independent learning in the context of evolving computing technologies.
<b>PO-09</b>	<b>Societal, Environmental, and Cultural Impact</b>	Understand and evaluate the broader impacts of computing solutions on individuals, organizations, society, and the environment, both locally and globally.
<b>PO-10</b>	<b>Innovation and Entrepreneurship</b>	Demonstrate the ability to innovate and identify entrepreneurial opportunities in computing, contributing to economic and social value creation.

**Program Specific Outcomes (PSOs)**

<b>PSO I</b>	Apply advanced computing knowledge and programming skills to design and develop effective software solutions for real-world problems.
<b>PSO II</b>	Demonstrate competency in emerging technologies, tools, and frameworks to solve complex industry challenges and contribute to modern computing innovations.
<b>PSO III</b>	Exhibit innovation, adaptability, and leadership qualities in multidisciplinary environments, fostering entrepreneurship and continuous learning.

Poornima University  
Detailed Programme Structure

MCA General

S.No.	Type	Course Code	Name of the Course	Semester	Credits	L	T	P	Total	Total Hours	Internal Marks	External Marks	Total	T/P	Nature of Course
<b>Ist SEMESTER 2025-27 Batch</b>															
101	Mandatory	25MCACSA1101	Foundation of Mathematics	I	3	3	0	0	3	45	40	60	100	T	Core
102	Mandatory	25MCACCA1101	Data Structure and Algorithm	I	3	3	0	0	4	45	40	60	100	T	Core
103	Mandatory	25MCACCA1102	Python Programming	I	3	3	0	0	4	45	40	60	100	T	Core
104	Mandatory	25MCACCA1103	Linux and Shell Programming	I	3	3	0	0	4	45	40	60	100	T	Core
105	Mandatory	25MCACCA1104	Programming in C	I	3	3	0	0	4	45	40	60	100	T	Core
109	Mandatory	25MCACCA1201	Data Structure and Algorithm Lab	I	1	0	0	2	2	30	60	40	100	P	Core
108	Mandatory	25MCACCA1202	Python Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
106	Mandatory	25MCACCA1203	Linux Shell Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
107	Mandatory	25MCACCA1204	Programming in C Lab	I	1	0	0	2	2	30	60	40	100	P	Core
110	Mandatory	25MCAECA1111	Software Engineering Principles and Agile Practices	I	3	3	0	0	4	45	40	60	100	T	Departmental Elective
111	Mandatory	25MULCHM1201	Communication Skills with Grammar, Vocabulary & Emotional Intelligence	I	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
112	Mandatory	25MULCUL1201	Introduction to Design Thinking & Problem Solving	I	1	0	0	2	2	30	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>18</b>	<b>0</b>	<b>13</b>	<b>36</b>	<b>465</b>	<b>600</b>	<b>600</b>	<b>1200</b>		
<b>IInd SEMESTER 2025-27 Batch</b>															
201	Mandatory	25MCACCA2101	Design & Analysis Of Algorithms	II	3	3	0	0	3	45	40	60	100	T	Core
202	Mandatory	25MCACCA2102	Data Base Management System	II	3	3	0	0	3	45	40	60	100	T	Core
203	Mandatory	25MCACCA2103	Backend With Java	II	3	3	0	0	3	45	40	60	100	T	Core
204	Mandatory	25MCAECA2201	Design & Analysis of Algorithms Lab	II	1	0	0	2	2	30	60	40	100	P	Core
206	Mandatory	25MCACCA2202	Data Base Management System Lab	II	1	0	0	2	2	30	60	40	100	P	Core
205	Mandatory	25MCACCA2203	Backend with Java Lab	II	1	0	0	2	2	30	60	40	100	P	Core
208	Mandatory	25MCAECA2111	Frontend with Angular JS	II	3	3	0	0	3	45	40	60	100	T	Departmental Elective
209	Mandatory	25MCAECA2112/ 25MCAECA2113	Soft Computing/ Internet of Things	II	3	3	0	0	3	45	40	60	100	T	Departmental Elective
210	Mandatory	25MCAECA2211	Frontend with Angular Lab	II	1	0	0	2	2	30	60	40	100	P	Departmental Elective
207	Mandatory	25MCACCA2401	Industrial Training Seminar-I	II	1	0	0	1	1	15	60	40	100	P	Internship
211	Mandatory		MOOC	II	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
212	Mandatory	25MULCHM2201	Business Writing for IT Professionals	II	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
213	Mandatory	25MULCUL2201	Aptitude & Logical Reasoning for Placements	II	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>	<b>II</b>	<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IIIrd SEMESTER 2025-27 Batch</b>															
301	Mandatory	25MCACCA3101	Operating System	III	3	3	0	0	3	45	40	60	100	T	Core
302	Mandatory	25MCACCA3102	Computer Networks	III	3	3	0	0	3	45	40	60	100	T	Core
303	Mandatory	25MCACCA3103	Cloud Computing	III	3	3	0	0	3	45	40	60	100	T	Core
304	Mandatory	25MCACCA3201	Operating System Lab	III	1	0	0	2	2	30	60	40	100	P	Core
305	Mandatory	25MCACCA3202	Computer Networks Lab	III	1	0	0	2	2	30	60	40	100	P	Core
306	Mandatory	25MCACCA3203	Cloud Computing Lab	III	1	0	0	2	2	30	60	40	100	P	Core
308	Mandatory	25MCAECA3111/25 MCAECA3114	Advanced Frontend with Angular/ Salesforce	III	3	3	0	0	3	45	40	60	100	T	Departmental Elective
309	Mandatory	25MCAECA3112/25 MCAECA3113	Fundamentals of Artificial Intelligence/ Big Data Analytics	III	3	3	0	0	3	45	40	60	100	T	Departmental Elective
307	Mandatory	25MCAECA3211/ 25MCAECA3212	Advanced Frontend with Angular Lab/ Salesforce Lab	III	1	0	0	2	2	30	60	40	100	P	Departmental Elective
310	Mandatory		MOOC	III	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
311	Mandatory	25MCACCA3401	Industrial Training Seminar-II	III	1	0	0	1	2	30	60	40	100	P	Internship
312	Mandatory	25MULCHM3201	Leadership, Team Building & Interpersonal Skills	III	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
313	Mandatory	25MULCUL3201	Algorithmic Thinking & Programming Practice	III	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>33</b>	<b>495</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IVth SEMESTER 2025-27 Batch</b>															
401	Mandatory	25MCACCA4501	Project/Internship	IV	11	0	0	6	6	90	120	80	200	P	Dissertation
405	Mandatory		MOOC	IV	1	1	0	0	2	15	40	60	100	T	Multidisciplinary Elective
			<b>Total</b>		<b>12</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>90</b>	<b>160</b>	<b>140</b>	<b>300</b>		

Poornima University  
Detailed Programme Structure

MCA specialization in AI & DS

S.No.	Type	Course Code	Name of the Course	Semester	Credits	L	T	P	Total	Total Hours	Internal Marks	External Marks	Total	T/P	Nature of Course
<b>Ist SEMESTER 2025-27 Batch</b>															
101	Mandatory	25MCACSA1101	Foundation of Mathematics	I	3	3	0	0	3	45	40	60	100	T	Core
102	Mandatory	25MCACCA1101	Data Structure and Algorithm	I	3	3	0	0	4	45	40	60	100	T	Core
103	Mandatory	25MCACCA1102	Python Programming	I	3	3	0	0	4	45	40	60	100	T	Core
104	Mandatory	25MCACCA1103	Linux and Shell Programming	I	3	3	0	0	4	45	40	60	100	T	Core
105	Mandatory	25MCACCA1104	Programming in C	I	3	3	0	0	4	45	40	60	100	T	Core
106	Mandatory	25MCACCA1201	Data Structure and Algorithm Lab	I	1	0	0	2	2	30	60	40	100	P	Core
107	Mandatory	25MCACCA1202	Python Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
108	Mandatory	25MCACCA1203	Linux Shell Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
109	Mandatory	25MCACCA1204	Programming in C Lab	I	1	0	0	2	2	30	60	40	100	P	Core
110	Mandatory	25MCDECA1111	Fundamentals of AI and Data Science	I	3	3	0	0	3	45	40	60	100	T	Minor
111	Mandatory	25MULCHM1201	Communication Skills with Grammar, Vocabulary & Emotional Intelligence	I	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
112	Mandatory	25MULCUL1201	Introduction to Design Thinking & Problem Solving	I	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>18</b>	<b>0</b>	<b>14</b>	<b>36</b>	<b>480</b>	<b>600</b>	<b>600</b>	<b>1200</b>		
<b>IInd SEMESTER 2025-27 Batch</b>															
201	Mandatory	24MCACCA2101	Design & Analysis Of Algorithms	II	3	3	0	0	3	45	40	60	100	T	Core
202	Mandatory	24MCACCA2102	Data Base Management System	II	3	3	0	0	3	45	40	60	100	T	Core
203	Mandatory	25MCACCA2103	Backend With Java	II	3	3	0	0	3	45	40	60	100	T	Core
204	Mandatory	25MCAECA2201	Design & Analysis of Algorithms Lab	II	1	0	0	2	2	30	60	40	100	P	Core
205	Mandatory	25MCACCA2202	Data Base Management System Lab	II	1	0	0	2	2	30	60	40	100	P	Core
206	Mandatory	25MCACCA2203	Backend with Java Lab	II	1	0	0	2	2	30	60	40	100	P	Core
207	Mandatory	25MCDECA2111	Data Science and Analytics	II	3	3	0	0	3	45	40	60	100	T	Minor
208	Mandatory	25MCDECA2112	Machine Learning	II	3	3	0	0	3	45	40	60	100	T	Minor
209	Mandatory	25MCDECA2211	R Programming Lab	II	1	0	0	2	2	30	60	40	100	P	Minor
210	Mandatory		MOOC	II	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
211	Mandatory	25MCACCA2401	Industrial Training Seminar-I	II	1	0	0	1	1	15	60	40	100	P	Internship
212	Mandatory	25MULCHM2201	Business Writing for IT Professionals	II	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
213	Mandatory	25MULCUL2201	Aptitude & Logical Reasoning for Placements	II	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>	<b>II</b>	<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IIIrd SEMESTER 2025-27 Batch</b>															
301	Mandatory	25MCACCA3101	Operating System	III	3	3	0	0	3	45	40	60	100	T	Core
302	Mandatory	25MCACCA3102	Computer Networks	III	3	3	0	0	3	45	40	60	100	T	Core
303	Mandatory	25MCACCA3103	Cloud Computing	III	3	3	0	0	3	45	40	60	100	T	Core
304	Mandatory	25MCACCA3201	Operating System Lab	III	1	0	0	2	2	30	60	40	100	P	Core
305	Mandatory	25MCACCA3202	Computer Networks Lab	III	1	0	0	2	2	30	60	40	100	P	Core
306	Mandatory	25MCDECA3111	NLP and Computer Vision	III	3	3	0	0	3	45	40	60	100	T	Minor
307	Mandatory	25MCDECA3112	Deep Learning and ANN	III	3	3	0	0	3	45	40	60	100	T	Minor
308	Mandatory	25MCDECA3211	Deep Learning and ANN Lab	III	1	0	0	2	2	30	60	40	100	P	Minor
309	Mandatory	25MCDECA3212	NLP and Computer Vision Lab	III	1	0	0	2	2	30	60	40	100	P	Minor
310	Mandatory		Finance for Non-Finance Professionals	III	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
311	Mandatory	25MCACCA3401	Industrial Training Seminar-II	III	1	0	0	1	1	15	60	40	100	P	Internship
312	Mandatory	25MULCHM3201	Leadership, Team Building & Interpersonal Skills	III	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
313	Mandatory	25MULCUL3201	Algorithmic Thinking & Programming Practice	III	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IVth SEMESTER 2025-27 Batch</b>															
401	Mandatory	25MCACCA4501	Project/Internship	IV	6	0	0	6	6	90	120	80	200	P	Dissertation
405	Mandatory		Responsible AI	IV	1	1	0	0	2	15	40	60	100	T	Multidisciplinary Elective
			<b>Total</b>		<b>7</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>90</b>	<b>160</b>	<b>140</b>	<b>300</b>		

S.No.	Type	Course Code	Name of the Course	Semester	Credits	L	T	P	Total	Total Hours	Internal Marks	External Marks	Total	T/P	Nature of Course
<b>Ist SEMESTER 2025-27 Batch</b>															
101	Mandatory	25MCACSA1101	Foundation of Mathematics	I	3	3	0	0	3	45	40	60	100	T	Core
102	Mandatory	25MCACCA1101	Data Structure and Algorithms	I	3	3	0	0	4	45	40	60	100	T	Core
103	Mandatory	25MCACCA1102	Python Programming	I	3	3	0	0	4	45	40	60	100	T	Core
108	Mandatory	25MCACCA1201	Data Structure and Algorithm Lab	I	1	0	0	2	2	15	60	40	100	P	Core
109	Mandatory	25MCACCA1202	Python Programming Lab	I	1	0	0	2	2	15	60	40	100	P	Core
110	Mandatory	25MCACCA1203	Linux Shell Programming Lab	I	1	0	0	2	2	15	60	40	100	P	Core
104	Mandatory	25MALECA1111	Base SAS Programming	I	3	3	0	0	4	45	40	60	100	T	Minor
105	Mandatory	25MALECA1112	Application of ML using SAS ® Viya	I	3	3	0	0	4	45	40	60	100	T	Minor
106	Mandatory	25MALECA1113	Statistics You Need To Know For ML	I	3	3	0	0	4	45	40	60	100	T	Minor
107	Mandatory	25MALECA1211	SAS ® Programming in Viya ® Lab	I	1	0	0	2	2	15	60	40	100	P	Minor
111	Mandatory	25MULCHM1201	Communication Skills with Grammar, Vocabulary & Emotional Intelligence	I	1	0	0	3	3	15	60	40	100	P	Ability Enhancement
112	Mandatory	25MULCUL1201	Introduction to Design Thinking & Problem Solving	I	1	0	0	3	2	15	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>18</b>	<b>0</b>	<b>14</b>	<b>36</b>	<b>360</b>	<b>600</b>	<b>600</b>	<b>1200</b>		
<b>IInd SEMESTER 2025-27 Batch</b>															
201	Mandatory	24MCACCA2101	Design & Analysis Of Algorithms	II	3	3	0	0	3	45	40	60	100	T	Core
202	Mandatory	24MCACCA2102	Data Base Management System	II	3	3	0	0	3	45	40	60	100	T	Core
207	Mandatory	25MCAECA2201	Design & Analysis of Algorithms Lab	II	1	0	0	2	2	15	60	40	100	P	Core
210	Mandatory	25MCACCA2202	Data Base Management System Lab	II	1	0	0	2	2	15	60	40	100	P	Core
203	Mandatory	25MALECA2111	SAS Visual Text Analytics in SAS® Viya	II	3	3	0	0	3	45	40	60	100	T	Minor
204	Mandatory	25MALECA2112	Deep Learning using SAS® Software	II	3	3	0	0	3	45	40	60	100	T	Minor
205	Mandatory	25MALECA2113	Neural Network: Essentials	II	3	3	0	0	3	45	40	60	100	T	Minor
208	Mandatory	25MALECA2211	SAS® Visual Text Analytics in SAS®Viya Lab	II	1	0	0	2	2	15	60	40	100	P	Minor
209	Mandatory	25MALECA2212	Deep Learning using SAS® Software Lab	II	1	0	0	2	2	15	60	40	100	P	Minor
211	Mandatory	25MCACCA2401	Industrial Training Seminar-I	II	1	0	0	1	1	15	60	40	100	P	Internship
206	Mandatory		MOOC	II	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
212	Mandatory	25MULCHM2201	Business Writing for IT Professionals	II	1	0	0	3	3	15	60	40	100	P	Ability Enhancement
213	Mandatory	25MULCUL2201	Aptitude & Logical Reasoning for Placements	II	1	0	0	3	3	15	60	40	100	P	Skill Enhancement
			<b>Total</b>	<b>II</b>	<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>360</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IIIrd SEMESTER 2025-27 Batch</b>															
301	Mandatory	25MCACCA3101	Operating System	III	3	3	0	0	3	45	40	60	100	T	Core
303	Mandatory	25MCACCA3103	Cloud Computing	III	3	3	0	0	3	45	40	60	100	T	Core
304	Mandatory	25MCACCA3201	Operating System Lab	III	1	0	0	2	2	15	60	40	100	P	Core
305	Mandatory	25MCACCA3203	Cloud Computing Lab	III	1	0	0	2	2	15	60	40	100	P	Core
302	Mandatory	25MALECA3111	Forecasting using Model Studio in SAS® Viya	III	3	3	0	0	3	45	40	60	100	T	Minor
307	Mandatory	25MCDECA3111	NLP and Computer Vision	III	3	3	0	0	3	45	40	60	100	T	Minor
308	Mandatory	25MALECA3112	Optimization for Data Science & Artificial Intelligence	III	3	3	0	0	3	45	40	60	100	T	Minor
309	Mandatory	25MALECA3211	Forecasting using Model Studio Lab in SAS ® Viya Lab	III	1	0	0	2	2	15	60	40	100	P	Minor
310	Mandatory	25MALECA3212	NLP and Computer Vision Lab	III	1	0	0	2	2	15	60	40	100	P	Minor
306	Mandatory	25MCACCA3401	Industrial Training Seminar-II	III	1	0	0	1	2	15	60	40	100	P	Internship
311	Mandatory		Finance for Non-Finance Professionals	III	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
312	Mandatory	25MULCHM3201	Leadership, Team Building & Interpersonal Skills	III	1	0	0	3	3	15	60	40	100	P	Ability Enhancement
313	Mandatory	25MULCUL3201	Algorithmic Thinking & Programming Practice	III	1	0	0	3	3	15	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>33</b>	<b>360</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IVth SEMESTER 2025-27 Batch</b>															
401	Mandatory	25MCACCA4501	Project/Internship	IV	6	0	0	6	6	90	120	80	200	P	Dissertation
402	Mandatory		Responsible AI	IV	1	1	0	0	2	15	40	60	100	T	Multidisciplinary Elective
			<b>Total</b>		<b>7</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>90</b>	<b>160</b>	<b>140</b>	<b>300</b>		

Poornima University  
Detailed Programme Structure

MCA Specialization in Cyber Security

S.No.	Type	Course Code	Name of the Course	Semester	Credits	L	T	P	Total	Total Hours	Internal Marks	External Marks	Total	T/P	Nature of Course
<b>Ist SEMESTER 2025-27 Batch</b>															
101	Mandatory	25MCACSA1101	Foundation of Mathematics	I	3	3	0	0	3	45	40	60	100	T	Core
102	Mandatory	25MCACCA1101	Data Structure and Algorithm	I	3	3	0	0	4	45	40	60	100	T	Core
103	Mandatory	25MCACCA1102	Python Programming	I	3	3	0	0	4	45	40	60	100	T	Core
104	Mandatory	25MCACCA1103	Linux and Shell Programming	I	3	3	0	0	4	45	40	60	100	T	Core
105	Mandatory	25MCACCA1104	Programming in C	I	3	3	0	0	4	45	40	60	100	T	Core
106	Mandatory	25MCACCA1201	Data Structure and Algorithm Lab	I	1	0	0	2	2	30	60	40	100	P	Core
107	Mandatory	25MCACCA1202	Python Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
108	Mandatory	25MCACCA1203	Linux Shell Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
109	Mandatory	25MCACCA1204	Programming in C Lab	I	1	0	0	2	2	30	60	40	100	P	Core
110	Mandatory	25MCYECA1111	Introduction to Cyber Security	I	3	3	0	0	4	45	40	60	100	T	Departmental Elective
111	Mandatory	25MULCHM1201	Communication Skills with Grammar, Vocabulary & Emotional Intelligence	I	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
112	Mandatory	25MULCUL1201	Introduction to Design Thinking & Problem Solving	I	1	0	0	3	2	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>18</b>	<b>0</b>	<b>14</b>	<b>36</b>	<b>480</b>	<b>600</b>	<b>600</b>	<b>1200</b>		
<b>IInd SEMESTER 2025-27 Batch</b>															
201	Mandatory	25MCACCA2101	Design & Analysis Of Algorithms	II	3	3	0	0	3	45	40	60	100	T	Core
202	Mandatory	25MCACCA2102	Data Base Management System	II	3	3	0	0	3	45	40	60	100	T	Core
203	Mandatory	25MCACCA2103	Backend With Java	II	3	3	0	0	3	45	40	60	100	T	Core
204	Mandatory	25MCAECA2201	Design & Analysis of Algorithms Lab	II	1	0	0	2	2	30	60	40	100	P	Core
205	Mandatory	25MCACCA2202	Data Base Management System Lab	II	1	0	0	2	2	30	60	40	100	P	Core
206	Mandatory	25MCACCA2203	Backend with Java Lab	II	1	0	0	2	2	30	60	40	100	P	Core
208	Mandatory	25MCYECA2111	Ethical Hacking	II	3	3	0	0	3	45	40	60	100	T	Departmental Elective
209	Mandatory	25MCYECA2112	Cyber Forensics	II	3	3	0	0	3	45	40	60	100	T	Departmental Elective
210	Mandatory	25MCYECA2211	Ethical Hacking Lab	II	1	0	0	2	2	30	60	40	100	P	Departmental Elective
207	Mandatory	25MCACCA2401	Industrial Training Seminar-I	II	1	0	0	1	1	15	60	40	100	P	Internship
211	Mandatory		MOOC	II	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
212	Mandatory	25MULCHM2201	Business Writing for IT Professionals	II	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
213	Mandatory	25MULCUL2201	Aptitude & Logical Reasoning for Placements	II	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>	<b>II</b>	<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IIIrd SEMESTER 2025-27 Batch</b>															
301	Mandatory	25MCACCA3101	Operating System	III	3	3	0	0	3	45	40	60	100	T	Core
302	Mandatory	25MCACCA3102	Computer Networks	III	3	3	0	0	3	45	40	60	100	T	Core
304	Mandatory	25MCACCA3201	Operating System Lab	III	1	0	0	2	2	30	60	40	100	P	Core
305	Mandatory	25MCACCA3202	Computer Networks Lab	III	1	0	0	2	2	30	60	40	100	P	Core
303	Mandatory	25MCYECA3111	Vulnerability Assessment & Penetration Testing	III	3	3	0	0	3	45	40	60	100	T	Minor
308	Mandatory	25MCYECA3112	Cyber Threat Intelligence and Bug Bounty	III	3	3	0	0	3	45	40	60	100	T	Minor
309	Mandatory	25MCYECA3113	Cryptography & Network Security	III	3	3	0	0	3	45	40	60	100	T	Minor
306	Mandatory	25MCYECA3211	Vulnerability Assessment and Penetration Testing Lab	III	1	0	0	2	2	30	60	40	100	P	Minor
310	Mandatory	25MCYECA3212	Cyber Threat Intelligence & Bug Bounty Lab	III	1	0	0	2	2	30	60	40	100	P	Minor
307	Mandatory	25MCACCA3401	Industrial Training Seminar-II	III	1	0	0	1	1	15	60	40	100	P	Internship
311	Mandatory		Finance for Non-Finance Professionals	III	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
312	Mandatory	25MULCHM3201	Leadership, Team Building & Interpersonal Skills	III	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
313	Mandatory	25MULCUL3201	Algorithmic Thinking & Programming Practice	III	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IVth SEMESTER 2025-27 Batch</b>															
401	Mandatory	25MCACCA4501	Project/Internship	IV	6	0	0	6	6	90	120	80	200	P	Dissertation
402	Mandatory		Responsible AI	IV	1	1	0	0	2	15	40	60	100	T	Multidisciplinary Elective
			<b>Total</b>		<b>7</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>90</b>	<b>160</b>	<b>140</b>	<b>300</b>		

Poornima University  
Detailed Programme Structure

MCA Specialization in Cloud Technology & Devops

S.No.	Type	Course Code	Name of the Course	Semester	Credits	L	T	P	Total	Total Hours	Internal Marks	External Marks	Total	T/P	Nature of Course
<b>Ist SEMESTER 2025-27 Batch</b>															
101	Mandatory	25MCACSA1101	Foundation of Mathematics	I	3	3	0	0	3	45	40	60	100	T	Core
102	Mandatory	25MCACCA1101	Data Structure and Algorithm	I	3	3	0	0	4	45	40	60	100	T	Core
103	Mandatory	25MCACCA1102	Python Programming	I	3	3	0	0	4	45	40	60	100	T	Core
104	Mandatory	25MCACCA1103	Linux and Shell Programming	I	3	3	0	0	4	45	40	60	100	T	Core
105	Mandatory	25MCACCA1104	Programming in C	I	3	3	0	0	4	45	40	60	100	T	Core
106	Mandatory	25MCACCA1201	Data Structure and Algorithm Lab	I	1	0	0	2	2	30	60	40	100	P	Core
107	Mandatory	25MCACCA1202	Python Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
108	Mandatory	25MCACCA1203	Linux Shell Programming Lab	I	1	0	0	2	2	30	60	40	100	P	Core
109	Mandatory	25MCACCA1204	Programming in C Lab	I	1	0	0	2	2	30	60	40	100	P	Core
110	Mandatory	25MCTECA1111	Cloud Computing Fundamentals and Service Models	I	3	3	0	0	4	45	40	60	100	T	Minor
111	Mandatory	25MULCHM1201	Communication Skills with Grammar, Vocabulary & Emotional Intelligence	I	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
112	Mandatory	25MULCUL1201	Introduction to Design Thinking & Problem Solving	I	1	0	0	3	2	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>18</b>	<b>0</b>	<b>14</b>	<b>36</b>	<b>480</b>	<b>600</b>	<b>600</b>	<b>1200</b>		
<b>IInd SEMESTER 2025-27 Batch</b>															
201	Mandatory	25MCACCA2101	Design & Analysis Of Algorithms	II	3	3	0	0	3	45	40	60	100	T	Core
202	Mandatory	25MCACCA2102	Data Base Management System	II	3	3	0	0	3	45	40	60	100	T	Core
203	Mandatory	25MCACCA2103	Backend With Java	II	3	3	0	0	3	45	40	60	100	T	Core
204	Mandatory	25MCAECA2201	Design & Analysis of Algorithms Lab	II	1	0	0	2	2	30	60	40	100	P	Core
205	Mandatory	25MCACCA2202	Data Base Management System Lab	II	1	0	0	2	2	30	60	40	100	P	Core
206	Mandatory	25MCACCA2203	Backend with Java Lab	II	1	0	0	2	2	30	60	40	100	P	Core
207	Mandatory	25MCTECA2111	DevOps Lifecycle and Best Practices	II	3	3	0	0	3	45	40	60	100	T	Minor
208	Mandatory	25MCTECA2112	Containerization & Orchestration with Kubernetes	II	3	3	0	0	3	45	40	60	100	T	Minor
209	Mandatory	25MCTECA2211	Kubernetes Lab	II	1	0	0	2	2	30	60	40	100	P	Minor
210	Mandatory	25MCACCA2401	Industrial Training Seminar-I	II	1	0	0	1	1	15	60	40	100	P	Internship
211	Mandatory		MOOC	II	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
212	Mandatory	25MULCHM2201	Business Writing for IT Professionals	II	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
213	Mandatory	25MULCUL2201	Aptitude & Logical Reasoning for Placements	II	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>	<b>II</b>	<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IIIrd SEMESTER 2025-27 Batch</b>															
301	Mandatory	25MCACCA3101	Operating System	III	3	3	0	0	3	45	40	60	100	T	Core
302	Mandatory	25MCAECA3112	Fundamentals of Artificial Intelligence	III	3	3	0	0	3	45	40	60	100	T	Core
303	Mandatory	25MCACCA3201	Operating System Lab	III	1	0	0	2	2	30	60	40	100	P	Core
304	Mandatory	25MCACCA3202	Computer Networks Lab	III	1	0	0	2	2	30	60	40	100	P	Core
306	Mandatory	25MCTECA3111	Cloud Security and Risk Management	III	3	3	0	0	3	45	40	60	100	T	Minor
307	Mandatory	25MCTECA3112	Frontend with Angular for cloud professionals	III	3	3	0	0	3	45	40	60	100	T	Minor
308	Mandatory	25MCTECA3113	Infrastructure Automation & IaC	III	3	3	0	0	3	45	40	60	100	T	Minor
309	Mandatory	25MCTECA3211	Angular JS Lab	III	1	0	0	2	2	30	60	40	100	P	Minor
310	Mandatory	25MCTECA3212	DevOps Lab	III	1	0	0	2	2	30	60	40	100	P	Minor
305	Mandatory	25MCACCA3401	Industrial Training Seminar-II	III	1	0	0	1	1	15	60	40	100	P	Internship
311	Mandatory		Finance for Non-Finance Professionals	III	2	2	0	0	2	30	40	60	100	T	Multidisciplinary Elective
312	Mandatory	25MULCHM3201	Leadership, Team Building & Interpersonal Skills	III	1	0	0	3	3	45	60	40	100	P	Ability Enhancement
313	Mandatory	25MULCUL3201	Algorithmic Thinking & Programming Practice	III	1	0	0	3	3	45	60	40	100	P	Skill Enhancement
			<b>Total</b>		<b>24</b>	<b>17</b>	<b>0</b>	<b>15</b>	<b>32</b>	<b>480</b>	<b>660</b>	<b>640</b>	<b>1300</b>		
<b>IVth SEMESTER 2025-27 Batch</b>															
401	Mandatory	25MCACCA4501	Project/Internship	IV	6	0	0	6	6	90	120	80	200	P	Dissertation
402	Mandatory		Responsible AI	IV	1	1	0	0	2	15	40	60	100	T	Multidisciplinary Elective
			<b>Total</b>		<b>7</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>90</b>	<b>160</b>	<b>140</b>	<b>300</b>		

**1<sup>st</sup> SEMESTER CORE  
Theory Subjects**

<b>Code:25MCACSA1101</b>	<b>Foundation of Mathematics</b>	<b>3 Credits [LTP: 3-0-0]</b>
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**COURSE OUTCOME:**

<b>CO</b>	<b>Cognitive Abilities</b>	<b>Course Outcomes</b>
CO1	Remembering	Define the basic concept of matrices and their various properties.
CO2	Understanding	Relate the Eigen value and Eigen vectors and inverse of matrix using Cayley Hamilton theorem.
CO3	Applying	Determine important features of vector, Del operator and its various forms in gradient, divergence and curl.
CO4	Analyzing	Estimate the order and degree of differential equations and their solutions.
CO5	Evaluating	Detecting the complex number and their properties.

**A. OUTLINE OF THE COURSE**

<b>Unit No.</b>	<b>Title of the unit</b>	<b>Time required for the Unit (Hours)</b>
<b>1.</b>	<b>Matrix Theory</b>	<b>08</b>
<b>2.</b>	<b>Eigen Values</b>	<b>07</b>
<b>3.</b>	<b>Vector calculus</b>	<b>08</b>
<b>4.</b>	<b>Differential Equation</b>	<b>08</b>
<b>5.</b>	<b>Complex Algebra</b>	<b>07</b>

**B. DETAILED SYLLABUS**

<b>Unit</b>	<b>Unit Details</b>
<b>1.</b>	<b>Matrix Theory</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to the matrix theory</li> <li>● Types of matrices,</li> <li>● Inverse of matrices,</li> <li>● Rank of matrices,</li> <li>● Solving system of linear equations.</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Eigen Values</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Eigen values and Eigen vectors,</li> <li>● Cayley-Hamilton Theorem (without proof) with application ,</li> <li>● Diagonalization of matrices.</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Vector calculus</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Scalar and Vector quantity</li> <li>● Derivative of a vector function, Velocity and accelerations</li> <li>● Basic concepts of vectors, gradient, divergence and curl of a vector.</li> <li>● Conclusion of Unit</li> </ul>

<b>4.</b>	<b>Differential Equation</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Basic idea of differential equations</li> <li>● Degree and order of Differential equation</li> <li>● Variable separation, Homogeneous,</li> <li>● Linear equations and equations reducible to linear form</li> <li>● Exact Differential equation</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Complex Algebra</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to the complex algebra, complex numbers,</li> <li>● Geometrical representation of complex numbers,</li> <li>● Argand diagram,</li> <li>● De- Moirvre's theorem</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Higher Engineering Mathematics	Ramana B. V.	Latest	Tata McGraw – Hill
2.	Engineering Mathematics	Babu Ram	Latest	Pearson
3.	Higher Engineering Mathematics	B S Grewal	Latest	Khanna Publication
<b>Reference Book</b>				
1.	Higher Engineering Mathematics, Grewal B. S. and Grewal J. S, Khanna Publishers, New Delhi, Latest Edition			
2.	Engineering Mathematics, Kreyszig Errwin, John Wiley & Sons, New York, Latest Edition			
Online Recourses				
1.	<a href="https://www.tutorialspoint.com/mathematical-foundation-introduction">https://www.tutorialspoint.com/mathematical-foundation-introduction</a>			
2.	<a href="https://archive.nptel.ac.in/courses/111/104/111104071/">https://archive.nptel.ac.in/courses/111/104/111104071/</a>			

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1					-	-	-	-	-	3	-	-	-
CO2	3	1	2					-	-	-	-	-	3	-	-	-
CO3	2	3	1					-	-	-	-	-	3	-	-	-
CO4	3	1	2					-	-	-	-	-	3	-	-	-
CO5	3	2	1					-	-	-	-	-	3	-	-	-

**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Identify various types of data structures and their uses according complexity.
CO2	Understand	Demonstrate the concept of searching and sorting techniques and linked list.
CO3	Apply	Compute stack and queue data structure and its applications.
CO4	Analyze	Classify tree data structure for real life applications
CO5	Evaluate	Assess graph data structure for real life applications

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	<b>Complexity, Memory Allocation, and Arrays</b>	<b>08</b>
2.	<b>Sorting Techniques and Linked List</b>	<b>07</b>
3.	<b>Stack and Queue</b>	<b>08</b>
4.	<b>Tree and its Applications</b>	<b>08</b>
5.	<b>Graphs</b>	<b>08</b>

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Complexity, Memory Allocation, Arrays, and Searching Techniques</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Classification of data structures: primitive and non-primitive</li> <li>● Applications of data structures</li> <li>● Time and space complexity of an algorithm</li> <li>● Asymptotic Notations</li> <li>● Memory allocation functions: Malloc(), Calloc(), free() and realloc()</li> <li>● Array Operations</li> <li>● Search Techniques: Sequential search</li> <li>● Iterative and Recursive methods-Binary search</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Sorting Techniques and Linked List</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Sorting: General background and definition,</li> <li>● Bubble sort, Selection sort and Insertion sort</li> <li>● Merge sort and Quick sort.</li> <li>● Radix Sorts</li> <li>● Complexity of Sorting Algorithms</li> <li>● Components of linked list, Representation of linked list,</li> <li>● Advantages and disadvantages of linked list.</li> <li>● Types of linked list: Singly linked list, doubly linked list, Circular linked list,</li> <li>● Operations on singly linked list: creation, insertion, deletion, search and display.</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Stack and Queue</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Stack – Definition, Array representation of stack,</li> <li>● Operations on stack: Infix, prefix and postfix notations,</li> <li>● Conversion of an arithmetic expression from Infix to postfix,</li> </ul>

	<ul style="list-style-type: none"> <li>● Applications of stacks.</li> <li>● Queue: Definition, Array representation of queue,</li> <li>● Types of queue: Simple queue, Circular queue, Double ended queue (deque), Priority queue,</li> <li>● Operations on all types of Queues</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Tree and its Applications</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Binary Trees - Operations on Binary trees</li> <li>● Binary Tree Representations - node representation,</li> <li>● Internal and external nodes, implicit array representation</li> <li>● Binary Search Tree (BST),</li> <li>● BST Insertions, Searching, Traversing and Deletions</li> <li>● Introduction to AVL Tree, Heap Tree and General trees</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Graphs</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Graphs - An application of graphs - Representation</li> <li>● Shortest path algorithm - a flow Problem</li> <li>● Dijkstra's algorithm - An application of scheduling</li> <li>● Graph Traversals</li> <li>● Minimum Spanning Tree- Prims and Kruskal's Algorithm</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Data Structures using C	Tanenbaum A.S., Langsam Y. Augestein M.J	Latest	Pearson Education
2.	Data Structures and Program Design in C	Robert Kruse & Clovis L. Tondo	Latest	Prentice Hall
<b>Reference Book</b>				
1.	Weiss, "Data Structures and Algorithm Analysis in C", Addison Wesley, Second Edition, 2005.			
2.	Y.Langsam, M.J.Augestein, A.M.Tanenbaum, "Data Structures Using C and C++", 2nd Edition, Prentice Hall of India, 2000.			
<b>Online Resources</b>				
1.	<a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a>			
2.	<a href="https://www.coursera.org/learn/data-structures">https://www.coursera.org/learn/data-structures</a>			

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	2	-	-
CO2	-	2	1	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	1	1	2		-	-	-	-	-	-	-	-	1	-	-	-
CO4	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	3	-	-	-	-	-	-	-	-	3	1	-	-

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall basic concepts of programming language and its types, define data types and building blocks.
CO2	Understand	Describe and understand the concept of Decision making in python, Control statements and loop manipulation and how it is implemented in Python.
CO3	Apply	Use Python packages like pandas, numpy, matplotlib, and scipy, along with data types like list, tuple, set, and dictionary, and understand how to import them into Python code
CO4	Analyze	Explain the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
CO5	Evaluate	How to Handle files in python and Also evaluate the efficiency and performance of different approaches to solving a programming problem in Python.

**Code: 25MCACCA1102**

**Python Programming**

**3 Credits [LTP: 3-0-0]**

## **COURSE OUTCOME**

### **A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	<b>Introduction To Python and Data Types</b>	<b>08</b>
2.	<b>Python Program Flow Control</b>	<b>07</b>
3.	<b>Python Functions, Modules and Packages</b>	<b>08</b>
4.	<b>Python String, List and Dictionary Manipulations</b>	<b>07</b>
5.	<b>Python File Operation</b>	<b>08</b>

### **B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Introduction To Python and Data Types</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Installation and Working with Python</li> <li>● Understanding Python variables, Operators</li> <li>● Understanding python blocks</li> <li>● Declaring and using Numeric data types: int, float, complex</li> <li>● Using string data type and string operations</li> <li>● Defining list and list slicing</li> <li>● Use of Tuple data type</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Python Program Flow Control</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Conditional blocks using if, else and elif</li> <li>● Simple for loops in python</li> <li>● For loop using ranges, string, list and dictionaries</li> <li>● Use of while loops in python</li> <li>● Loop manipulation using pass, continue, break and else</li> <li>● Pattern Matching(Match-case statement, introduced in python 3.10)</li> <li>● Programming using Python conditional and loops block</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Python Functions, Modules And Packages</b>

	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Organizing python codes using functions</li> <li>● Organizing python projects into modules</li> <li>● Importing own module as well as external modules</li> <li>● Understanding Packages</li> </ul>
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	<ul style="list-style-type: none"> <li>● Powerful Lamda function in python</li> <li>● Programming using functions, modules and external packages</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Python String, List and Dictionary Manipulations</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Building blocks of python programs</li> <li>● Understanding string in build methods</li> <li>● List manipulation using in build methods</li> <li>● Dictionary manipulation</li> <li>● Set and Frozenset data Types.</li> <li>● Nested and comprehension techniques for list &amp; dictionary</li> <li>● Programming using string, list and dictionary in build functions.</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Python File Operation</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Reading various types of files in python</li> <li>● Writing log files in python</li> <li>● Understanding read functions, read(), readline() and readlines()</li> <li>● Understanding write functions, write() and writelines()</li> <li>● Manipulating file pointer using seek()</li> <li>● Programming using file operations.</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Fundamentals of Python: First Programs	Kenneth Lambert	Latest	Course Technology, Cengage Learning
2.	Python: The Complete Reference	Martin Brown	Latest	McGraw Hill
3.	Programming and Problem Solving with Python	Ashok NamdevKamthane	Latest	McGraw Hill
<b>Reference Book</b>				
1.	Python Programming Fundamentals: A Beginner's Handbook, By NischaykumarHegde, Educreation Publishing			
2.	Python Programming: An Introduction to Computer Science, By John M. Zelle, Jim Leisy Publication			
<b>Online Resources</b>				
1.	<a href="https://www.tutorialspoint.com/python/index.htm">https://www.tutorialspoint.com/python/index.htm</a>			
2.	<a href="https://nptel.ac.in/courses/106106145">https://nptel.ac.in/courses/106106145</a>			

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
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**FIRST SEMESTER CORE  
Practical Subjects**

**Code: 25MCACCA1201**

**Data Structure and Algorithms Lab**

**1 Credit[LTP: 0-0-2]**

**Course Outcome :-**

Students will be able to:

- Develop skills to design and analyze simple linear and nonlinear data structures.
- Choose appropriate data structures to represent data items in real world.
- Implement and know the application of algorithms for sorting and searching and data items.
- Design data structures such as stacks, queues, hash tables, binary trees, and search trees, heaps, graphs, and B-trees according to the requirement of software.
- Implement ADTs such as lists, graphs, search trees in C to solve problems

**A. List of Programs:**

<b>1</b>	Write a program to implement the linear array operations. (a) Insert an integer into a given position in an array. (b) Deleting an integer from an array.
<b>2</b>	Write a program to perform the following operations on a matrix using array: Addition, Multiplication, Transpose
<b>3</b>	Write a program to implement binary search.
<b>4</b>	Write a program to sort N numbers using selection sort.
<b>5</b>	Write program to sort numbers using bubble sort
<b>6</b>	Write a program to sort N numbers using insertion sort.
<b>7</b>	Write a program to implement merge sort
<b>8</b>	Write a program to implement quicksort.
<b>9</b>	Write a program to implement stack operations
<b>10</b>	Write a program to implement queue operations
<b>11</b>	Creating a binary search tree and traversing it using inorder,preorder and postorder. Perform deletion operation on binary search tree
<b>12</b>	Create singly linked list and perform following operations on it. Inserting a node into a singly linked list. Deleting a node from a singly linkedlist. Searching a node from a singly linked list.
<b>13</b>	Create a doubly linked list and perform insertion and deletion operations
<b>14</b>	Write a program to implement BFS & DFS

## B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Data Structures using C	Tanenbaum A.S., Langsam Y. Augestein M.J	Latest	Pearson Education
2.	Data Structures and Program Design in C	Robert Kruse & Clovis L. Tondo	Latest	Prentice Hall
<b>Reference Books</b>				
1.	Weiss, "Data Structures and Algorithm Analysis in C", Addison Wesley, Second Edition, 2005.			
2.	Y.Langsam, M.J.Augestein, A.M.Tanenbaum, "Data Structures Using C and C++", 2nd Edition, Prentice Hall of India, 2000.			
<b>Online Resources</b>				
1.	<a href="https://nptel.ac.in/courses/106102064">https://nptel.ac.in/courses/106102064</a>			
2.	<a href="https://www.coursera.org/learn/data-structures">https://www.coursera.org/learn/data-structures</a>			

Code: 25MCACCA1202

Python Programming Lab

1Credit [LTP: 0-0-2]

### Course Outcome :-

Students will be able to:

- Interpret the use of procedural statements like assignments, conditional statements, loops and function calls.
- Infer the supported data structures like lists, dictionaries and tuples in Python.
- Illustrate the application of matrices and regular expressions in building the Python programs.
- Discover the use of external modules in creating excel files and navigating the file systems.
- Describe the need for Object-oriented programming concepts in Python.

## A. LIST OF EXPERIMENTS:

1	Write simple programs using input, output, and variable types in Python.
2	Perform arithmetic operations, string manipulations, and type casting.
3	Use conditional statements ( <b>if</b> , <b>elif</b> , <b>else</b> ) and <b>match-case</b> statements (Pattern Matching).
4	Demonstrate usage of <b>for</b> and <b>while</b> loops including nested and range-based iterations.
5	Define and call user-defined functions; demonstrate default and keyword arguments.
6	Create and use modules; import external packages like <b>math</b> , <b>random</b> , etc.
7	Demonstrate use of list operations, slicing, and <b>list comprehensions</b> .
8	Perform dictionary operations, and demonstrate <b>dictionary comprehensions</b> .
9	Use of <b>set</b> and <b>frozenset</b> , basic operations (union, intersection, etc.).
10	Read and write text files using different methods like <b>read()</b> , <b>readline()</b> , <b>write()</b> , and file pointer handling.
11	<b>Read and write JSON files</b> using the json module.
12	Create basic data visualizations using <b>matplotlib</b> .
13	Perform operations on arrays using numpy
14	Handle and analyze data using pandas.

**B. RECOMMENDED STUDY MATERIAL**

S. No	Text Books:	Author	Edition	Publication
1.	Fundamentals of Python: First Programs	Kenneth Lambert	Latest	Course Technology, Cengage Learning
2.	Python: The Complete Reference	Martin Brown	Latest	McGraw Hill
3.	Programming and Problem Solving with Python	Ashok NamdevKamthane	Latest	McGraw Hill
<b>Reference Book</b>				
1.	Python Programming Fundamentals: A Beginner's Handbook, By NischaykumarHegde, Educreation Publishing			
2.	Python Programming: An Introduction to Computer Science, By John M. Zelle, Jim Leisy Publication			
<b>Online Resources</b>				
1.	<a href="https://www.tutorialspoint.com/python/index.htm">https://www.tutorialspoint.com/python/index.htm</a>			
2.	<a href="https://nptel.ac.in/courses/106106145">https://nptel.ac.in/courses/106106145</a>			

**FIRST SEMESTER ELECTIVES****Theory Subject****Departmental Elective / Professional Elective****Professional Elective -1 (Specialization: General, AI & DS , Cyber Security, AIML and Cloud)**

<b>Code: 25MCACCA1103</b>	<b>Linux and Shell Programming</b>	<b>3 Credits[LTP: 3-0-0]</b>
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CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall the historical development of LINUX and its architecture. Comprehend the use of standard streams, redirection, pipes, the tee command, and command-line editing in Linux shells.
CO2	Understand	Comprehend the concept of standard streams in Linux and their significance in command-line interactions.
CO3	Apply	Apply the concept of inodes (Index Nodes) in UNIX file systems and understand their role in file management.
CO4	Analyze	Examine process scheduling and the mechanisms for starting new processes, including issues related to waiting, zombie processes, and orphan processes.
CO5	Evaluate	Assess the implementation of message queues, understanding msgget, msgsnd, msgrcv, and msgctl operations. Assess the use of IPC status commands for monitoring and managing IPC resources effectively.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Linux and Linux utilities	07
2.	Introduction to shells	08
3.	Unix file structure	08
4.	Process and signals	07
5.	Inter process communication	07

**B. DETAILED SYLLABUS**

Unit	Unit Details
<b>1.</b>	<b>Introduction to Linux and Linux utilities</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Linux, Linux utilities: A brief history of LINUX, architecture of Linux,</li> <li>● Features of Linux, introduction to vi editor.</li> <li>● Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir,</li> <li>● rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions,</li> <li>● Process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask,</li> <li>● ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text Processing utilities and backup utilities , tail, head ,</li> <li>● sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Introduction to shells</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command,</li> <li>● Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases,</li> <li>● Variables, Predefined Variables, Options, Shell/Environment Customization.</li> <li>● Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste,</li> <li>● Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines,</li> <li>● Comparing Files.</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Unix file structure</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Grep: Operation, grep Family, Searching for File Content.</li> <li>● Sed :Scripts, Operation, Addresses, commands, Applications, grep and sed.</li> <li>● UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors,</li> <li>● system calls and device drivers.</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Process and signals</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing</li> <li>● processes, system processes, process scheduling, starting new processes: waiting for a process,</li> <li>● zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable</li> <li>● signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets.</li> <li>● File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.</li> <li>● Conclusion of Unit</li> </ul>



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CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall the fundamentals, syntax, and compilation process of the C language.
CO2	Understand	Articulate flow control and decision-making structures in C
CO3	Apply	Appraise the use of Array and String with solve problems...
CO4	Analyze	Analysing the efficiency of using function and pointer in different programming scenarios.
CO5	Evaluate	Assess role of file handling and memory management

**Code: 24MCACCA1104**

**Programming in C**

**3 Credits [LTP: 3-0-0]**

**COURSE OUTCOME**

**A. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to C Programming</b>	7
2.	<b>Decision Making &amp; Looping</b>	7
3.	<b>Array, String and Functions</b>	8
4.	<b>Advance programming in C</b>	8
5.	<b>File handling &amp; Additional features</b>	8

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Introduction to C Programming</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to computer-based problem solving, Program design and implementation issues- Flowcharts &amp; Algorithms, Top-down design &amp; stepwise refinement</li> <li>● Programming environment – Machine language, assembly language, high level languages, Assemblers, Compilers, and Interpreters.</li> <li>● Overview of C, Data Types, Constants &amp; Variables, Literals, Operators &amp; Expressions</li> <li>● Conclusion of Unit</li> </ul>
2.	<b>Decision Making &amp; Looping</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Decision making in C- if statement, if-else statement, Nested if statement, if else if Ladder, Switch case</li> <li>● Loop control in C – for loop, while loop, do-while loop</li> <li>● Control flow in C- break, continue and goto statement.</li> <li>● Conclusion of Unit</li> </ul>
3.	<b>Array, String and Functions</b>



CO5	-	2	2	3	1	-	-	-	-	-	-	-	-	-	-
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## Specialization: General

<b>Code: 25MCAECA1111</b>	<b>Software Engineering Principles and Agile Practices</b>	<b>3 Credits [LTP: 3-0-0]</b>
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### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Identify basic principles, models, and processes in software engineering
CO2	Understand	Explain software development life cycle (SDLC) models and agile methodologies
CO3	Apply	Apply requirements engineering techniques to define the software project scope.
CO4	Analyze	Analyze software design principles and create appropriate UML diagrams.
CO5	Apply	Evaluate software quality, testing strategies, and project management practices.

### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	<b>Introduction to Software Engineering</b>	<b>09</b>
2.	<b>Requirements Engineering</b>	<b>09</b>
3.	<b>Software Design Principles</b>	<b>09</b>
4.	<b>Software Quality and Testing</b>	<b>09</b>
5.	<b>Software Project Management</b>	<b>09</b>

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Software Engineering</b> <ul style="list-style-type: none"> <li>● Software engineering — definition, nature, scope</li> <li>● Software process models: waterfall, incremental, spiral, V-model</li> <li>● Agile software development — principles, Scrum, Extreme Programming (XP)</li> <li>● Software development life cycle (SDLC)</li> </ul>

2.	<b>Requirements Engineering</b> <ul style="list-style-type: none"> <li>● Requirements gathering techniques</li> <li>● Functional vs. non-functional requirements</li> <li>● Software requirements specification (SRS)</li> <li>● Requirements validation and management</li> </ul>
3.	<b>Software Design Principles</b>

	<ul style="list-style-type: none"> <li>● Design concepts: cohesion, coupling, abstraction, modularity</li> <li>● Object-oriented design principles</li> <li>● UML diagrams: class diagram, sequence diagram, activity diagram</li> <li>● Architectural design: patterns, layered architecture</li> </ul>
<b>4.</b>	<b>Software Quality and Testing</b>
	<ul style="list-style-type: none"> <li>● Software quality factors: usability, maintainability, reliability</li> <li>● Software testing fundamentals</li> <li>● Black box vs. white box testing</li> <li>● Unit testing, integration testing, and system testing</li> <li>● Agile testing practices — test-driven development (TDD)</li> </ul>
<b>5.</b>	<b>Software Project Management</b>
	<ul style="list-style-type: none"> <li>● Project planning, estimation techniques</li> <li>● Risk management in software projects</li> <li>● Project scheduling — Gantt charts, PERT charts</li> <li>● Configuration management</li> <li>● DevOps concepts: CI/CD pipelines</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Software Engineering	Ian Sommerville	10th Edition,	Pearson Education
2.	Software Engineering: A Practitioner's Approach	Roger Pressman	Latest	McGraw-Hill Education
<b>Reference Book</b>				
1.	Agile Software Development	Alistair Cockburn	Latest	Addison-Wesley
<b>Online Resources</b>				
<ul style="list-style-type: none"> <li>● <a href="https://nptel.ac.in/courses/106105087">https://nptel.ac.in/courses/106105087</a> — NPTEL Software Engineering</li> <li>● <a href="https://www.coursera.org/specializations/software-development-life-cycle">https://www.coursera.org/specializations/software-development-life-cycle</a> — Coursera SDLC Specialisation</li> </ul>				

### MAPPING OF CO VS PO/PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO3
<b>CO1</b>	3	3	2	0	0	0	0	0	0	1	2	1	0
<b>CO2</b>	3	3	2	0	0	0	0	0	0	0	3	0	0
<b>CO3</b>	3	3	3	0	0	0	0	0	1	1	3	1	1
<b>CO4</b>	3	3	3	1	0	0	0	2	1	1	2	1	0
<b>CO5</b>	3	3	3	2	2	0	0	1	1	2	3	2	1

## Specialization: Artificial Intelligence and Data Science

Code: 25MCDECA1111 Fundamentals of Artificial Intelligence and Data Science 3 Credits [LTP: 3-0-0]

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Describe the applications of Artificial Intelligence and subsets of Artificial Intelligence
CO2	Understand	Describe real-world problems using Artificial Intelligence techniques
CO3	Apply	Compute formal methods of knowledge representation, logic and reasoning on real-world problems
CO4	Analyze	Categorize the various aspects of data science and its application in various fields
CO5	Evaluate	Evaluate Data preprocessing techniques for creation of datasets.

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Artificial Intelligence	07
2.	Problem solving Methods	07
3.	Knowledge Representation	08
4.	Introduction to Data science	07
5.	Data Collection and Data Pre-Processing	07

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Artificial Intelligence</b> <ul style="list-style-type: none"> <li>● Introduction to Artificial Intelligence</li> <li>● Definition, History and Applications of Artificial Intelligence</li> <li>● Future of Artificial Intelligence</li> <li>● Characteristics of Intelligent Agents</li> <li>● Typical Intelligent Agents</li> <li>● Problem Solving Approach to Typical AI problems.</li> <li>● Artificial Intelligence vs Machine learning vs Deep learning</li> <li>● Artificial intelligence vs big data vs Data science</li> <li>● Conclusion of Unit</li> </ul>

2.	<b>Problem solving Methods</b> <ul style="list-style-type: none"> <li>● Introduction to Problem solving Methods</li> <li>● Search Strategies: Uninformed, Informed and Heuristics</li> <li>● Local Search Algorithms and Optimization Problems</li> <li>● Searching with Partial Observations</li> <li>● Constraint Satisfaction Problems</li> <li>● Constraint Propagation</li> <li>● Backtracking Search</li> <li>● Game Playing: Minimax, alpha-beta pruning, water jug problem, chess problem, tiles problem, Hanoi Tower problem</li> <li>● Optimal Decisions in Games</li> <li>● Stochastic Games</li> </ul>
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	<ul style="list-style-type: none"> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Knowledge Representation</b>
	<ul style="list-style-type: none"> <li>● Introduction to Knowledge Representation</li> <li>● First Order Predicate Logic</li> <li>● Prolog Programming</li> <li>● Unification</li> <li>● Forward Chaining-Backward Chaining</li> <li>● Resolution</li> <li>● Knowledge Representation</li> <li>● Ontological Engineering</li> <li>● Categories and Objects</li> <li>● Events : Mental Events and Mental Objects</li> <li>● Reasoning Systems for Categories</li> <li>● Reasoning with Default Information</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Introduction to Data science</b>
	<ul style="list-style-type: none"> <li>● Introduction to Data science</li> <li>● Evolution and Definition of Data science</li> <li>● Big Data and Data Science</li> <li>● Need for data science</li> <li>● Data Science Roles</li> <li>● Stages in a Data Science Project</li> <li>● Applications of Data Science in various fields</li> <li>● Data Security Issues.</li> <li>● Conclusion of the unit</li> </ul>
<b>5.</b>	<b>Data Collection and Data Pre-Processing</b>
	<ul style="list-style-type: none"> <li>● Introduction to Data Collection and Data Pre-Processing</li> <li>● Data Collection Strategies</li> <li>● Data Pre-Processing Overview</li> <li>● Data Cleaning</li> <li>● Data Integration and Transformation</li> <li>● Data Reduction</li> <li>● Data Discretization</li> <li>● Data Analysis in Data science</li> <li>● Conclusion of the unit</li> </ul>

### RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Artificial Intelligence: A Modern Approach	S. Russell and P. Norvig	Third Edition	Prentice Hall
2.	Prolog: Programming for Artificial Intelligence	I. Bratko	Fourth edition	Addison-Wesley Educational Publishers Inc
3.	Smarter Decisions : The Intersection of IoT and Data Science	JojoMoolayil		PACKT
4.	Doing Data Science	Cathy O'Neil and Rachel Schutt		O'Reilly
<b>Reference Book</b>				
1.	Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, M. Tim Jones.			

2.	The Quest for Artificial Intelligence, Cambridge University Press, Nils J. Nilsson.
3.	Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, William F. Clocksin and Christopher S. Mellish.
4.	Data Science and Big data Analytics”, EMC 2013, David Dietrich, Barry Heller, Beibei Yang.
5.	Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global, Raj, Pethuru.
<b>Online Resources</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_ge20/preview">https://onlinecourses.nptel.ac.in/noc21_ge20/preview</a>
2.	<a href="https://www.coursera.org/learn/introduction-to-ai">https://www.coursera.org/learn/introduction-to-ai</a>
3.	<a href="https://www.udemy.com/courses/development/data-science">https://www.udemy.com/courses/development/data-science</a>
4.	<a href="https://www.coursera.org/browse/data-science">https://www.coursera.org/browse/data-science</a>

#### MAPPING OF CO VS PO/PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO4
CO1	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-	2
CO2	1	3	-	2	-	-	-	-	-	-	-	-	2	-	3	-
CO3		1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	-	1	2	2	-	-	-	-	-	-	-	-	2	-	-	3
CO5	-	-	2	3	-	-	-	-	-	-	-	-	2	-	3	2

### Specialization: Cyber Security

<b>Code: 25MCYECA1111</b>			<b>Introduction to Cyber Security</b>			<b>3 Credits [LTP: 3-0-0]</b>		
CO	Cognitive Abilities	Course Outcomes						
CO1	Remember	Identify basic concepts of Information Security, its principles and importance of Information Security.						
CO2	Understand	Understand different types of Cryptography techniques and algorithms and how to implement these algorithms.						
CO3	Apply	Determine concepts of IT security, Threats, Vulnerabilities, Impact and control measures and testing tools.						
CO4	Analyze	Illustrate network models, plan network security with the help of different security tools and explain email security protocols.						
CO5	Evaluate	Evaluate various vulnerabilities in database and review common attackson database and its preventing measures.						

## A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to Information Security</b>	07
2.	<b>The importance of Cryptography</b>	08
3.	<b>Threats and vulnerabilities</b>	08
4.	<b>Network and email security</b>	07
5.	<b>Database Security</b>	07

## B.SYLLABUS OUTLINE

Unit	Unit Details
1.	<b>Introduction to Information Security</b>
	<ul style="list-style-type: none"> <li>● Introduction to the unit</li> <li>● Definition of Information Security, Evolution of Information Security, Basics Principles of Information Security (CIA triad), Terminologies in information security               <ul style="list-style-type: none"> <li>● Latest news in information security</li> <li>● Conclusion</li> </ul> </li> </ul>
2.	<b>The importance of Cryptography</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Overview of Cryptography &amp; Steganography</li> <li>● Understanding the AES and DSA (overview)</li> <li>● Private key and Public key Cryptography</li> <li>● RSA and Digital Signature</li> <li>● Conclusion of Unit</li> </ul>
3.	<b>Threats and vulnerabilities</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Types of Hackers, Hacktivism</li> <li>● Common Threats to the data</li> <li>● Vulnerability and Penetration testing and its tools</li> <li>● Malicious Codes, Back Doors, Spoofing, sniffing, Spam, Social Engineering</li> <li>● Denial of Service and Distributed Denial of Service,</li> <li>● Conclusion of Unit</li> </ul>
4.	<b>Network and email security</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Planning for Network Security, TCP/IP and OSI models</li> <li>● Firewalls and its types, VPNs, and Wireless security</li> <li>● Intrusion Detection and Prevention Systems and Other Security Tools</li> <li>● Email security and PGP</li> <li>● Conclusion of Unit</li> </ul>
5.	<b>Database Security</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Describe the structures and vulnerabilities of key databases for cyber security including SQL, Oracle and MongoDB</li> <li>● Common database Vulnerabilities and Owasp top 10</li> <li>● SQL injection</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Cryptography and Network Security	William Stallings	Fourth Edition	McGraw Hill India, 2017
2.	Information security: Principles and Practice	Mark Stamp	Second Edition	John Wiley & Sons, Inc., 2011
<b>Reference Book</b>				
1.	Cryptography and Network Security, Ferouzan, Behrouz A.			
2.	Data and Computer Communication, Pearson Education, Stallings William			
3.	Cryptography and Network Security, S. Bose			

<b>Online Resources</b>	
	<a href="https://onlinecourses.swayam2.ac.in/nou19_cs08">https://onlinecourses.swayam2.ac.in/nou19_cs08</a>
	<a href="https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks">https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks</a>
	<a href="https://www.codecademy.com/learn/introduction-to-cybersecurity">https://www.codecademy.com/learn/introduction-to-cybersecurity</a>

#### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-

### Specialization: Artificial Intelligence and Machine Learning with SAS

Code: 25MALECA1111      Base SAS Programming 3 Credits [LTP: 3-0-

#### COURSE OUTCOME

Students will be able to:

- Know the essentials of SAS programming tools
- Access and import data through libraries into SAS
- Create frequency reports

#### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction to SAS programming	3
2	Accessing Data	3
3	Exploring and Validating Data	4
4	Preparing and Analyzing and Reporting on Data	7
5	Exporting Results and Using SQL in SAS	3

## B. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Introduction to SAS Programming</b>
	<ul style="list-style-type: none"> <li>• The SAS programming process.</li> <li>• Using SAS programming tools.</li> <li>• Understanding SAS syntax.</li> </ul>
<b>2.</b>	<b>Accessing Data</b>
	<ul style="list-style-type: none"> <li>• Understanding SAS data.</li> <li>• Accessing data through libraries.</li> <li>• Importing data into SAS.</li> </ul>
<b>3.</b>	<b>Exploring and Validating Data</b>
	<ul style="list-style-type: none"> <li>• Exploring data.</li> <li>• Filtering rows.</li> <li>• Formatting columns.</li> <li>• Sorting data and removing duplicates.</li> </ul>
<b>4.</b>	<b>Preparing and Analyzing and Reporting on Data</b>
	<ul style="list-style-type: none"> <li>• Reading and filtering data.</li> <li>• Computing new columns.</li> <li>• Conditional processing.</li> <li>• Analyzing and Reporting on Data</li> <li>• Enhancing reports with titles, footnotes, and labels.</li> <li>• Creating frequency reports.</li> <li>• Creating summary statistics reports.</li> </ul>
<b>5</b>	<b>Exporting Results and Using SQL in SAS</b>
	<ul style="list-style-type: none"> <li>• Exporting data.</li> <li>• Using Structured Query Language in SAS.</li> <li>• Joining tables using SQL in SAS.</li> </ul>

<b>Code:25MALECA1113</b>	<b>Statistics you need to know for Machine Learning 3CR [LTP:3-0-0]</b>
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### COURSE OUTCOME

The student would be able:

- know the fundamental statistical concepts
- learn ANOVA
- Understanding the concepts of logistic regression and multiple logistic regression

### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
<b>1.</b>	<b>Introduction to Statistics</b>	<b>5</b>
<b>2</b>	<b>Analysis of Variance (ANOVA)</b>	<b>3</b>
<b>3</b>	<b>Regression</b>	<b>7</b>
<b>4</b>	<b>Regression Diagnostics</b>	<b>2</b>
<b>5</b>	<b>Categorical Data Analysis</b>	<b>4</b>

## B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Statistics</b>
	Statistics and Machine Learning Relevance of statistics in big data and machine learning. Terminology and vocabulary.
2.	<b>Introduction to SAS Viya and SAS Studio</b>
	<ul style="list-style-type: none"> <li>● Introduction to SAS Viya and SAS Studio.</li> <li>● Fundamental Statistical Concepts Introduction to statistical analysis. Descriptive statistics. Inferential statistics. Explanatory Modeling Using Linear Regression Correlation and simple linear regression.</li> <li>● Conclusion of Unit</li> </ul>
3.	<b>Regression</b>
	Multiple regression and model selection. Model diagnostics. Predictive Modeling Using Logistic Regression
4.	<b>Predictive Modeling</b>
	Introduction to predictive modeling. Categorical associations. Logistic regression model. Model deployment. Statistical
5.	<b>Introduction to Machine Learning</b>
	Foundations of Machine Learning Overview of machine learning. Data pre-processing for machine learning models. Model evaluation, estimation, and post-training tasks.

**Code:25MALECA1112**      **Application of Machine Learning Using SAS(R) Viya**      **3 Credit [LTP:3-0-0]**

### COURSE OUTCOME

The students will be able to

- Apply the analytical life cycle to business need.
- Incorporate a business-problem-solving approach in daily activities.
- Prepare and explore data for analytical model development.
- Create and select features for predictive modeling.
- Develop a series of supervised learning models based on different techniques such as decision

### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	<b>Introduction</b>	3
2	<b>Data Preparation</b>	7
3	<b>Decision Trees and Ensembles of Trees</b>	5
4	<b>Neural Networks</b>	3
5	<b>Support Vector Machines and Additional Topics &amp; Model Assessment and Deployment</b>	6

## B. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Introduction</b>
	<ul style="list-style-type: none"> <li>● Machine learning in business decision making.</li> <li>● Essentials of supervised prediction.</li> <li>● Introduction to SAS</li> </ul>
<b>2.</b>	<b>Data Preparation</b>
	<ul style="list-style-type: none"> <li>● Data exploration</li> <li>● Feature extraction.</li> <li>● Input transformations.</li> <li>● Feature selection.</li> <li>● Variable clustering .</li> <li>● Best practices.</li> <li>● Selecting your algorithm.</li> </ul>
<b>3.</b>	<b>Decision Trees and Ensembles of Trees</b>
	<ul style="list-style-type: none"> <li>● Introduction.</li> <li>● Tree-structure models.</li> <li>● Recursive partitioning.</li> <li>● Pruning.</li> <li>● Ensembles of trees</li> </ul>
<b>4.</b>	<b>Neural Networks</b>
	<ul style="list-style-type: none"> <li>● Introduction.</li> <li>● Network architecture.</li> <li>● Network learning and optimization.</li> </ul>
<b>5.</b>	<b>Support Vector Machines and Additional Topics &amp; Model Assessment and Deployment</b>
	<ul style="list-style-type: none"> <li>● Large-margin linear classifier.</li> <li>● Methods of solution.</li> <li>● Nonlinear classifier: Kernel Trick.</li> <li>● Additional tools.</li> <li>● Model assessment and comparison.</li> <li>● Model deployment.</li> </ul>

## Specialization: Cloud Computing & DevOps Technology

**Code: 25MCTECA1111 Cloud Computing Fundamentals and Service Models 3 Credits [LTP: 3-0-0]**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Define fundamental concepts of cloud computing, its evolution, characteristics, and architecture.
CO2	Understand	Explain cloud service models (IaaS, PaaS, SaaS) and deployment models.
CO3	Apply	Identify and use cloud-enabling technologies and basic virtualization components.
CO4	Analyze	Compare different service providers and evaluate deployment decisions based on performance/security.
CO5	Evaluate	Assess benefits, limitations, and security concerns of various cloud services and applications.

## A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Cloud Computing	08
2.	Cloud Computing Architecture & Characteristics	07
3.	Cloud Service Models: IaaS, PaaS, SaaS	08
4.	Virtualization and Cloud Technologies	07
5.	Cloud Deployment Models and Security	08

## B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Cloud computing</b>
	<ul style="list-style-type: none"> <li>● Introduction to the Unit</li> <li>● Definition, history and evolution of cloud computing</li> <li>● Traditional computing vs. cloud computing</li> <li>● Characteristics of cloud computing</li> <li>● Benefits and challenges</li> <li>● Overview of cloud providers (AWS, Azure, Google Cloud)</li> <li>● Conclusion of Unit</li> </ul>
2.	<b>Cloud Computing Architecture &amp; Characteristics</b>
	<ul style="list-style-type: none"> <li>● Introduction to the Unit</li> <li>● Cloud reference architecture (NIST)</li> <li>● Key components: clients, datacenters, distributed servers</li> <li>● Multi-tenancy and elasticity</li> <li>● Resource pooling and scalability</li> <li>● On-demand self-service and measured service</li> <li>● Cloud computing platforms and standards</li> <li>● Conclusion of Unit</li> </ul>
3.	<b>Cloud Service Models: IaaS, PaaS, SaaS</b>
	<ul style="list-style-type: none"> <li>● Introduction to the Unit</li> <li>● Infrastructure as a Service (IaaS): definition, use cases, examples (AWS EC2, Google Compute Engine)</li> <li>● Platform as a Service (PaaS): definition, use cases, examples (Google App Engine, Heroku, Azure App Services)</li> <li>● Software as a Service (SaaS): definition, use cases, examples (Google Workspace, Salesforce, Dropbox)</li> <li>● Differences, advantages, and limitations of each model</li> <li>● Emerging service models: FaaS, BaaS, etc.</li> <li>● Conclusion of Unit</li> </ul>

<b>4.</b>	<b>Virtualization and Cloud Technologies</b>
	<ul style="list-style-type: none"> <li>● Introduction to the Unit</li> <li>● Introduction to virtualization: concept and types (server, storage, network)</li> <li>● Hypervisors: Type I and Type II</li> <li>● Containers vs Virtual Machines (Docker, Kubernetes basics)</li> <li>● Virtualization in cloud computing (VMware, KVM, Xen)</li> <li>● Role of APIs in cloud services</li> <li>● Cloud storage and databases (object, block, file storage)</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Cloud Deployment Models and Security</b>
	<ul style="list-style-type: none"> <li>● Introduction to the Unit</li> <li>● Introduction to virtualization: concept and types (server, storage, network)</li> <li>● Hypervisors: Type I and Type II</li> <li>● Containers vs Virtual Machines (Docker, Kubernetes basics)</li> <li>● Virtualization in cloud computing (VMware, KVM, Xen)</li> <li>● Role of APIs in cloud services</li> <li>● Cloud storage and databases (object, block, file storage)</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Cloud Computing: Concepts, Technology & Architecture	Thomas Erl	Third Edition	Prentice Hall
2.	Cloud Computing: Principles and Paradigms	Rajkumar Buyya et al.	Fourth edition	Wiley
3.	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola		McGraw Hill
<b>Reference Book</b>				
1.	<i>Cloud Computing Bible</i> by Barrie Sosinsky, Wiley			
2.	<i>Cloud Computing: A Practical Approach</i> by Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw-Hill			
<b>Online Resources</b>				
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_ge20/preview">https://onlinecourses.nptel.ac.in/noc21_ge20/preview</a>			
2.	<a href="https://www.coursera.org/learn/introduction-to-ai">https://www.coursera.org/learn/introduction-to-ai</a>			
3.	<a href="https://www.udemy.com/courses/development/data-science">https://www.udemy.com/courses/development/data-science</a>			
4.	<a href="https://www.coursera.org/browse/data-science">https://www.coursera.org/browse/data-science</a>			

### MAPPING OF CO VS PO/PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO4
CO1	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-	2
CO2	1	3	-	2	-	-	-	-	-	-	-	-	2	-	3	-
CO3		1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO4	-	1	2	2	-	-	-	-	-	-	-	-	2	-	-	3
CO5	-	-	2	3	-	-	-	-	-	-	-	-	2	-	3	2

### FIRST SEMESTER ELECTIVES

#### Practical Subjects

#### Professional Elective Labs

#### Specialization: All

**Code:25MCACCA1203 Linux Shell Programming Lab 1 Credits [LTP: 0-0-2]**

#### COURSE OUTCOME

Students will be able to:

- Get the basic set of commands and utilities in Linux/UNIX systems
- Able to work on VI editor and its commands
- Apply the concept of shell script to do basic programming.
- Implement Shell script to perform conditional statements
- Implement Shell script to perform Looping statements.

#### LIST OF EXPERIMENTS:

1	Study of Linux basic commands: cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, stty, pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, more, file, wc, od, cmp,comm, diff, chmod, vi.
2	Study of vi editor
3	Write a Script to print “hello world”
4	Write a script to create function.
5	Write a script to implement local variables.
6	Write a script to implement if...else.
7	Write a script to study for, while and until
8	Write a script that finds the prime factors of a given number.
9	a) Write a script to check if the two strings are same or not. b) Write a shell script to check the given number is Odd/Even
10	Write a script that will print a message “Good Morning” or “Good Afternoon” according to the user login time
11	Linux Commands: cmp, find, grep, od, tar, ps, df, du, finge, kill, nice, nonhup, sleep, test, umask, who, cal, tee, expr, uname, fsck, xargs. Filters for stream handling features of the shell for input and output. E.g. pr, head, tail, cut, paste, sort, nl, uniq, tr.
12	a) Write a shell script to show the Palindrome number b) Write a script to show the Factorial value of the given value

## Specialization: General, AI&D, Cyber & Cloud

Code: 25MCACCA1204

Programming in C Lab

1 Credit[LTP: 0-0-2]

### Course Outcome :-

Students will be able to:

- Demonstrate concept of functional hierarchical code organization.
- Work with textual information, characters and strings
- Implement file handling concepts
- Implement real time applications using the power of C language features.
- Handle possible errors during program execution.

### A. LIST OF EXPERIMENTS:

1	Given the values of the variables x, y and z, write a program to rotate their values such that x has the value of y, y has the value of z, and z has the value of x
2	Write a program that reads a floating point number and then displays the right-most digit of the integral part of the number.
3	Write a C program to calculate the sum of digits of given number.
4	Program to find largest and smallest number from four given number.
5	Program to find whether a year is leap or not.
6	Write a C program in which enter any number by the user and perform the operation of Sum of digits of entered number.
7	Write a C Program to convert Decimal number to Binary number.
8	Find the sum of this series up to n terms $1+2+3+4+5+6+\dots$
9	Program to print Armstrong's numbers from 1 to 100.
10	Write a program to convert years into Minute, Hours, Days, Months, Seconds using switch () statements
11	Write a C menu driven program
12	Write a program to generate the various pattern of numbers
13	Write a C Program to print the reverse of an integer number
14	Write a C program to perform the factorial of given number
15	Write a C program in which a function prime that returns 1 if its argument is a prime and return zero otherwise.
16	Write a C program to calculate factorial of a number using recursion
17	Write a C program in which enter 10 elements by the user and perform the operation of sorting in ascending order
18	Write a C program to perform to perform Matrix addition and multiplication operations

19	Write a program to determine the length of the string and find its equivalent ASCII codes.
20	Write a program to delete all the occurrences of the vowels in a given text. Assume that the text length will be of one line
21	Write a program to maintain the library record for 100 books with book name, author's name, and edition, year of publishing and price of the book

## B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Let us C, 6th Edition Yashwant Kanetka PBP Publication	YashwantKanetkar	6th Edition	PBP Publication
2.	The C programming Language	2. Richie and Kenninghan	2. 2nd Edition 2004	PBP Publication,2004
3.	Programming in ANSI C	Balaguruswamy Tata McGraw Hill	3. 3rd Edition, 2005	Tata McGraw Hill
<b>Reference Book</b>				
1.	The C programming Language Richie and Kenninghan PBP Publication,2004			
2.	Programming in ANSI C 3rd Edition, 2005 Balaguruswamy Tata McGraw Hill			
<b>Online Resources</b>				
1.	<a href="https://www.programiz.com/c-programming/examples">https://www.programiz.com/c-programming/examples</a>			
2.	<a href="https://www.w3resource.com/c-programming-exercises">https://www.w3resource.com/c-programming-exercises</a>			

## Specialization: AIML with SAS

Code: 25MALECA1211

SAS® Programming in Viya® Lab

1 Credit [LTP: 0-0-2]

1. Connect to Cloud Analytic Services (CAS).
3. Access and use caslibs.
4. Load SAS data sets, CSV files, and Microsoft Excel files into CAS.
5. Save SASHDAT files.
6. Modify Base SAS programs to execute in CAS.
7. Modify SQL procedure code to execute in CAS using FedSQL.
8. Use CAS-enabled functions and procedures.

## Ability Enhancement Courses (AEC)

**Code:25MULCHM1201    Communication Skills With Grammar, Vocabulary & Emotional Intelligence    1 Credit [LTP:0-0-2]**

### **Course Outcomes:**

On successful completion of the course, the learner will be able to

CO	Cognitive Abilities	Course Outcomes
CO1	REMEMBER	Recall fundamental concepts of grammar, vocabulary, and elements of communication.
CO2	UNDERSTAND	Explain the process of effective communication and the role of emotional intelligence.
CO3	APPLY	Apply appropriate grammar, vocabulary, and emotional awareness in professional and personal communication.
CO4	ANALYZE	Analyse barriers to communication and develop strategies to overcome them using emotional intelligence.
CO5	EVALUATE	Evaluate personal communication styles and develop improvement plans for effective interpersonal skills.

### **A. OUTLINE OF THE COURSE**

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	<b>Fundamentals of Communication &amp; Grammar Basics</b>	9
2	<b>Developing Listening, Speaking, Reading &amp; Writing Skills (LSRW)</b>	9
3	<b>Emotional Intelligence (EI) in Communication</b>	9
4	<b>Interpersonal and Workplace Communication</b>	9
5	<b>Advanced Grammar &amp; Communication Strategies</b>	9

### **B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Fundamentals of Communication &amp; Grammar Basics</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Definition and importance of communication</li> <li>● Types of communication: verbal, non-verbal, written, and visual</li> <li>● 7 Cs of effective communication</li> <li>● Common barriers to communication</li> <li>● Basic concepts of grammar: tenses, sentence structure, subject-verb agreement, articles, prepositions, and conjunctions</li> <li>● Vocabulary enhancement techniques</li> <li>● Conclusion of Unit</li> </ul>
2.	<b>Developing Listening, Speaking, Reading &amp; Writing Skills (LSRW)</b>

	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Active listening techniques</li> <li>● Pronunciation, tone, and clarity</li> <li>● Speaking with confidence: public speaking, group discussions, presentations</li> <li>● Reading comprehension strategies</li> <li>● Writing effective paragraphs, emails, reports, and summaries</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Emotional Intelligence (EI) in Communication</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Concept of emotional intelligence</li> <li>● Self-awareness, self-regulation, motivation, empathy, and social skills</li> <li>● Role of EI in effective communication</li> <li>● Managing emotions in stressful communication scenarios</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Interpersonal and Workplace Communication</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Interpersonal communication skills</li> <li>● Communication in professional settings: meetings, interviews, negotiations</li> <li>● Assertiveness vs. aggression</li> <li>● Giving and receiving feedback effectively</li> <li>● Cross-cultural communication</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Advanced Grammar &amp; Communication Strategies</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Advanced grammar usage in professional writing</li> <li>● Tone, style, and clarity in writing</li> <li>● Communication strategies for leadership</li> <li>● Conflict management through communication</li> <li>● Continuous self-improvement techniques for communication</li> <li>● Conclusion of Unit</li> </ul>

### Text Books

1. Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press.
2. Daniel Goleman, Emotional Intelligence, Bantam Books.

### Reference Books

1. Leena Sen, Communication Skills, Prentice Hall India.
2. Dale Carnegie, How to Win Friends and Influence People, Simon & Schuster.
3. Deborah J. Barrett, Business and Professional Communication: Keys for Workplace Excellence, Pearson.

### Online Resources

1. <https://www.skillsyouneed.com/>
2. <https://www.mindtools.com/>
3. <https://www.grammarly.com/blog/grammar/>
4. <https://www.coursera.org/learn/emotional-intelligence>

## Skill Enhancement Courses (SEC)

**Code: 25MULCUL1201 Introduction To Design Thinking & Problem Solving      1 Credit [LTP:0-0-2]**

### Course Outcomes:

**On successful completion of the course, the learner will be able to**

CO	Cognitive Abilities	Course Outcomes
CO1	REMEMBER	Recall the key principles and stages of the design thinking process.
CO2	UNDERSTAND	Explain the value of human-centred design and empathy in solving complex problems.
CO3	APPLY	Apply design thinking tools to ideate and prototype innovative solutions.
CO4	ANALYZE	Analyse user needs and define problem statements to develop effective solutions.
CO5	EVALUATE	Evaluate prototypes and iterate solutions based on user feedback.

Unit	Unit Details
<b>1.</b>	<b>Introduction to Design Thinking</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● What is Design Thinking?</li> <li>● Historical context and evolution of design thinking</li> <li>● Principles of human-centred design</li> <li>● Importance of empathy in problem-solving</li> <li>● 5 Stages of Design Thinking: Empathise, Define, Ideate, Prototype, Test</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Empathy and Problem Definition</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Techniques for empathy: Interviews, shadowing, empathy maps</li> <li>● Identifying user pain points</li> <li>● Defining user needs and insights</li> <li>● Crafting effective problem statements (How Might We questions)</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Idea Generation &amp; Creative Thinking</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Brainstorming techniques</li> <li>● Lateral thinking and divergent thinking</li> <li>● Using the SCAMPER technique for ideation</li> <li>● Selection of ideas: Feasibility, viability, desirability</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Prototyping and Testing</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Rapid prototyping techniques</li> <li>● Low-fidelity vs. high-fidelity prototypes</li> <li>● Testing prototypes with users</li> <li>● Collecting and analysing feedback</li> <li>● Iterative design process</li> </ul>

	<ul style="list-style-type: none"> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Prototyping and Testing</b>
	<ul style="list-style-type: none"> <li>● Introduction of the Unit</li> <li>● Applying design thinking in business, education, and social sectors</li> <li>● Design thinking for digital innovation</li> <li>● Case studies of successful design thinking applications</li> <li>● Developing a design thinking mindset for continuous improvement</li> <li>● Conclusion of Unit</li> </ul>

**Text Book(s)**

1. Tim Brown, *Change by Design: How Design Thinking Creates New Alternatives for Business and Society*, Harper Business.
2. Jeanne Liedtka & Tim Ogilvie, *Designing for Growth: A Design Thinking Toolkit for Managers*, Columbia Business School Publishing.

**Reference Book(s)**

1. David Kelley & Tom Kelley, *Creative Confidence: Unleashing the Creative Potential Within Us All*, Crown Business.
2. Idris Mootee, *Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School*, Wiley.
3. Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage*, Harvard Business Press.

**Online Resource(s)**

1. <https://designthinking.ideo.com/>
2. <https://www.interaction-design.org/literature/topics/design-thinking>
3. <https://www.coursera.org/learn/uva-darden-design-thinking-innovation>
4. <https://hbr.org/topic/design-thinking>

## SECOND SEMESTER CORE Theory Subjects

<b>Code: 25MCACCA2101</b>	<b>Design and Analysis of Algorithm 3 Credits [LTP: 3-0-0]</b>
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### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall the asymptotic performance of algorithms and data structures.
CO2	Understand	Demonstrate appropriate algorithm design paradigm like Divide and Conquer and Greedy for solving engineering problems.
CO3	Apply	Apply Dynamic Programming and Backtracking to solve engineering problems
CO4	Analyze	Characterize Randomize algorithms for solving common engineering design problems.
CO5	Evaluate	Evaluate arithmetic expressions using parallel model.

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to Analysis of Algorithms</b>	<b>07</b>
2.	<b>Divide and Conquer and Greedy Methods</b>	<b>08</b>
3.	<b>Dynamic Programming and Backtracking</b>	<b>08</b>
4.	<b>Randomized Algorithms</b>	<b>07</b>
5.	<b>Parallel Models</b>	<b>07</b>

### B. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Introduction to Analysis of Algorithms</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Algorithm definition and specification, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences,</li> <li>● Performance analysis</li> <li>● Elementary Data structures:- stacks and queues, trees, dictionaries, priority queues –sets and disjoint set union, graphs, basic traversal and search techniques.</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Divide and Conquer and Greedy Methods</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Divide and conquer:- General method, binary search, merge sort, Quick sort,</li> <li>● The Greedy method:-General method, knapsack problem, minimum cost spanning tree, single source shortest path.</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Dynamic Programming and Backtracking</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Dynamic Programming, general method, multistage graphs, all pair shortest path, optimal binary search trees, 0/1 Knapsack, traveling salesman problem, flow shop scheduling.</li> <li>● Backtracking:- general method, 8-Queens problem, sum of subsets, graph coloring, Hamiltonian cycles, knapsack problem, Branch and bound:- The Method, 0/1 Knapsack problem, traveling salesperson.</li> <li>● Conclusion of Unit</li> </ul>

<b>4.</b>	<b>Randomized Algorithms</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Randomized Algorithms: Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut, randomized algorithm for 2- SAT. Problem definition of Multicommodity flow, Flow shop scheduling and Network capacity assignment problems.</li> <li>• Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Parallel Models</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Parallel models:-Basic concepts, performance Measures,</li> <li>• Parallel Algorithms: Parallel complexity, Analysis of Parallel Addition, Parallel Multiplication and division</li> <li>• Parallel Evaluation of General Arithmetic Expressions, First-Order Linear recurrence.</li> <li>• Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Design and analysis of Algorithms	Aho A.V , J.D Ulman	Third Edition	Addison Wesley
2.	Design and Analysis of Algorithms	Dave and Dave	Second Edition	Pearson
<b>Reference Book</b>				
1.	Introduction to Algorithms, Cormen, Leiserson, Rivest, Prentice Hall of India			
2.	Fundamental of Computer algorithms, Horowitz and Sahani			
<b>Online Resources</b>				
1.	<a href="https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm">https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm</a>			
2.	<a href="https://nptel.ac.in/courses/106106131">https://nptel.ac.in/courses/106106131</a>			

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PSO 4
CO1	3	1	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	1	2		-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	1	-	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	2	2	-	-	-	-	-	-	-	-	1	-	-	-

<b>Code: 25MCACCA2102</b> <b>3-0-0</b>	<b>Database Management System</b>	<b>3 Credits [LTP:</b>
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### Course Outcome

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
CO2	Understand	Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
CO3	Apply	Learn and apply structured query language (SQL) for database definition and database manipulation.
CO4	Analyze	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO5	Evaluate	Learn various transaction processing, concurrency control mechanisms and database

		protection mechanisms.
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## A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction to Database Management System	7
2	RDBMS	7
3	SQL	7
4	PL/SQL	8
5	Oracle, Trigger and wrapping	7

## B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Database Management System</b>
	<ul style="list-style-type: none"> <li>• Introduction to Database Management System</li> <li>• Characteristics of database approach</li> <li>• Advantages of DBMS</li> <li>• Schemas: Three schema architecture - The external level, the conceptual level and the internal level.</li> <li>• Data Independence</li> <li>• Database languages and Interfaces</li> <li>• Roles of Database Administrator</li> <li>• Introduction to Data Models (Hierarchical, Network and Relation)</li> <li>• Entity type, Entity sets, Attributes and keys.</li> <li>• The ER Model: ER Diagram &amp; Database design with the ER Model</li> <li>• Conclusion of the Unit</li> </ul>
2.	<b>RDBMS</b>
	<ul style="list-style-type: none"> <li>• Introduction to Distributed Database</li> <li>• Classification of DBMS</li> <li>• Introduction to RDBMS</li> <li>• Relational Model –Concepts</li> <li>• Relational operations (Insert, delete, update, select, project, rename, union, intersection, minus, Join, division)</li> <li>• Transactions and ER mapping Examples</li> <li>• Normalization of RDBMS (1NF, 2NF, 3NF and 4NF) and inference rules.</li> <li>• Conclusion of the Unit</li> </ul>
3.	<b>SQL</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• DBMS v/s RDBMS</li> <li>• Introduction to SQL: Data types, Constraints</li> <li>• Commands in SQL: Create table, Drop command, Alter Queries in SQL</li> <li>• Statements in SQL (Insert, delete and update)</li> <li>• Features of SQL</li> <li>• Manipulation of data</li> <li>• Tables in SQL</li> <li>• Conclusion of the Unit</li> </ul>
4.	<b>PL/SQL</b>
	<ul style="list-style-type: none"> <li>• Introduction to PL/SQL</li> <li>• Approaches to database programming: with function calls, Embedded SQL using CURSORS, Dynamic SQL, SQL commands in Java, Retrieving multiple triples using Iterators</li> <li>• Advantages of PL/SQL</li> <li>• Features of PL/SQL :Blocks structure, Error handling, Input and output designing, variables and constant, data abstraction, control structures and subprogram</li> <li>• Fundamentals of PL/SQL : character sets, lexical, delimiters, identifiers, declarations, scope and visibility, Static and dynamic and static SQL, Implicit and explicit locking</li> <li>• Conclusion of the Unit</li> </ul>

<b>5.</b>	<b>Oracle, Trigger and wrapping</b>
	<ul style="list-style-type: none"> <li>● Introduction to <b>Oracle, Trigger and wrapping</b></li> <li>● Functions/responsibilities of DBA</li> <li>● Oracle product details</li> <li>● Oracle files, System and User process</li> <li>● Oracle Memory</li> <li>● Protecting data: Oracle backup &amp; recovery</li> <li>● Triggers - types, uses, data access for triggers</li> <li>● PL/SQL Packages and Wrapping</li> <li>● Conclusion of the Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL:

S. No	Text Books:	Author	Edition	Publication
1.	Database System Concepts	S. Sudarshan, Henry F. Korth, Avi Silberschatz	6 <sup>th</sup> Edition	McGraw Hill
2.	SQL, PL/SQL	Ivan Bayross		Bpb
3.	Oracle Complete Reference	Kevin Loney		Bpb

Reference Book	
1.	PL/SQL, best practices, Bpb Publications, Steven Feuerstein
2.	The Oracle Cook Book, Bpb Publications, Liebschutzy
3.	Oracle A Beginners Guide, TMH Publication, Michael Abbey, Michael J. Corey
Online Resources	
1.	<a href="https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm">https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm</a>
2.	<a href="https://nptel.ac.in/courses/106106093">https://nptel.ac.in/courses/106106093</a>
3.	<a href="https://www.coursera.org/learn/introduction-to-relational-databases">https://www.coursera.org/learn/introduction-to-relational-databases</a>

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	2	-	-	-	-	-	-	-	-	-	3	1	-	-
CO2	2	-	2	2	-	-	-	-	-	-	-	-	2	2	-	-
CO3	2	1	2	-	-	-	-	-	-	-	-	-	2	1	2	-
CO4	2	1	2	1	-	-	-	-	-	-	-	-	1	-	-	1
CO5	1	2	-	2	-	-	-	-	-	-	-	-	-	2	2	2

### PRACTICAL

<b>Code: 25MCACCA2201</b> <b>[LTP: 0-0-2]</b>	<b>Design and Analysis of Algorithm Lab</b>	<b>1 Credit</b>
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#### Course Outcomes:

Students will be able to:

- a. Design an algorithm in an effective manner
- b. Apply iterative and recursive algorithms.
- c. Design iterative and recursive algorithms.
- d. Implement optimization algorithms for specific applications.
- e. Design optimization algorithms for specific applications

## LIST OF EXPERIMENTS:

1	Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted. The elements can be read from a file or can be generated using the random number generator.
2	Implement a Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted. The elements can be read from a file or can be generated using the random number generator.
3	A. Obtain the Topological ordering of vertices in a given digraph. B. Compute the transitive closure of a given directed graph using Warshall's algorithm.
4	Implement 0/1 Knapsack problem using Dynamic Programming.
5	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm
6	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7	A. Print all the nodes reachable from a given starting node in a digraph using BFS method. B. Check whether a given graph is connected or not using DFS method.
8	Find a subset of a given set $S = \{s_1, s_2, \dots, s_N\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$ . A suitable message is to be displayed if the given problem instance doesn't have a solution.
9	Implement any scheme to find the optimal solution for the Traveling Sales person problem and then solve the same problem in stance using any Approximation algorithm and determine the error in the approximation.
10	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
12	Implement N Queen's problem using BackTracking.

## B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1	Design and analysis of Algorithms	Aho A.V , J.D Ulman	Third Edition	Addison Wesley
2	Design and Analysis of Algorithms	Dave and Dave	Second Edition	Pearson
<b>Reference Book</b>				
1	Introduction to Algorithms, Cormen, Leiserson, Rivest, Prentice Hall of India			
2	Fundamental of Computer algorithms, Horowitz and Sahani			
<b>Online Resources</b>				
1	<a href="https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm">https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm</a>			
2.	<a href="https://nptel.ac.in/courses/106106131">https://nptel.ac.in/courses/106106131</a>			
3.	Design and analysis of Algorithms			

Code:25MCACCA2202

DBMS Lab

1 Credit[LTP: 0-0-2]

### Course Outcome:-

Students will be able:

- f. Appreciate, define and effectively demonstrate the underlying concepts of database technologies.
- g. Design and implement a database schema for a given problem-domain.

- h. Populate and query a database using SQL DML/DDDL commands.
- i. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.
- j. Programming PL/SQL including stored procedures, stored functions, cursors, packages.

**A. LIST OF EXPERIMENTS:**

1.	To setup and removal phases of a Student database using the basic Data Definition Language (DDL) commands: <ul style="list-style-type: none"><li>1. CREATE</li><li>2. ALTER</li><li>3. DROP</li><li>4. RENAME</li><li>5. TRUNCATE</li></ul>
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2.	The routine operation of the Employee database like retrieve, insert and modify by basic Data Manipulation Language (DML) commands: 1. INSERT 2. UPDATE 3. DELETE
3.	To Retrieve data from one or more tables using DATA RETRIEVAL LANGUAGE (DRL) commands SELECT FROM SELECT - FROM –WHERE SELECT - FROM -GROUP BY SELECT - FROM -ORDER BY JOIN using SELECT - FROM - ORDER BY JOIN using SELECT - FROM - GROUP BY UNION INTERSET MINUS
4.	DATA CONTROL LANGUAGE (DCL) and TRANSATIONAL CONTROL LANGUAGE (TCL) commands. Creating objects: tables, views, users, sequences, Collections etc. Privilege management through the Grant and Revoke commands Transaction processing using Commit and Rollback Save points.
5.	Queries for following functions Conversion functions (to_char, to_number and to_date) string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
6.	Simple queries: selection, projection, sorting on a simple table for employee database Small-large number of attributes Distinct output values Renaming attributes Computed attributes Simple-complex conditions (AND, OR, NOT) Partial Matching operators (LIKE, %, _, *, ?) ASC-DESC ordering combinations Checking for Nulls
7.	To manipulate data items and returning the results using Group functions or Aggregate functions and Single Row or scalar functions: Group functions or Aggregate functions: Sum(), Avg(), Min(), Max() and Count() Single Row or scalar function: Abs(), Power(), Sqrt(), Round(), Exp(), Greastest(), Least(), Mod(), Floor(), Sign() and Log().
8.	Multi-table queries (JOIN OPERATIONS) Simple joins (no INNER JOIN) Aliasing tables – Full/Partial name qualification Inner-joins (two and more (different) tables) Inner-recursive-joins (joining to itself) Outer-joins (restrictions as part of the WHERE and ON clauses) Using where & having clauses
9.	Write Nested queries to retrieve the name of each employee who has a dependent with the same first name and same sex as the employee using following Nested queries. In, Not In Exists, Not Exists Dynamic relations (as part of SELECT, FROM, and WHERE clauses)
10.	Write a query to make a list of all project numbers for projects that involve an employee whose last name is 'Smith', either as a worker or as a manager of the department that controls the project using the following Set Oriented Operations Union Difference Intersection Division

11.	PL/SQL Programming using the following Programs using named and unnamed blocks Programs using Cursors, Cursor loops and records
12.	PL/SQL Programming using Creating stored procedures, functions and packages Error handling and Exception Triggers and auditing triggers

## B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Database System Concepts	S. Sudarshan, Henry F. Korth,	6 <sup>th</sup> Edition	McGraw Hill
2.	SQL, PL/SQL	Ivan Bayross		Bpb
3.	Oracle Complete Reference	Kevin Loney		Bpb
<b>Reference Book</b>				
1.	PL/SQL, best practices, Bpb Publications, Steven Feuerstein			
2.	The Oracle Cook Book, Bpb Publications, Liebschuty			
3.	Oracle A Beginners Guide, TMH Publication, Michael Abbey, Michael J.Corey			
<b>Online Resources</b>				
1.	<a href="https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm">https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm</a>			
2.	<a href="https://nptel.ac.in/courses/106106093">https://nptel.ac.in/courses/106106093</a>			
3.	<a href="https://www.coursera.org/learn/introduction-to-relational-databases">https://www.coursera.org/learn/introduction-to-relational-databases</a>			

## Second Semester Departmental Elective/ Professional Elective

### Professional Elective: IV

### Specialization: General/Cyber/AI & DS

<b>Code: 25MCACCA2103</b>	<b>Backend with Java</b>	<b>3 Credits [LTP: 3-0-0]</b>
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CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall and identify basic Java syntax, including data types, variables, and operators.
CO2	Understand	Demonstrate an understanding of the importance of encapsulation, inheritance, polymorphism and abstraction and how it is implemented in Java.
CO3	Apply	Apply object-oriented design principles to create well-structured Java classes and objects.
CO4	Analyze	Analyze existing Java code to identify and debug errors.
CO5	Evaluate	Evaluate the efficiency and performance of different approaches to solving a programming problem in Java

## B. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Java Fundamentals	08
2.	OOP in Java	09
3.	Exception Handling, Collections & File I/O	09
4.	Multithreading & Java 8 Features	07
5.	Basics of Backend Development with Java	07

### C. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Java Fundamentals</b>
	<ul style="list-style-type: none"> <li>• Java architecture &amp; JVM overview</li> <li>• Data types, variables, operators</li> <li>• Control statements (if, switch, loops)</li> <li>• Functions, recursion, method overloading</li> <li>• Arrays and command-line arguments</li> </ul>
<b>2.</b>	<b>OOP in Java</b>
	<ul style="list-style-type: none"> <li>• Classes, Objects, Constructors</li> <li>• <code>this</code> keyword, method overriding</li> <li>• Inheritance, <code>super</code> keyword</li> <li>• Abstraction (abstract classes &amp; interfaces)</li> <li>• Polymorphism</li> </ul>
<b>3.</b>	<b>Exception Handling, Collections &amp; File I/O</b>
	<ul style="list-style-type: none"> <li>• try-catch-finally, throw, throws</li> <li>• Custom exceptions</li> <li>• File reading/writing (<code>FileReader</code>, <code>BufferedReader</code>)</li> <li>• Collections: List, Set, Map basics</li> <li>• Generic</li> </ul>
<b>8.</b>	<b>Multithreading &amp; Java 8 Features</b>
	<ul style="list-style-type: none"> <li>• Thread lifecycle, <code>Runnable</code> vs <code>Thread</code></li> <li>• Synchronization and inter-thread communication</li> <li>• Thread methods: sleep, join, wait, notify</li> <li>• Java 8: Lambda expressions and Functional Interfaces</li> </ul>
<b>9.</b>	<b>Basics of Backend Development with Java</b>
	<ul style="list-style-type: none"> <li>• Introduction to backend (client-server, HTTP basics)</li> <li>• What is an API? Understanding REST</li> <li>• Setting up a basic Spring Boot project</li> <li>• Creating a simple REST controller</li> <li>• Overview of HTTP methods and JSON</li> <li>• Persistence in an in memory Database</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
3.	The complete reference Java –2	Herbert Schildt	V Edition,	TMH.
4.	SAMS teach yourself Java – 2	Rogers Cedenhead and Leura Lemay	3rd Edition	Pearson Education
<b>Reference Book</b>				
4.	The complete reference Java –2			
5.	SAMS teach yourself Java – 2			

Online Resources	
8.	<a href="https://www.programiz.com/java-programming/online-compiler/">https://www.programiz.com/java-programming/online-compiler/</a>
9.	<a href="https://www.tutorialspoint.com/compile_java_online.php">https://www.tutorialspoint.com/compile_java_online.php</a>
10	<a href="https://onecompiler.com/java">https://onecompiler.com/java</a>

#### D. Mapping of CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	1	-	-	-	-	-	-	-	-	2	-	-	-
CO2		2	-		-	-	-	-	-	-	-	-	-	2	-	-
CO3	1	2	-	2	-	-	-	-	-	-	-	-	-	1	-	-
CO4	-	2	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	2	-	-	3	-	-	-	-	-	-	-	-	2	2	-	-

#### Specialization: AIML with SAS

Code: 24MALECA2111	SAS® Visual Text Analytics in SAS® Viya®	3 Credits [LTP: 3-0-0]
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#### COURSE OUTCOME

Students will be able to:

- Use the point-and-click interface of Model Studio and SAS Visual Text Analytics.
- Explore collections of text documents to discover key topics.
- Interpret term maps.
- Identify key textual topics automatically in your large document collections.
- Create robust models for categorizing the content according to your organization's specific needs.

#### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Introduction to SAS Visual Text Analytic	3
2	SAS Visual Text Analytics Demonstrations	4
3	SAS Visual Text Analytics Nodes	6
4	Concept and Category Rule Definitions	4
5	Case Studies	4

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to SAS Visual Text Analytics</b> <ul style="list-style-type: none"> <li>• SAS Visual Text Analytics.</li> <li>• Language challenges (self-study)</li> <li>• Conclusion of Unit</li> </ul>

2.	<b>SAS Visual Text Analytics Demonstrations</b> <ul style="list-style-type: none"> <li>• Converting documents for analysis using SAS Data Explorer.</li> <li>• Creating a project with no predefined concepts.</li> <li>• Creating a project with custom concepts.</li> <li>• Conclusion of Unit</li> </ul>
3.	SAS Visual Text Analytics Nodes <ul style="list-style-type: none"> <li>• Projects.</li> <li>• Concepts and terms.</li> <li>• Machine-generated topics.</li> <li>• Categories.</li> <li>• Document scoring.</li> </ul> Conclusion of unit
4.	Concept and Category Rule Definitions <ul style="list-style-type: none"> <li>• SAS Visual Text Analytics rules.</li> <li>• SAS Visual Text Analytics concept rules.</li> <li>• SAS Visual Text Analytics demo category rules.</li> </ul> Conclusion of unit
5.	Case Studies <ul style="list-style-type: none"> <li>• Retrieving information about anxiety and depression from drug reports.</li> <li>• Automatic categorization of ASRS incident reports.</li> <li>• Retrieving mortgage complaints from the CFPB customer complaints data.</li> </ul> Conclusion of unit

**Professional Elective: V Specialization: General**

<b>Code: 25MCAECA2111</b>	<b>Frontend with Angular JS</b>	<b>3 Credits [LTP: 3-0-0]</b>
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**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall basic concepts of HTML, CSS, JavaScript, and AngularJS framework.
CO2	Understand	Describe structure and styling of web pages using HTML and CSS, and behavior with JavaScript.
CO3	Apply	Create interactive web pages using JavaScript and AngularJS directives and data binding.
CO4	Analyze	Explain how AngularJS enhances frontend development with MVC concepts and dynamic views.
CO5	Evaluate	Build and test small AngularJS applications integrating HTML, CSS, and JavaScript effectively

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	<b>Basics of HTML and CSS</b>	<b>08</b>
2.	<b>Introduction to JavaScript</b>	<b>07</b>
3.	<b>JavaScript DOM Manipulation and Events</b>	<b>09</b>
4.	<b>Introduction to AngularJS and Core Concept</b>	<b>07</b>
5.	<b>AngularJS Directives, Forms, Validation, and \$http Servic</b>	<b>08</b>

## B. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Basics of HTML and CSS</b>
	<ul style="list-style-type: none"> <li>● Introduction to HTML: Elements, tags, attributes</li> <li>● Common HTML tags: headings, paragraphs, links, images, lists, tables</li> <li>● Introduction to CSS: Syntax, selectors, properties, colors, fonts</li> <li>● CSS Box Model and Layout basics: margin, padding, borders</li> <li>● Simple page structuring and styling exercises</li> <li>● Responsive basics with simple media queries</li> </ul>
<b>2.</b>	<b>Introduction to JavaScript</b>
	<ul style="list-style-type: none"> <li>● Variables, data types, operators</li> <li>● Control structures: conditionals, loops</li> <li>● Functions and scope</li> <li>● Arrays and objects basics</li> <li>● Basic debugging and using browser console</li> </ul>
<b>3.</b>	<b>JavaScript DOM Manipulation and Events</b>
	<ul style="list-style-type: none"> <li>● Understanding DOM tree and elements</li> <li>● Accessing and modifying HTML elements dynamically</li> <li>● Event handling: click, input, change events</li> <li>● Simple interactive examples with DOM and events</li> </ul>
<b>4.</b>	<b>Introduction to AngularJS and Core Concept</b>
	<ul style="list-style-type: none"> <li>● What is AngularJS and why use it?</li> <li>● Setting up AngularJS environment (CDN usage)</li> <li>● AngularJS app basics: ng-app, ng-controller</li> <li>● Expressions and data binding: {{ }}, ng-bind</li> <li>● Controllers and scope basics</li> </ul>
<b>5.</b>	<b>AngularJS Directives, Forms, Validation, and \$http Service</b>
	<ul style="list-style-type: none"> <li>● Built-in directives: ng-model, ng-repeat, ng-if, ng-show</li> <li>● Two-way data binding and form inputs</li> <li>● Using filters in AngularJS</li> <li>● Form validation and validation states (\$valid, \$invalid, etc.)</li> <li>● Handling form submission</li> <li>● Introduction to \$http service for AJAX calls</li> <li>● Fetching and displaying data from JSON APIs</li> </ul>

## C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Web Programming, building internet applications	Chris Bates, Dreamtech	Latest	Wiley
2.	The complete Reference HTML and DHTML	A. Powey	Latest	Thomas
3.	The complete Reference J2ME,	James Keogh	Latest	-
4.	Core Servlets and Java Server Pages	Marty Hall Larry Brown	Latest	-
<b>Reference Book</b>				
1.	Internet, World Wide Web, How to program, Dietel , Nieto, PHI/PEA			
2.	Web Tehnologies, Godbole, Kahate, 2 <sup>nd</sup> Ed., TMH			
<b>Online Resources</b>				

1.	<a href="https://nptel.ac.in/courses/106105084">https://nptel.ac.in/courses/106105084</a>
2.	<a href="https://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm">https://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm</a>

### MAPPING OF CO VS PO/PSO

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CO2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	2		-	-	-	-	-	-	-	-	1	-	-	-
CO4	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	3	-	-	-	-	-	-	-	-	2	1	-	-

### Specialization: Artificial Intelligence and Data Science

<b>Code: 25MCDECA2111 Data Science and Analytics</b>	<b>3 Credits [LTP: 3-0-0]</b>
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### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Memorize key programming languages and tools used in data science
CO2	Understand	Comprehend the significance of different machine learning algorithms
CO3	Apply	Implement programming languages and tools to manipulate and process data.
CO4	Analyze	Evaluate the effectiveness of different statistical methods in various scenarios
CO5	Evaluate	Assess the ethical implications of data science and analytics practices

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Statistics	08
2.	Data Analytics	07
3.	Business Intelligence	08
4.	Web Data Analytics	07
5.	Analytics in social Media	07

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Statistics</b> <ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Statistics and Probability</li> <li>● Basic terminologies, contingency table, frequency and cross table, graphs, histogram and frequency polygon, Random variables, statistical properties of random variables, Expectation, jointly distributed random variables, moment generating function, characteristic function, limit theorems, probability, trial, events, types of events, apriori probability, statistical or empirical probability, Bayes theorem,</li> <li>● Regression and Correlation</li> <li>● Introduction to linear model, properties of regression coefficients, Spurious regression concepts, significance of regression coefficients using t test and F test, concepts of auto correlation, multiple linear regression analysis, correlation analysis, properties of correlation coefficients, significance of single correlation coefficient, significance of multiple correlation coefficients, concepts of multiple correlation and partial correlation</li> <li>● Conclusion of Unit</li> </ul>

<b>2.</b>	<b>Data Analytics</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Data Analytics Lifecycle: Overview - Discovery - Data Preparation - Model Planning - Model Building - Communicate Results – Operationalize</li> <li>● Regression analysis</li> <li>● Classification techniques</li> <li>● Clustering</li> <li>● Association rules analysis</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Business Intelligence</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Business intelligence: Definition - Effective and timely decisions - data, information and knowledge – role of mathematical models - BI architectures.</li> <li>● Decision Support Systems: Definition - Representation of the decision-making process - Evolution of information systems - - development of DSS.</li> <li>● Mathematical models for decision making: Structure - development of a model - classes of models</li> </ul> <p>Conclusion of Unit</p>
<b>4.</b>	<b>Web Data Analytics</b>
	<ul style="list-style-type: none"> <li>● Introduction to Web Analytics 2.0</li> <li>● Clickstream</li> <li>● Multiple outcome analysis</li> <li>● Experimentation and testing</li> <li>● Voice of customer</li> <li>● Competitive intelligence</li> <li>● The tactical shift</li> <li>● Optimal strategy for choosing web analytics</li> <li>● Conclusion of Unit</li> </ul>
<b>5..</b>	<b>Analytics in social Media</b>
	<ul style="list-style-type: none"> <li>● Introduction to Analytics in social Media</li> <li>● Types of analytics. Dedicated Vs. Hybrid Tools</li> <li>● Data Integration Tools</li> <li>● Best Setup</li> <li>● Social Network Landscape: Concept and UX on social networks</li> <li>● Interactivity of social network</li> <li>● Content flow on social network</li> <li>● Interaction Pattern between users</li> <li>● Social Media as a two way channel.</li> <li>● Conclusion of Unit</li> </ul>

#### D. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Data Smart: Using Data Science to Transform Information into Insight	John W. Foreman		Wiley Publication
2.	Introduction to probability Models	Sheldon M. Ross	Ninth Edition	Elsevier Publication
3.	Text Mining Classification, Clustering, and Applications	Ashok N. Srivastava, Mehran Sahami		CRC Press
4.	Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity	Avinash Kaushik	1st Edition	Wiley Publishing
5.	Social Media Analytics Strategy - Using Data	Alex Goncalves		APress

	to Optimize Business Performance.			
<b>Reference Book</b>				
1.	Data Science from Scratch: First Principles with Python, Joel Grus, PHI			
2.	Principles of Data Science, SinanOzdemir, PACKT			
3.	Mining Text Data, Charu C. Aggarwal, ChengXiangZhai, Springer Publication			

#### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3	PSO 4
CO1	2	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-
CO2	1	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	1	1	-	2	-	-	-	-	-	-	-	-	1	1	-	-
CO5	-	1	2	1	-	-	-	-	-	-	-	-		1	-	-

#### Specialization: Cyber Security

<b>Code: 25MCYECA2111</b>	<b>Ethical Hacking</b>	<b>3 Credits [LTP: 3-0-0]</b>
<b>COURSE OUTCOME</b>		

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Define basic concepts of Ethical Hacking, Identify different reconnaissance techniques and Penetration Testing techniques.
CO2	Understand	Understand different types of attack on web application server and security elements.
CO3	Apply	Determine web application hacking by different methods.
CO4	Analyze	Explain attacks on database and network and analyze preventing measures.
CO5	Evaluate	Evaluate report writing and mitigation methods of Penetration Testing and reviewing vulnerabilities of network.

#### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Ethical Hacking	07
2.	Hacking methodologies	08
3.	Web Application hacking	08
4.	Database and Network hacking	07
5.	Report writing & Mitigation	07

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction to Ethical Hacking
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Hacking vs. Ethical Hacking</li> <li>● Hacking Methodologies</li> </ul>

	<ul style="list-style-type: none"> <li>● Footprinting and Scanning</li> <li>● Trojans and Viruses</li> <li>● Black Box vs. White Box Techniques</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Hacking methodologies</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Denial of Service and DDOS</li> <li>● Sniffers, Session Hijacking and Hacking Web Servers</li> <li>● Attacks on CIA triad</li> <li>● Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Web Application hacking</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Web Application Vulnerabilities</li> <li>● Web Techniques Based Password Cracking</li> <li>● Web Jacking and its tools</li> <li>● Phishing and its tools</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Database and Network hacking</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● SQL Injection</li> <li>● Hacking Wireless Networking</li> <li>● Worms and Physical Security</li> <li>● Evading IDS and Firewalls</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Report writing &amp; Mitigation</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Report Writing &amp; Mitigation</li> <li>● Requirements for low level reporting &amp; high level reporting of Penetration testing results</li> <li>● Demonstration of vulnerabilities and Mitigation of issues identified including tracking</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Basic of Hacking and Penetration	Patrick Egerbrestson	First Edition	2010
2.	Certified Ethical Hacker All-in-One	Matt Walker	First Edition	2011
<b>Reference Book</b>				
1.	Hacking Exposed - Stuart McClure, Joel Scambray, George Kurtz			
2.	Gray Hat Hacking: The Ethical Hacker's Handbook, Fifth Edition (NETWORKING & COMM - OMG)			
<b>Online Resources</b>				
1.	<a href="https://www.javatpoint.com/ethical-hacking-tutorial">https://www.javatpoint.com/ethical-hacking-tutorial</a>			
2.	<a href="https://www.guru99.com/ethical-hacking-tutorials.html">https://www.guru99.com/ethical-hacking-tutorials.html</a>			
3.	<a href="https://www.youtube.com/watch?v=dz7Ntp7KQGA">https://www.youtube.com/watch?v=dz7Ntp7KQGA</a>			

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	2	-								3	-	-	1
CO2	1	2	1	1	-								1	1	-	1
CO3	-	1	3	-									1	2	1	1

CO4	1	1	-	1	1								-	1	2	2
CO5	-	1	-	-	1								-	-	-	1

### Specialization: AIML with SAS

**Code: 25MALECA2112 Deep Learning Using SAS® Software 3 Credits [LTP: 3-0-0]**

#### COURSE OUTCOME

Students will be able to:

- Define and understand deep learning.
- Build models using deep learning techniques.
- Apply models to score(inference) new data.
- Modify data for better analysis results.
- Search the hyper parameter space of a deep learning model.

#### A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction to Deep Learning	6
2	Convolutional Neural Networks	7
3	Recurrent Neural Networks	4
4	Tuning a Neural Network	6
5	Additional Topics	6

#### B. Detailed Syllabus

Unit	Unit Details
1.	Introduction to Deep Learning
	<ul style="list-style-type: none"> <li>● Introduction to neural networks.</li> <li>● Introduction to deep learning.</li> <li>● ADAM optimization.</li> <li>● Dropout.</li> <li>● Batch normalization.</li> <li>● Auto encoders.</li> </ul>
2.	Convolutional Neural Networks
	<ul style="list-style-type: none"> <li>● Applications.</li> <li>● Input layers.</li> <li>● Convolution allayers.</li> <li>● Padding.</li> <li>● Pooling layers.</li> <li>● Traditional layers.</li> <li>● Types of skip-layer connections.</li> <li>● Image pre-processing and data enrichment.</li> <li>● Training convolutional neural networks.</li> </ul>

3.	Recurrent Neural Networks
	<ul style="list-style-type: none"> <li>● Introduction.</li> <li>● Recurrent neural networks overview.</li> <li>● Sub-types of recurrent neural networks.</li> <li>● Timeseries analysis using recurrent neural networks.</li> <li>● Sentiment analysis using recurrent neural networks.</li> </ul>
4.	Tuning a Neural Network
	<ul style="list-style-type: none"> <li>● Selecting hyperparameters.</li> <li>● Hyper band.</li> </ul>
5.	Additional Topics
	<ul style="list-style-type: none"> <li>● Types of transfer learning.</li> <li>● Transfer learning basics.</li> <li>● Transfer learning strategies.</li> <li>● Transfer learning with unsupervised pretraining.</li> <li>● Customizations with FCMP.</li> </ul>

### Specialization: Cloud & DevOps Technology

<b>Code: 25MCTECA2111</b>	<b>DevOps Lifecycle and Best Practices</b>	<b>3 Credits [LTP: 3-0-0]</b>
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#### COURSE OUTCOME

CO No.	Cognitive Ability	Course Outcomes
CO1	Remember	Recall key DevOps terminologies, concepts, and the evolution of DevOps practices.
CO2	Understand	Explain the DevOps lifecycle stages and the role of automation, collaboration, and CI/CD.
CO3	Apply	Demonstrate use of tools like Git, Jenkins, Docker, and Kubernetes for different phases of DevOps.
CO4	Analyze	Identify performance bottlenecks, integration gaps, and security challenges across DevOps pipelines.
CO5	Evaluate	Assess DevOps metrics, monitoring tools, and industry best practices for quality delivery and feedback.

#### D. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to DevOps</b>	<b>07</b>
2.	<b>DevOps Lifecycle &amp; CI/Cd Pipeline</b>	<b>08</b>
3.	<b>Version Control, Build Automation and continuous Integration</b>	<b>08</b>
4.	<b>Containerization and Orchestration</b>	<b>08</b>

5.	<b>Monitoring, Logging and Best practices</b>	07
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**E. DETAILED SYLLABUS**

Unit No.	Unit Details
<b>1.</b>	<b>Introduction to DevOps</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● What is DevOps? History and Evolution</li> <li>● DevOps vs Traditional IT</li> <li>● Benefits of DevOps: Agility, Speed, Reliability</li> <li>● DevOps Culture: Collaboration and Shared Responsibility</li> <li>● CALMS Framework (Culture, Automation, Lean, Measurement, Sharing)</li> <li>● Overview of DevOps tools ecosystem</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>DevOps Lifecycle &amp; CI/CD Pipeline</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● DevOps Lifecycle: Plan, Develop, Build, Test, Release, Deploy, Operate, Monitor</li> <li>● Introduction to Continuous Integration (CI)</li> <li>● Introduction to Continuous Delivery and Continuous Deployment (CD)</li> <li>● Toolchain overview for CI/CD (Jenkins, GitHub Actions, GitLab CI)</li> <li>● Key principles of automation and feedback loops</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Version Control, Build Automation, and Continuous Integration</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Git basics: clone, commit, push, branch, merge</li> <li>● Git workflows: Git Flow, Feature Branch Workflow</li> <li>● Build automation using tools like Maven, Gradle, or npm</li> <li>● Jenkins setup and pipelines (Freestyle and Declarative)</li> <li>● Integration with GitHub/GitLab</li> <li>● Automated testing and static code analysis</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Containerization and Orchestration</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Introduction to Docker: Images, Containers, Dockerfile</li> <li>● Docker Compose and multi-container setup</li> <li>● Container Registry (Docker Hub, ECR, etc.)</li> <li>● Kubernetes: Pods, Deployments, Services, Namespaces</li> <li>● Helm charts basics for Kubernetes packaging</li> <li>● DevOps practices for container deployment</li> <li>● Conclusion of Unit</li> </ul>

5.	<b>Monitoring, Logging, and Best Practices</b>
	<ul style="list-style-type: none"> <li>• Introduction to Unit</li> <li>• Infrastructure and Application Monitoring (Prometheus, Grafana)</li> <li>• Logging tools (ELK Stack – Elasticsearch, Logstash, Kibana)</li> <li>• Incident response and alerting</li> <li>• DevOps Metrics: Lead time, MTTR, Deployment frequency, Change failure rate</li> <li>• Best Practices: Infrastructure as Code (IaC), Security (DevSecOps), Documentation</li> <li>• DevOps case studies from industry</li> <li>• Conclusion of Unit</li> </ul>

**A. RECOMMENDED STUDY MATERIAL**

S. No	Text Books:	Author	Edition	Publication
1.	The DevOps Handbook	Gene Kim, Patrick Debois	Latest Edition	IT Revolution
2.	Accelerate: The Science of DevOps	Nicole Forsgren et al.	Latest Edition	IT Revolution
<b>Reference Book</b>				
1.	<i>DevOps</i> by Jennifer Davis & Katherine Daniels			
2.	<i>Docker Deep Dive</i> by Nigel Poulton			
<b>Online Resources</b>				
1.	<ul style="list-style-type: none"> <li>• <a href="#">DevOps with AWS (AWS Training)</a></li> <li>• <a href="#">Microsoft DevOps Documentation</a></li> </ul>			

**MAPPING OF CO VS PO/PSO**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-		-									-	-	3
CO2		3	2	1	-										-	
CO3	-	2	2	1	1											
CO4			2	2	2								-			
CO5	3	2	2	2									-	-	-	

**Professional Elective- VI**

**Specialization: General**

**Code:25MCAECA2112 Soft Computing**

**3 Credits [LTP: 3-0-0]**

**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall hard computing and describe soft computing techniques and their applications
CO2	Understand	Demonstrate an understanding of Fuzzy logic system and its implementation.
CO3	Apply	Apply to understand various neural network architectures and functions.
CO4	Analyze	Analyse the genetic algorithm and other optimization concepts and their applications.
CO5	Evaluate	Evaluate suitable Soft Computing technology to solve the Multi-Objective Optimization Problems.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to Soft Computing</b>	8
2.	<b>Fuzzy Logic</b>	7
3.	<b>Artificial Neural Networks</b>	7
4.	<b>Nature Inspired Algorithms</b>	8
5.	<b>Multi-Objective Optimization</b>	8

**B. DETAILED SYLLABUS**

Unit No.	Unit Details
1.	<b>Introduction to Soft Computing</b> <ul style="list-style-type: none"><li>● Introduction of Unit</li><li>● Concept of Computing Systems</li><li>● Soft Computing Versus Hard Computing</li><li>● Characteristics of Soft Computing,</li><li>● Applications of Soft Computing Techniques</li><li>● Conclusion of Unit</li></ul>
2.	<b>Fuzzy Logic</b> <ul style="list-style-type: none"><li>● Introduction of Unit</li><li>● Fuzzy Sets and Membership Functions,</li><li>● Operations on Fuzzy Sets,</li><li>● Fuzzy Relations, Rules, Propositions,</li><li>● Implications and Inferences,</li><li>● Defuzzification Techniques - Fuzzy Logic Controller Design,</li><li>● Applications of Fuzzy Logic</li><li>● Conclusion of Unit</li></ul>
3.	<b>Artificial Neural Networks</b> <ul style="list-style-type: none"><li>● Introduction of Unit</li><li>● Biological Neurons and its Working,</li><li>● Simulation of Biological Neurons to Problem Solving,</li><li>● Different ANNs Architectures,</li><li>● Training Techniques for ANNs,</li><li>● Applications of ANNs to Solve Real Life Problems</li><li>● Conclusion of Unit</li></ul>



**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Innovative methods and concepts of Internet of Things (IoT), recognize various devices, sensors and applications
CO2	Understand	Recognize the design concept to IoT solutions and fundamental enable techniques.
CO3	Apply	Demonstrating various IoT Model and Architecture M2M and IoT architectures
CO4	Analyze	Integrate and Evaluate design issues in IoT applications, Back-end and Data Handling Analysis
CO5	Evaluate	Assess and create IoT solutions using sensors, actuators, devices with cloud computing and Case Study.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to IoT	8
2.	IoT Networking Core	8
3.	IoT Architecture	7
4.	IoT Application development	8
5.	Industrial IoT	7

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	<p><b>Introduction to IoT</b></p> <ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● IoT Definition, Characteristics of IoT</li> <li>● Functional Blocks, Physical design of IoT, Logical design of IoT</li> <li>● Communication models &amp; APIs</li> <li>● Sensors, Actuators, Networking basics,</li> <li>● Communication Protocols</li> <li>● Sensor Networks</li> <li>● Conclusion of Unit</li> </ul>
2.	<p><b>IoT Networking Core</b></p> <ul style="list-style-type: none"> <li>● Introduction to unit</li> <li>● Introduction to Arduino Programming</li> <li>● Integration of Sensors and Actuators with Arduino</li> <li>● Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi</li> <li>● Other IoT supported hardware platforms such as: ARM Cortex Processors, Intel Galileo boards</li> <li>● Wireless networking equipment and configurations</li> <li>● Accessing hardware and device file interactions</li> <li>● Conclusion of Unit</li> </ul>
3.	<p><b>IoT Architecture</b></p>

	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● IoT reference Model and Architecture</li> <li>● Remote monitoring and sensing</li> <li>● Remote controlling and performance analysis</li> <li>● Communication pattern, 6LoWPAN,</li> <li>● Sensors and sensor Node and interfacing using any Embedded target boards</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>IoT Application Development</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Node MCU</li> <li>● Node MCU Pin Description</li> <li>● Programming of NodeMCU using Arduino IDE</li> <li>● Application protocols: MQTT, REST/HTTP, CoAP, MySQL</li> <li>● Back-end Application Designing</li> <li>● Apache for handling HTTP Requests</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Industrial IoT</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Cloud Computing Platforms for IoT</li> <li>● Data Handling and Analytics</li> <li>● Sensor-Cloud, Cloud Computing Services for IoT</li> <li>● Case Study: Agriculture, Healthcare, Activity Monitoring</li> <li>● Conclusion of Unit</li> </ul>

### C.RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Internet of Things: Architectures, Protocols and Standards	Simone Cirani, Gianluigi, Marco, and Luca Veltri	Latest	WILEY
2.	Internet of Things	RMD SundaramShriram K Vasudevan, Abhishek S	Latest	WILEY
<b>Reference Book</b>				
1.	Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, John Wiley and Sons			
2.	Internet of Things (A Hands-on Approach), Vijay Madiseti and Arshdeep Bahga, 1 <sup>st</sup> Edition, VPT, 2014			
<b>Online Resources</b>				
1	<a href="https://onlinecourses.nptel.ac.in/noc22_cs53/preview">https://onlinecourses.nptel.ac.in/noc22_cs53/preview</a>			
2	<a href="https://www.tutorialspoint.com/internet_of_things/index.htm">https://www.tutorialspoint.com/internet_of_things/index.htm</a>			

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PS O 4
CO1	2	3		2	-	-	-	-	-	-	-	-	3	2	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3		-	1	3	-	-	-	-	-	-	-	-	2	2	-	-
CO4	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	-	3	-	-	-	-	-	-	-	-	3	2	-	-

**Specialization: AI& DS**

<b>Code: 25MCDECA2112</b>	<b>Machine Learning</b>	<b>3 Credits [LTP: 3-0-0]</b>
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**COURSE OUTCOME**

<b>CO</b>	<b>Cognitive Abilities</b>	<b>Course Outcomes</b>
CO1	Remember	Introduction of Machine Learning, development history, Classification of ML, Reinforcement Learning Working, Markov Decision Process
CO2	Understand	Regression and Correlation, Types of Regression, Contingency Table
CO3	Apply	Classification model building, Logistic Regression Decision Trees, Random forest, SVM
CO4	Analyze	Clustering and its Workflow, Types of clustering , K-means clustering. Fuzzy C Means Algorithm
CO5	Evaluate	Evaluation, Performance Metrics, Performance metrics for Regression (MAE, MSE, RMSE), Performance Clustering

**A. OUTLINE OF THE COURSE**

<b>Unit No.</b>	<b>Title of The Unit</b>	<b>Time required for the Unit (Hours)</b>
1.	<b>Introduction to Machine Learning</b>	<b>07</b>
2.	<b>Regression</b>	<b>08</b>
3.	<b>Classification</b>	<b>08</b>
4.	<b>Clustering</b>	<b>07</b>
5.	<b>Performance Metrics</b>	<b>07</b>

**B. DETAILED SYLLABUS**

<b>Unit</b>	<b>Unit Details</b>
1.	<b>Introduction to Machine Learning</b>
	<ul style="list-style-type: none"> <li>● Introduction to Machine Learning</li> <li>● Definition of Machine Learning</li> <li>● Working principles of Machine Learning</li> <li>● Classification of Machine Learning - Supervised Learning, Unsupervised Learning, Reinforcement Learning</li> <li>● Supervised Learning: Classification and Regression</li> <li>● Unsupervised Learning: Clustering and Association</li> <li>● Reinforcement Learning</li> <li>● Types of Reinforcement learning - Positive Reinforcement and Negative Reinforcement.</li> <li>● Working of Reinforcement learning</li> <li>● Markov Decision Process</li> <li>● Reinforcement Learning Algorithms: Q-Learning and State Action Reward State action (SARSA)</li> <li>● Application of Reinforcement Learning</li> <li>● Conclusion of Unit</li> </ul>
2.	<b>Regression</b>

	<ul style="list-style-type: none"> <li>● Introduction to Regression</li> <li>● Types of Regression: Linear regression, Logistics regression, Ridge Regression, Lasso Regression, Bayesian Linear Regression and Polynomial Regression</li> <li>● Regression and Correlation</li> <li>● Crosstabs and Scatterplots</li> <li>● Pearson's Regression – Finding The line</li> <li>● Regression – Describing the line</li> <li>● Contingency Tables</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Classification</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Classification model building</li> <li>● Types of Classification Algorithm: Binary Classification and Multi Class Classification</li> <li>● Logistic Regression</li> <li>● k-Nearest Neighbors</li> <li>● Decision Trees</li> <li>● Random Forest</li> <li>● Support Vector Machine</li> <li>● Naïve bayes</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Clustering</b>
	<ul style="list-style-type: none"> <li>● Introduction of clustering</li> <li>● Clustering Workflow</li> <li>● Types of Clustering: Centroid-based clustering, Density-based clustering, Distribution-based Clustering and Hierarchical clustering</li> <li>● K- means Clustering</li> <li>● Agglomerative Nesting or AGNES</li> <li>● Fuzzy C Means Algorithm – FANNY (Fuzzy Analysis Clustering)</li> <li>● Mean Shift Clustering</li> <li>● DBSCAN – Density-based Spatial Clustering</li> <li>● Gaussian Mixed Models (GMM) with Expectation-Maximization Clustering</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Performance Metrics</b>
	<ul style="list-style-type: none"> <li>● Introduction of Performance metrics</li> <li>● Performance metrics for Regression : Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), R-Squared, Adjusted R-squared</li> <li>● Performance metrics for classification: Accuracy, Confusion Matrix, Precision, Recall, F1 score, ROC AUC, Kappa, MCC (Matthews Correlation Coefficient) and Log-loss.</li> <li>● Performance metrics for clustering : Silhouette Score, Rand Index, Adjusted Rand Index, Mutual Information, Calinski-Harabasz Index and Davies-Bouldin Index</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1	Machine Learning – An Algorithmic Perspective, Chapman and Hall	Stephen Marsland	Second Edition	CRC Press
2	Machine Learning	Tom M Mitchell	First Edition	McGraw Hill Education
<b>Reference Book</b>				
6.	Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, Ethem Alpaydin.			

7.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data, 1 st Edition, Cambridge University Press, Peter Flach.
<b>Online Resources</b>	
1.	<a href="https://nptel.ac.in/courses/106106139">https://nptel.ac.in/courses/106106139</a>
2.	<a href="https://www.udemy.com/course/machine-learning-course/">https://www.udemy.com/course/machine-learning-course/</a>
3.	<a href="https://www.javatpoint.com/machine-learning">https://www.javatpoint.com/machine-learning</a>

### Mapping of CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	2	-								3	-	-	1
CO2	2	2	1	1	-								2	1	-	1
CO3	-	1	3	-	1								1	2	1	1
CO4	1	2	-	-	1								-	1	2	2
CO5	-	1	-	-	-								-	-	-	1

Code: 25MCYECA2112Cyber Forensic

3 Credits [LTP: 3-0-0]

#### A. COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall the fundamental principles and methodologies of cyber forensics, including evidence collection, preservation, and analysis techniques. Memorize key legal and ethical considerations related to cyber investigations, including chain of custody and rules of evidence.
CO2	Understand	Grasp the underlying concepts of digital evidence, file systems, and data storage mechanisms. Understand the forensic process, from initial incident response to evidence presentation in legal proceedings.
CO3	Apply	Apply forensic tools and techniques to collect, preserve, and analyze digital evidence from diverse sources, including computers, mobile devices, and network logs. Utilize forensic imaging tools to create bit-by-bit copies of storage media while maintaining data integrity.
CO4	Analyze	Analyze digital evidence to reconstruct timelines, identify attack vectors, and establish the sequence of events in a cyber incident.
CO5	Evaluate	Evaluate the reliability and admissibility of digital evidence in legal proceedings, considering factors such as authenticity, relevance, and probative value.

#### B. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Cyber Forensics	07
2.	Storage Devices & Data Recover Methods	08
3.	Forensics Techniques I	08
4.	Forensics Techniques II	07
5.	Cyber Law	07

#### C. DETAILED SYLLABUS

Unit	Unit Details
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<b>1.</b>	<b>Introduction to Cyber Forensics</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit Introduction to Computer Forensics</li> <li>● Forms of Cyber Crime</li> <li>● First Responder Procedure- Non-technical staff, Technical Staff,</li> <li>● Forensics Expert and Computer Investigation procedure</li> <li>● Conclusion of Unit</li> </ul>
<b>2.</b>	<b>Storage Devices &amp; Data Recovery Methods</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Storage Devices- Magnetic Medium, Non-magnetic medium and Optical Medium.</li> <li>● Working of Storage devices-Platter, Head assembly, spindle motor.</li> <li>● Data Acquisition</li> <li>● Data deletion and data recovery method and techniques</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Forensics Techniques I</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Windows forensic</li> <li>● Linux Forensics</li> <li>● Mobile Forensics</li> <li>● Steganography, Application</li> <li>● Password cracking-Brute force</li> <li>● Conclusion of Unit</li> </ul>

<b>4.</b>	<b>Forensics Techniques II</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Dictionary attack</li> <li>● Rainbow attack</li> <li>● Email Tacking – Header option of SMTP, POP3, IMAP</li> <li>● Arsenal – Surveillance Tools</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Cyber Law</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit Corporate espionage</li> <li>● Evidence handling procedure</li> <li>● Chain of custody</li> <li>● Main features of Indian IT Act 2008 (Amendment)</li> <li>● Conclusion of Unit</li> </ul>

#### D. RECOMMENDED STUDY MATERIAL.

S. No	Text Books:	Author	Edition	Publication
1.	Guide to Computer Forensics and Investigations	B. Nelson	First Edition	Cengage, 2010 BBS
2.	Hacking Exposed Computer Forensics	Aaron Philipp, David Cowen, Chris Davis	First Edition	McGraw Hill-2011
<b>Reference Book</b>				
1.	Introduction to Computer Forensics and Digital Investigation, Rauf gauney			
2.	MariE-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Learning; 2nd Edition, 2014			
<b>Online Resources</b>				

1.	<a href="https://www.techtarget.com/searchsecurity/definition/computer-forensics">https://www.techtarget.com/searchsecurity/definition/computer-forensics</a>
2.	<a href="https://intellipaat.com/blog/what-is-cyber-forensics/">https://intellipaat.com/blog/what-is-cyber-forensics/</a>
3.	<a href="https://www.educba.com/cyber-forensics/">https://www.educba.com/cyber-forensics/</a>

### Mapping of CO PO/PSO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	1	-	1
CO2	-	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	1	1	3	1	-	-	-	-	-	-	-	-	1	1	-	2
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	1	2	-	1	-	-	-	-	-	-	-	-	-	1	-	1

**Code:25MALECA2113 Neural network : Essentials**

**3 Credits[LTP: 3-0-0]**

### COURSE OUTCOME

Students will be able to:

1. You gain hands-on practice building neural networks in SAS 9.4 and the cutting-edge cloud computing platform for big data analytics, SAS Viya.
2. Building Neural networks in SAS 9.4 and SAS Viya.
3. Modify neural networks' parameters for better performance.
4. Conduct automatic search for neural networks' hyperparameters through genetic algorithm.
5. Enhance data with autoencoders and synthetic observations.

### A. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction	6
2	Supervised Learning	7
3	Attractor Neural Networks	4
4	Self-organization Feature Map	6
5	Deep learning	6

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	Introduction
	<ul style="list-style-type: none"> <li>• Biological Neuron – Artificial Neural Model</li> <li>• Types of activation functions – Architecture:</li> <li>• Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability,</li> <li>• Non-Linear Separable Problem. XOR Problem,</li> <li>• Multilayer Networks. Learning: Learning Algorithms,</li> <li>• Error correction and Gradient Descent Rules,</li> <li>• Learning objective of TLNs, Perceptron Learning Algorithm,</li> <li>• Perceptron Convergence Theorem. L1, L2</li> </ul>
2.	Supervised Learning
	<ul style="list-style-type: none"> <li>• Perceptron learning and Non Separable sets</li> <li>• A-Least Mean Square Learning</li> <li>• MSE Error surface, Steepest Descent Search,</li> <li>• j-LMS approximate to gradient descent,</li> <li>• Application of LMS to Noise Cancelling,</li> <li>• Multi-layered Network Architecture, Back propagation Learning Algorithm,</li> <li>• Practical consideration of BP algorithm. L1,L2, L3</li> </ul>

<b>3.</b>	<b>Attractor Neural Networks</b>
	<ul style="list-style-type: none"> <li>• Associative Learning Attractor Associative Memory</li> <li>• Linear Associative memory</li> <li>• Hopfield Network, application of Hopfield Network</li> <li>• Brain State in a Box neural Network</li> <li>• , Simulated Annealing, Boltzmann Machine,</li> <li>• Bidirectional Associative Memory. L1,L2, L3</li> </ul>
<b>4.</b>	<b>Self-organization Feature Map</b>
	<ul style="list-style-type: none"> <li>• Maximal Eigenvector Filtering, Extracting Principal Components</li> <li>• Generalized Learning Laws, Vector Quantization</li> <li>• Self-organization Feature Maps, Application of SOM,</li> <li>• Growing Neural Gas. L1,L2, L3</li> </ul>
<b>5.</b>	<b>Deep learning</b>
	<ul style="list-style-type: none"> <li>• Hands-on practice building neural networks in SAS 9.4 and the cutting-edge cloud computing platform for big data analytics, SAS Viya.</li> </ul>

<b>Code: 25MCTECA2112</b>	<b>Containerization &amp; Orchestration with Kubernetes</b>	<b>3 Credits[LTP:</b>
<b>3-0-0]</b>		

#### COURSEOUTCOME

<b>CO No.</b>	<b>Cognitive Ability</b>	<b>Course Outcome</b>
CO1	Remember	Define and explain key concepts of containerization and orchestration.
CO2	Understand	Describe Docker architecture and Kubernetes components.
CO3	Apply	Deploy and manage containerized applications using Docker and Kubernetes.
CO4	Analyze	Inspect and troubleshoot container orchestration workflows.
CO5	Evaluate	Assess container deployment strategies and performance using orchestration tools like Kubernetes.

#### A. OUTLINE OF THE COURSE

<b>Unit No.</b>	<b>Title of The Unit</b>	<b>Time required for the Unit (Hours)</b>
<b>1.</b>	Introduction to Containers and Docker	<b>07</b>
<b>2.</b>	Container Lifecycle and Dockerfile	<b>08</b>
<b>3.</b>	Kubernetes Architecture and Installation	<b>08</b>
<b>4.</b>	Core Kubernetes Objects	<b>07</b>
<b>5.</b>	Advanced Kubernetes Operations and Best Practices	<b>07</b>

#### B. DETAILED SYLLABUS

<b>Unit</b>	<b>Unit Details</b>
<b>1.</b>	<b>Introduction to Containers and Docker</b>

	<ul style="list-style-type: none"> <li>• What is a container? Benefits and comparison with VMs</li> <li>• Introduction to Docker: Images, containers, volumes, and networks</li> <li>• Docker CLI basics: <code>docker run</code>, <code>build</code>, <code>exec</code>, <code>logs</code></li> <li>• Docker Hub and image repositories</li> </ul>
<b>2.</b>	<b>Container Lifecycle and Dockerfile</b>
	<ul style="list-style-type: none"> <li>• Building custom images using Dockerfile</li> <li>• Docker Compose basics for multi-container apps</li> <li>• Managing volumes and persistent storage</li> <li>• Common troubleshooting techniques and logs</li> <li>• Security best practices in Docker</li> </ul>
<b>3.</b>	<b>Kubernetes Architecture and Installation</b>
	<ul style="list-style-type: none"> <li>• What is Kubernetes? Why Kubernetes over Docker Swarm?</li> <li>• Components: Master node (API Server, Scheduler, Controller), Worker node (kubelet, kube-proxy)</li> <li>• Minikube setup for local clusters</li> <li>• Using <code>kubectl</code> to interact with the cluster</li> <li>• YAML syntax basics for Kubernetes configurations</li> </ul>

<b>4.</b>	<b>Core Kubernetes Objects</b>
	<ul style="list-style-type: none"> <li>• Pods: Definition, lifecycle, and health checks</li> <li>• Deployments and ReplicaSets</li> <li>• Services: ClusterIP, NodePort, LoadBalancer</li> <li>• Config Maps and Secrets</li> <li>• Namespaces for multi-environment management</li> </ul>
<b>5.</b>	<b>Advanced Kubernetes Operations and Best Practices</b>
	<ul style="list-style-type: none"> <li>• Horizontal Pod Autoscaling</li> <li>• Rolling updates and rollbacks</li> <li>• Introduction to Helm (optional for beginners)</li> <li>• Resource quotas and limits</li> <li>• Logging and monitoring overview: Intro to Prometheus and Grafana</li> <li>• Best practices for app deployment in Kubernetes</li> </ul>

#### E. RECOMMENDED STUDY MATERIAL.

S. No	Text Books:	Author	Edition	Publication
1.	Docker Deep Dive	Nigel Poulton	First Edition	Independently Published
2.	Kubernetes Up and Running	B. Burns, J. Beda, K. Hightower	First Edition	O'Reilly Media

**Note: Text Books to be read first followed by reference book.**



4	<b>Methods and Control Structures</b>	A. Demonstrate the use of methods ( <code>add()</code> , <code>subtract()</code> , etc.) B. Create a package and use it with <code>import</code> and fully qualified names
5	<b>Using Packages and Interfaces</b>	A. Demonstrate interface and abstract class usage
6	<b>Exception Handling in Java</b>	A. Write a program using <code>try-catch-finally</code> and <code>throw</code> B. Create a user-defined exception for invalid age

7	<b>File Input/Output Operations</b>	A. Read content from a text file B. Write user input to a file
8	<b>Exploring Java Collections</b>	A. Use <code>ArrayList</code> and <code>HashMap</code> to store and manage data B. Sort a list of students by name or score
9	<b>Multithreading and Synchronization</b>	A. Create multiple threads (e.g., count up/down) B. Demonstrate synchronization using a shared bank balance
10	<b>Java 8 Features: Lambdas and Functional Interfaces</b>	A. Use Lambda expressions to filter a list B. Demonstrate use of a functional interface
11	<b>Introduction to Spring Boot and REST API</b>	A. Set up a simple Spring Boot project using Spring Initializer B. Create a basic REST API with <code>GET</code> and <code>POST</code> endpoints for student data
12	<b>Mini Project: Java Backend Application</b>	Build a complete REST API to manage employee records, persistence in an in memory DB(H2) (CRUD operations). Test all endpoints using Postman

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	The complete reference Java –2	Herbert Schildt	V Edition,	TMH.
2.	SAMS teach yourself Java – 2	Rogers and Leura Lemay	3rd Edition,	Pearson Education
<b>Reference Book</b>				
1.	The complete reference Java –2			
2.	SAMS teach yourself Java – 2			
<b>Online Resources</b>				
1.	<a href="https://www.programiz.com/java-programming/online-compiler/">https://www.programiz.com/java-programming/online-compiler/</a>			
2.	<a href="https://www.tutorialspoint.com/compile_java_online.php">https://www.tutorialspoint.com/compile_java_online.php</a>			
3.	<a href="https://onecompiler.com/java">https://onecompiler.com/java</a>			

**Specialization: AIML with SAS**

<b>Code:25MALECA2211 SAS® Visual Text Analytics in SAS® Viya®</b>	<b>3 Credits [LTP: 3-0-0]</b>
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**COURSE OUTCOME**

Students will be able to:

- Use the point-and-click interface of Model Studio and SAS Visual Text Analytics.
- Explore collections of text documents to discover key topics.
- Interpret term maps.
- Identify key textual topics automatically in your large document collections.
- Create robust models for categorizing the content according to your organization's specific needs.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	<b>Introduction to SAS Visual Text Analytics</b>	3
2	<b>SAS Visual Text Analytics Demonstrations</b>	4
3	<b>SAS Visual Text Analytics Nodes</b>	6
4	<b>Concept and Category Rule Definitions</b>	4
5	<b>Case Studies</b>	4

**A. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Introduction to SAS Visual Text Analytics</b>
	<ul style="list-style-type: none"> <li>● SAS Visual Text Analytics.</li> <li>● Language challenges (self-study)</li> </ul>
2.	<b>SAS Visual Text Analytics Demonstrations</b>
	<ul style="list-style-type: none"> <li>● Converting documents for analysis using SAS Data Explorer.</li> <li>● Creating a project with no predefined concepts.</li> <li>● Creating a project with custom concepts.</li> </ul>
3.	<b>SAS Visual Text Analytics Nodes</b>
	<ul style="list-style-type: none"> <li>● Projects.</li> <li>● Concepts and terms.</li> <li>● Machine-generated topics.</li> <li>● Categories.</li> <li>● Document scoring.</li> </ul>
4.	<b>Concept and Category Rule Definitions</b>
	<ul style="list-style-type: none"> <li>● SAS Visual Text Analytics rules.</li> <li>● SAS Visual Text Analytics concept rules.</li> <li>● SAS Visual Text Analytics demo category rules.</li> </ul>
5.	<b>Case Studies</b>
	<ul style="list-style-type: none"> <li>● Retrieving information about anxiety and depression from drug reports.</li> <li>● Automatic categorization of ASRS incident reports.</li> <li>● Retrieving mortgage complaints from the CFPB customer complaints data</li> </ul>

### Professional Elective Lab-IV Specialization: General

Code: 25MCAECA2211

Frontend With Angular Lab

1 Credit[LTP: 0-0-2]

#### Course Outcome:-

Students will be able to:

- Run web programming
- Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's.
- Describe Web Application Terminologies, Internet Tools, E – Commerce and other web services.
- Define Database Connectivity to web applications.
- Familiarize with Client-Side Programming, Server-Side Programming, Active server Pages.

#### A. LIST OF EXPERIMENTS:

1.	Design of the Web pages using various features of HTML and DHTML
2.	Client server programming using Servlets, ASP and JSP on the server side and java script on the client side
3.	Web enabling of databases
4.	Multimedia effects on web pages design using Flash.
5.	Case Study: Design & Development of Websites with Database Connectivity and Multimedia Effects
6.	Creating Online shopping
7.	Creating Online examination
8.	Design Chat system
9.	Design Mailing system
10.	Design a university home page
11.	Design navigation on university home page
12.	Design a website as minor project

#### B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Web Programming, building internet applications	Chris Bates, Dreamtech	Latest	Wiley
2.	The complete Reference HTML and DHTML	A. Powey	Latest	Thomas
3.	The complete Reference J2ME,	James Keogh	Latest	-
4.	Core Servlets and Java Server Pages	Marty Hall Larry Brown	Latest	-
<b>Reference Book</b>				
1.	Internet, World Wide Web, How to program, Dietel , Nieto, PHI/PEA			
2.	Web Tehnologies, Godbole, Kahate, 2 <sup>nd</sup> Ed., TMH			
<b>Online Resources</b>				
1.	<a href="https://nptel.ac.in/courses/106105084">https://nptel.ac.in/courses/106105084</a>			
2.	<a href="https://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm">https://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm</a>			

**Specialization: AI& DS**

<b>Code:25MCDECA2211</b>	<b>R Programming Lab</b>	<b>1 Credit [LTP: 0-0-2]</b>
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**Course outcomes:**

Students will be able to:

- Run the procedure to read and write different format of data set into R environment
- apply function in R programming language
- Implement different options in I/O operations in R programming Language,
- interpret of summary statistics and test hypothesis
- perform non-parametric testing of hypothesis in R

**A. LIST of EXPERIMENTS**

S.No	Programs
<b>Part-A</b>	
1	Install and configure R, set working directory.
2	Install Packages and calling installed packages.
3	R studio environment and functionalities of R studio.
4	Implement basic R operations (data input, missing values, importing data into R using different formats :xlsx, CSV, Text files).
5	Use R as a calculator.
6	Explore various functionalities of data frames.
7	Create data set using data frames, list and tables.
8	Create the contingency table for the given raw data.
9	Create the interactive user input code line in r using readline ( ) function.
10	Create the contingency table for the given vector format data.
11	Convert the contingency table to original format of the given data.
12	Analyze and give interpretation of summary statistics for the given data.
13	Calculate mean, median and mode for the grouped data and compare the results for the given data.
14	Analyse the given data for non-parametric tests and give the interpretations.
15	Use R for test the given data In order to compare the effectiveness of two sources of nitrogen, namely ammonium chloride (NH <sub>4</sub> Cl) and urea, on grain yield of Coarse cereal, an experiment was conducted. The results on the grain yield of Coarse Cereal (kg/plot) under the two treatments are given below. NH <sub>4</sub> Cl : 13.4, 10.9, 11.2, 11.8, 14.0, 15.3, 14.2, 12.6, 17.0, 16.2, 16.5, 15.7. Urea : 12.0, 11.7, 10.7, 11.2, 14.8, 14.4, 13.9, 13.7, 16.9, 16.0, 15.6, 16.0. Assess which source of nitrogen is better for Coarse Cereal.

<b>Part B</b>	
1	Use R for test the given data A health status survey in a few villages revealed that the normal serum protein value of children in that locality is 7.0 g/100ml. A group of 16 children who received high protein food for a period of six months had serum protein values shown below. Can we consider that the mean serum protein level of those who were fed on high protein diet is different from that of the general population? S.No. (Child No.)            1        2        3        4        5        6        7        8 Protein level (g%)            7.10 7.70 8.20 7.56 7.05 7.08 7.21 7.25  S.No. (Child No.)            9        10    11    12    13    14    15    16 Protein level (g%)            7.36 6.59 6.85 7.90 7.27 6.56 7.93 8.56
2	Students were selected to training. Their performance was noted by giving a test and the marks recorded out of 50. They were given effective 6 months training and again they were given a test and marks were recorded out of 50. Students            1        2        3        4        5        6        7        8        9        10 Before training 25        20        35        15        42        28        26        44        35        48 After training    26        20        34        13        43        40        29        41        36        46 By applying the t-test can it be concluded that the students have benefited by the training?

3	100 individuals of a particular race were tested with an intelligence test and classified into two classes. Another group of 120 individuals belong to another race were administered the same intelligence test and classified into the same two classes. The following are the observed frequencies of the two races: Race Intelligence Intelligent      Non-intelligent      Total Race I            42   58   100 Race II            55   65   120 Total              97   123   220 Test whether the intelligence is anything to do with the race.
4	Obtain the correlation coefficient between the heights of father(X) and of the son (Y) from the following data X      65      66      67      68      69      70      71      72 Y      67      68      65      68      72      72      69      71 And also test its significance. Using R functions.
5	Consider the inbuilt data set cars.
6	Find Correlation between possible variables and pairwise correlation
7	Find regression line between appropriate variables.
8	Display the summary statistics and comment on the results

## B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Beginning R: The statistical Programming Language	Dr. Mark Gardener	Latest Edition	John Wiley & Sons, Inc.
2.	The art of R programming	Norman Matloff	Latest Edition	no starch Press, San Francisco
3.	Advanced R	Ken Black	Sixth Edition	John Wiley & Sons, Inc.
<b>Reference Book</b>				
1.	Introduction to Probability and Statistics for Engineers and Scientists and Andrew Robinson, CRC Press		Owen Jones, Robert Maillardet	
2.	The R Book, Hadley Wickham, CRC Press			
<b>Online Resources</b>				
1.	<a href="https://www.r-project.org/about.html">https://www.r-project.org/about.html</a>			
2.	<a href="https://nptel.ac.in/courses/111104100">https://nptel.ac.in/courses/111104100</a>			
3.	<a href="https://www.w3schools.com/r/">https://www.w3schools.com/r/</a>			

### Specialization: Cyber Security

<b>Code: 25MCYECA2211Ethical Hacking Lab</b>	<b>1 Credit[LTP: 0-0-2]</b>
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#### Course outcomes:

Students will be able to:

- Translate end-user requirements into system and software requirements
- Generate a high-level design of the system from the software requirements
- Get experience and/or awareness of testing problems and will be able to develop a simple testing report
- Create and analyze Trojans
- Use different Data recovery and password protecting tool's for network security and analysis

### A. LIST OF EXPERIMENTS:

1	Passive Reconnaissance using “Who is” and Online tools.
2	Active Reconnaissance using “Sam spade” and web site details
3	Full Scan, Half Open Scan and Stealth scan using “nmap”
4	UDP and Ping Scanning using “Advance LAN Scanner” and “Super Scanner”
5	Packet crafting using “Packet creator” tools
6	Exploiting NetBIOS vulnerability
7	Password Revelation from browsers and social networking application
8	Creating and Analyzing spoofed emails
9	Analyzing the Trojans
10	Creating the Trojans
11	OS password cracking
12	Data recovery and password protecting techniques for Pen drive and CD

### B. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Hacking: The Art of Exploitation	Jon Erickson	Ist	Cengage, 2010 BBS
2.	Basics of Hacking and Penetration Testing	Patrick Enggbretson	Ist	McGraw Hill-2011
<b>Reference Book</b>				
1.	Introduction to Computer Forensics and Digital Investigation, Rauf gauney			
2.	MariE-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Learning; 2nd Edition, 2014			
<b>Online Resources</b>				
1.	<a href="https://www.techtarget.com/searchsecurity/definition/computer-forensics">https://www.techtarget.com/searchsecurity/definition/computer-forensics</a>			
2.	<a href="https://intellipaat.com/blog/what-is-cyber-forensics/">https://intellipaat.com/blog/what-is-cyber-forensics/</a>			

### Specialization: AIML with SAS :

**Code:25MALECA2212 Deep Learning Using SAS® Software Lab3 Credits [LTP: 3-0-0]**

#### COURSE OUTCOME

Students will be able to:

- Define and under stand deep learning.
- Build models using deep learning techniques.
- Apply models to score(inference)new data.
- Modify data for better analysis results.
- Search the hyper parameter space of a deep learning model.

Lab No	Details
1.	<ul style="list-style-type: none"> <li>● ADAMoptimization.</li> <li>● Dropout.</li> <li>● Batch normalization.</li> <li>● Auto encoders.</li> </ul>

2.	Convolutional Neural Networks
	<ul style="list-style-type: none"> <li>● Input layers.</li> <li>● Convolution allayers.</li> <li>● Padding.</li> <li>● Pooling layers.</li> <li>● Traditional layers.</li> <li>● Types of skip-layer connections.</li> <li>● Image pre-processing and data enrichment.</li> <li>● Training convolutional neural networks.</li> </ul>
6.	Recurrent Neural Network
	<ul style="list-style-type: none"> <li>● Implementation of Recurrent neural networks.</li> <li>● Sub-types of recurrent neural networks.</li> <li>● Time series analysis using recurrent neural networks.</li> <li>● Sentiment analysis using recurrent neural networks.</li> </ul>
7.	Tuning a Neural Network
	<ul style="list-style-type: none"> <li>● Selecting hyper parameters.</li> <li>● Hyper band.</li> </ul>
8.	Additional Topics
	<ul style="list-style-type: none"> <li>● Demonstration of transfer learning.</li> <li>● Transfer learning with unsupervised pre training.</li> <li>● Customizations with FCMP.</li> </ul>

### Specialization: Cloud & DevOps Technology

Code:25MCTECA2211	Kubernetes Lab	1 Credits [LTP: 0-0-2]
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#### COURSE OUTCOME

CO No.	Cognitive Ability	Lab Course Outcomes
CO1	Remember	Execute basic Docker commands and understand the lifecycle of containers.
CO2	Understand	Construct Dockerfiles and Compose files to build and manage custom containers.
CO3	Apply	Deploy, scale, and manage containerized applications on Kubernetes using Minikube and <a href="#">kubectl</a> .

CO4	Analyze	Evaluate Kubernetes objects and troubleshoot deployment issues using CLI and logs.
CO5	Create	Build and demonstrate a basic CI/CD-ready microservice architecture using containers and Kubernetes.

## Lab Experiments

Exp No.	Lab Title / Experiment
1	Install Docker and run basic commands: <code>run</code> , <code>ps</code> , <code>exec</code> , <code>stop</code> , <code>rm</code>
2	Create and run a custom container using Dockerfile
3	Use Docker Compose to define a multi-container application
4	Push and pull images from Docker Hub
5	Set up Minikube locally and verify cluster using <code>kubectl</code>
6	Create and apply a Pod manifest ( <code>pod.yaml</code> ), inspect Pod status and logs
7	Deploy an application using a Deployment and manage replicas using <code>kubectl scale</code>
8	Expose deployments using Kubernetes Services (ClusterIP, NodePort)
9	Use ConfigMaps and Secrets in application deployment
10	Implement health checks ( <code>livenessProbe</code> , <code>readinessProbe</code> ) in Pod definitions
11	Demonstrate horizontal pod auto-scaling based on CPU usage
12	Perform rolling updates and rollbacks in a Kubernetes deployment
13	Basic monitoring setup using Prometheus and Grafana (optional based on lab infra)
14	<b>Mini Project:</b> Deploy a multi-tier app (e.g., web + API + DB) using Docker and Kubernetes

### ABILITY ENHANCEMENT COURSE(AEC)

<b>Code: 25MULCHM2201</b>	<b>Business Writing for IT Professionals</b>	<b>1Credits</b>	<b>[LTP: 0-0-2]</b>
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#### Course Outcomes:

Students will be able to:

- **Understand** the purpose and importance of business and technical writing in the IT industry.
- **Apply** principles of clear, concise, and audience-appropriate writing to create effective professional communication.
- **Demonstrate** proficiency in drafting professional emails, memos, and internal communications suited for IT work environments.
- **Create** structured and user-friendly technical documents such as manuals, user guides, and FAQs
- **Develop** well-organized and persuasive IT proposals addressing client or organizational needs.

#### Unit 1: Introduction to Business Writing in IT (Hours: 6)

- **Importance of business writing in the IT industry**
- **Differences between technical writing and business writing**
- **Understanding audiences: technical vs. non-technical**
- **Tone and purpose in professional communication**

#### Assignment:

- **Personal communication style self-assessment**

## **Unit 2: Principles of Clear and Concise Writing (Hours: 6)**

- **The 7 Cs of effective communication (Clear, Concise, Concrete, Correct, Coherent, Complete, Courteous)**
- **Grammar, sentence structure, and professional word choice**
- **Avoiding ambiguity and technical jargon**
- **Common errors in technical writing**

### **Assignment:**

- **Rewrite a poorly written internal IT memo for clarity and effectiveness**

## **Unit 3: Professional Emails and Internal Communication (Hours: 6)**

- **Writing structured emails and internal instant messages**
- **Crafting effective subject lines, tone, and message clarity**
- **Email best practices in IT project environments**
- **Types of communication: escalation vs. update emails**

### **Assignment:**

- **Draft a technical update email to internal and external stakeholders**

## **Unit 4: Technical Documentation and User Guides (Hours: 6)**

- **Types of technical documents: user manuals, FAQs, release notes**
- **Writing user-centered documentation**
- **Formatting and structure for readability**
- **Incorporating visual aids: diagrams, screenshots, charts**

### **Assignment:**

- **Create a step-by-step user guide for a common IT process (e.g., software installation or password reset)**

## **Unit 5: Writing IT Proposals (Hours: 6)**

### **Purpose and Types of Proposals**

- **Internal vs. external proposals**
- **Solicited vs. unsolicited proposals**

### **Core Components of a Proposal**

- C. **Executive summary**
- D. **Problem statement**
- E. **Proposed solution**
- F. **Scope, deliverables, and objectives**
- G. **Timeline and milestones**
- H. **Budget and resource estimation**
- I. **Risk assessment and mitigation**
- J. **Conclusion and call to action**

### **Writing Strategies**

- **Using persuasive language in business cases**
- **Tailoring content to various stakeholders**
- **Incorporating data, visuals, and evidence to support proposals**

### **Assignment:**

- **Draft a complete project proposal for a new IT system or system upgrade**

## Skill Enhancement Courses (SEC)

Code: 25MULCUL2201

Aptitude & Logical Reasoning for Placements

1 Credit [LTP:

0-0-2]

### COURSEOUTCOMES:

Students will be able to:

- **Recall** fundamental concepts of quantitative aptitude and logical reasoning.
- **Understand and interpret** different types of aptitude and reasoning questions commonly asked in placement exams.
- **Analyze and solve** logical reasoning problems involving patterns, sequences, blood relations, directions, and puzzles.
- **Evaluate** statements and arguments to answer verbal reasoning questions like syllogisms, coding-decoding, assumptions, and conclusions.
- **Demonstrate** improved problem-solving techniques and time management skills to perform effectively in competitive tests and interviews during placements.

### Unit 1: Quantitative Aptitude – Arithmetic (9 Hrs)

#### Introduction of the Unit

- Number Systems: LCM, HCF, Factors, Multiples
  - Ratio and Proportion, Partnership
  - Percentages, Profit and Loss
- Simple and Compound Interest
- Time, Speed, Distance, Time and Work
- Conclusion of Unit

### Unit 2: Quantitative Aptitude – Advanced (9 Hrs)

#### Introduction of the Unit

- A. Averages and Mixtures
  - B. Permutations and Combinations
  - C. Probability
  - D. Geometry, Mensuration
  - E. Algebraic equations, Quadratic equations
- Conclusion of Unit

### Unit 3: Logical Reasoning – Analytical Thinking (9 Hrs)

#### Introduction of the Unit

- Number and Letter Series
  - Coding-Decoding
  - Blood Relations
  - Directions and Distance
  - Order and Ranking
- Conclusion of Unit

### Unit 4: Logical Reasoning – Critical Thinking (9 Hrs)

#### Introduction of the Unit

- Puzzles and Seating Arrangement
  - Syllogisms and Venn Diagrams
  - Cause and Effect
  - Statements and Assumptions
  - Logical Deduction
- Conclusion of Unit

### Unit 5: Data Interpretation & Placement Readiness (9 Hrs)

### **Introduction of the Unit**

- Data Tables, Bar Graphs, Line Graphs, Pie Charts
- Caselets and Data Sufficiency
- Strategy for Solving Aptitude Tests in Placements
- Time Management Techniques
- Mock Test Practice and Feedback

Conclusion of Unit

**Code:25MCACCA2401**

**Industrial Training Seminar -1 1 Credit[LTP: 0-0-2]**

**OBJECTIVE:** To expose engineering students to technology development at workplaces and appraise them regarding shop-floor problems. To provide practical experience in solving open ended problems in real work setting so as to cause transfer of college based knowledge and skills to solve practical problems and thereby develop confidence in the students in the analysis, synthesis and evaluation of practical problems leading to creative thinking.

At the end of the second semester each student would undergo Industrial Training in an industry/ Professional organization / Research Laboratory with the prior approval of the Head of Department and Training & Placement Officer, and shall be required to submit a written typed report along with a certificate from the organization and present a PPT based on the training.

This period shall include orientation and preparation for the said Training incorporated in the curriculum after second semester.

The report of the Training shall be evaluated during III Semester by a Board of Examiners to be appointed by the Faculty Coordinator-Training Seminar who will award the grades.

# Third Semester Core

## Theory Subjects

<b>Code: 25MCACCA3101</b>	<b>Operating System</b>	<b>3 Credits [LTP: 3-0-0]</b>
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### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Memorizing the fundamental concepts, structures, evolution of operating systems and effectively manage system resources and design efficient system programs.
CO2	Understand	Demonstrate process and thread management, inter-process communication, mutual exclusion, and process scheduling to design efficient and reliable system solutions.
CO3	Apply	Determining deadlock characterization, prevention, avoidance, detection, and recovery strategies to ensure system reliability and stability
CO5	Evaluate	Reviewing mastering file system fundamentals and implementation techniques for efficient data storage, retrieval, and management.

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1	Operating System Overview	07
2	Process Management	08
3	Process Deadlocks	08
4	Memory Management	07
5	File Management	07

### B. DETAILED SYLLABUS

Unit	Unit Details
1	<p><b>Operating System Overview</b></p> <ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Definition, Two views of operating system, Evolution of operating system, Types of OS.</li> <li>• System Call, Handling System Calls, System Programs, Operating System Structures,</li> <li>• The Shell, Open Source Operating Systems</li> <li>• Conclusion of Unit</li> </ul>
2	<p><b>Process Management</b></p> <ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Process vs Program, Multi-programming, Process Model, Process States, Process Control Block.</li> <li>• Threads, Thread vs Process, User and Kernel Space Threads.</li> <li>• Inter Process Communication, Race Condition, Critical Section</li> <li>• Implementing Mutual Exclusion: Mutual Exclusion with Busy Waiting (Disabling</li> <li>• Interrupts, Lock Variables, Strict Alteration, Peterson's Solution, Test and Set Lock),</li> </ul>

	<ul style="list-style-type: none"> <li>• Sleep and Wake-up, Semaphore, Monitors, Message Passing,</li> <li>• Classical IPC problems: Producer Consumer, Sleeping Barber, Dining Philosopher Problem</li> <li>• Process Scheduling: Goals, Batch System Scheduling (First-Come First-Served, Shortest Job First, Shortest Remaining Time Next), Interactive System Scheduling (Round-Robin Scheduling, Priority Scheduling, Multiple Queues), Overview of Real Time System Scheduling</li> <li>• Conclusion of Unit</li> </ul>
<b>3</b>	<b>Process Deadlocks</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Introduction, Deadlock Characterization, Preemptable and Non-preemptable Resources,</li> <li>• Resource – Allocation Graph, Conditions for Deadlock</li> <li>• Handling Deadlocks: Ostrich Algorithm, Deadlock prevention, Deadlock Avoidance</li> <li>• Deadlock Detection (For Single and Multiple Resource Instances), Recovery From</li> <li>• Deadlock (Through Preemption and Rollback)</li> <li>• Conclusion of Unit</li> </ul>
<b>4</b>	<b>Memory Management</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• Introduction, Monoprogramming vs. Multi-programming, Modelling Multiprogramming, Multiprogramming with fixed and variable partitions, Relocation and Protection.</li> <li>• Memory management (Bitmaps &amp; Linked-list), Memory Allocation Strategies</li> <li>• Virtual memory: Paging, Page Table, Page Table Structure, Handling Page Faults, TLB's</li> <li>• Page Replacement Algorithms: FIFO, Second Chance, LRU, Optimal, LFU, Clock, WS- Clock, Concept of Locality of Reference, Belady's Anomaly</li> <li>• Segmentation: Need of Segmentation, its Drawbacks, Segmentation with Paging(MULTICS)</li> <li>• Conclusion of Unit</li> </ul>
<b>5</b>	<b>File Management</b>
	<ul style="list-style-type: none"> <li>• Introduction of Unit</li> <li>• File Overview: File Naming, File Structure, File Types, File Access, File Attributes, File Operations, Single Level, two Level and Hierarchical Directory Systems, File System Layout.</li> <li>• Implementing Files: Contiguous allocation, Linked List Allocation, Linked List Allocation using Table in Memory, Inodes.</li> <li>• Directory Operations, Path Names, Directory Implementation, Shared Files</li> <li>• Free Space Management: Bitmaps, Linked List</li> <li>• Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1	Operating system concepts	Silberschatz, Galvin, Gagne	8 <sup>th</sup> edition	John Wiley and Sons
2	Modern Operating System	A.S.Tanenbaum	Second Edition	Pearson
<b>Reference Book</b>				
1	Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016.			
<b>Online Resources</b>				
1	<a href="https://www.coursera.org &gt; courses &gt; query=operating s...">https://www.coursera.org &gt; courses &gt; query=operating s...</a>			
2	<a href="https://www.javatpoint.com &gt; best-courses-for-the-oper...">https://www.javatpoint.com &gt; best-courses-for-the-oper...</a>			
3	<a href="https://hackr.io &gt; tutorials &gt; learn-operating-systems">https://hackr.io &gt; tutorials &gt; learn-operating-systems</a>			

### MAPPING OF CO VS PO/PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3	PSO4
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	1	2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	2	-	-	-	-	-	-	-	-	-	-	2	-

### Practical

**Code: 25MCACCA3201      Operating System Lab    1 Credit [LTP: 0-0-2]**

#### COURSE OUTCOME

Students will be able to:

- Implement basic services and functionalities of the operating system using system calls.
- Use modern operating system calls and synchronization libraries in software/ hardware interfaces.
- Know the benefits of thread over process and implement synchronized programs using multi-threading concepts.
- Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
- Implement memory management schemes and page replacement schemes.

#### A. LIST OF EXPERIMENTS:

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority
2	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked
3	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue

4	Write a C program to simulate the MVT and MFT memory management techniques.
5	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit
6	Write a C program to simulate paging technique of memory management
7	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
8	Write a C program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
9	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
10	Write a C program to simulate page replacement algorithms
11	Write a C program to simulate producer-consumer problem using semaphores.
12	Write a C program to simulate the concept of Dining-Philosophers problem.

#### A. RECOMMENDED STUDY MATERIAL

S.No	Text Books:	Author	Edition	Publication
1	Operating system concepts	Silberschatz, Galvin, Gagne	8 <sup>th</sup> edition	John Wiley and Sons
2	Modern Operating System	A.S. Tanenbaum	Second Edition	Pearson
<b>Reference Book</b>				
1	Operating Systems - SHalder, Alex A Aravind, Pearson Education Second Edition 2016.			
<b>Online Resources</b>				
1	<a href="https://www.coursera.org/courses?query=operatingsystem">https://www.coursera.org/courses?query=operatingsystem</a>			
2	<a href="https://www.javatpoint.com/best-courses-for-the-operating-System">https://www.javatpoint.com/best-courses-for-the-operating-System</a>			
3	<a href="https://hackr.io/tutorials/learn-operating-systems">https://hackr.io/tutorials/learn-operating-systems</a>			

# Third Semester

Departmental Elective/ Professional Elective

Professional Elective : VII

Specialization : General/AI&DS/Cyber/ Cloud

Code: 25MCAECA3102	Computer Networks & Data Communication	3 Credits [LTP: 3-0-0]
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## COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall Networking & Internet Fundamentals like LAN, MAN, WAN, TCP, OSI Model
CO2	Understand	Demonstrate and learn about the protocols like DHCP, DNS, HTTP/HTTPS, FTP, TFTP, SFTP, Telnet, Email : SMTP, POP3/IMAP, NTP.
CO3	Apply	Learn to apply the Ipv4, Ipv6 address, types, assignment, Data encapsulation
CO4	Analyze	Able to analyze the IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, wireless security Protocols: WEP, WPA, 802.1X.
CO5	Evaluate	Evaluate the PSTN, ISDN, DSL, CATV, Satellite-Based Services, And Last Mile Fiber.

## A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Networks and Devices	07
2.	The Data Link Layer	08
3.	Network Layer	08
4.	Transport Layer	07
5.	Application Layer	07

## B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Networks and Devices</b> <ul style="list-style-type: none"><li>• Introduction of Unit</li><li>• Definition and Uses of Computer Network</li><li>• Network Topologies</li><li>• Network classes</li><li>• Repeaters, Hub, Bridges, Switches</li><li>• Routers, Gateways</li><li>• Routing Algorithms, Distance Vector Routing, Link State Routing</li><li>• Conclusion of Unit</li></ul>
2.	<b>The Data Link Layer</b>

	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Design issues, error detection and correction</li> <li>● Elementary data link protocols,</li> <li>● Data link layer in the internet</li> <li>● THE MEDIUM ACCESS SUBLAYER: Channel allocations problem</li> <li>● Multiple access protocols, Ethernet, Data Link Layer switching,</li> <li>● Wireless LAN, Broadband Wireless, Bluetooth</li> <li>● Conclusion of Unit</li> </ul>
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<b>3.</b>	<b>Network Layer</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Logical Addressing, IPv4 Addresses, IPv6 Addresses,</li> <li>● Internet Protocol, Internetworking, IPv4, IPv6,</li> <li>● Transition from IPv4 to IPv6,</li> <li>● Address Mapping, Error Reporting and Multicasting,</li> <li>● Forwarding and Routing,</li> <li>● Unicast Routing Protocols, Multicast Routing Protocols</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Transport Layer</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Process-Process Delivery</li> <li>● UDP, TCP and SCTP</li> <li>● Congestion Control, Flow Control and Quality of Service</li> <li>● Techniques to improve QoS, Integrated Services,</li> <li>● QoS in Switched Networks</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Application Layer</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Domain Name System, Name Space, Domain Name Space,</li> <li>● Distribution of Name Space, DNS in the Internet,</li> <li>● Types of Records, Registrars, Dynamic Domain Name System (DDNS)</li> <li>● Electronic Mail and File Transfer, Remote Logging, Telnet, Electronic Mail</li> <li>● WWW and HTTP: Architecture,</li> <li>● Web Documents</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Data Communications and Networking,	Behrouza A. Forouzan	Fourth Edition	TMH.
2.	Computer Networks	A.S.Tanenbaum	Fourth Edition	Pearson
<b>Reference Book</b>				
1.	Data Communications and Networking, TATA McGraw Hill, Ferouzan, Behrouz A.			
2.	Data and Computer Communication, Pearson Education , Stallings William			

3.	Computer Networks, PHI, Tanenbaum, Andrew S,
<b>Online Resources</b>	
1.	<a href="https://nptel.ac.in/courses/106105082">https://nptel.ac.in/courses/106105082</a>
2.	<a href="https://www.tutorialspoint.com/data_communication_computer_network/index.htm">https://www.tutorialspoint.com/data_communication_computer_network/index.htm</a>

### MAPPING OF CO VS PO/PSO

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O 3	
CO 1	-	2	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CO 2	2	2	-	-	-	-	-	-	-	-	-	-	2	-	2	-
CO 3	2	1	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 4	2	2	-	2	-	-	-	-	-	-	-	-	3	-	2	-
CO 5	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-

## Specialization: AIML with SAS

Code: 24MALECA3111

Forecasting Using Model Studio in SAS® Viya® 3Credits [LTP: 3-0-0]

### COURSEOUTCOME

Students will be able to:

- Automatically create and fit custom forecast models using structured analytic workflow or pipelines.
- Visualize modeling data using attribute variables.
- Refine forecast models to improve forecast accuracy.
- Apply overrides-generated forecasts.
- Generate forecast datasets for deployment.

### A. OUTLINE OF THE COURSE

Unit No	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction and Data Visualization	06
2.	Pipeline Essentials	09
3.	Hierarchical Forecasting	09
4.	Post-forecasting Functionality	07
5.	In-Line Code Access and Overview (Appendix)	09

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction and Data Visualization</b>
	<ul style="list-style-type: none"> <li>• Overview of SAS Home.</li> <li>• Creating a forecasting project and loading the data.</li> <li>• Visualizing the modeling data using attribute variables</li> </ul>
2.	<b>Pipeline Essentials</b>

	<ul style="list-style-type: none"> <li>• Basic modeling with pipelines.</li> <li>• Pipeline templates and pipe line comparison.</li> <li>• Accuracy statistics and forecast model selection</li> <li>• Families of models supported.</li> </ul>
<b>3.</b>	<b>Hierarchical Forecasting</b>
	<ul style="list-style-type: none"> <li>• Hierarchical forecasting.</li> <li>• Timeseries data creation and forecast reconciliation.</li> <li>• Combined models.</li> <li>• Honest assessment</li> </ul>
<b>4.</b>	<b>Post-forecasting Functionality</b>
	<ul style="list-style-type: none"> <li>• Overrides.</li> <li>• Exporting generated tables.</li> <li>• Adjustment to statistical forecasting.</li> </ul>
<b>5.</b>	<b>In-Line Code Access and Overview(Appendix)</b>
	<ul style="list-style-type: none"> <li>• Code overview.</li> </ul> Adding event variables in the TSMODEL procedure.

### Specialization: Cloud & DevOps Technology

<b>Code:25MCTECA3111</b>	<b>Cloud Security and Risk Management</b>	<b>2Credits[LTP: 2-0-0]</b>
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#### Course Outcomes (COs)

CO No.	Cognitive Level	Course Outcome
CO1	Remember	Define key concepts in cloud security and risk management.
CO2	Understand	Explain cloud security models, compliance frameworks, and risk assessment methodologies.
CO3	Apply	Implement basic security controls and risk mitigation strategies in cloud environments.
CO4	Analyze	Evaluate cloud security threats and vulnerabilities using real-world scenarios.
CO5	Evaluate	Assess compliance requirements and audit mechanisms in cloud services.

#### C. OUTLINE OF THE COURSE

Unit No	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to cloud security	06
2.	Risk Management Framework & compliance standard	09
3.	Identity and access management(IAM) in the cloud	09
4.	Data protection and Encryption	07
5.	Cloud Security Operation and Incident Response	09

#### D. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Introduction to cloud security</b>
	<ul style="list-style-type: none"> <li>Overview of cloud computing models (IaaS, PaaS, SaaS)</li> <li>Shared responsibility model in cloud security</li> <li>Basic security challenges in cloud environments</li> </ul>
<b>2.</b>	<b>Risk Management Framework &amp; compliance standard</b>
	<ul style="list-style-type: none"> <li>Introduction to risk management frameworks (NIST, ISO/IEC 27001)</li> <li>Understanding compliance standards (GDPR, HIPAA, SOC 2)</li> <li>Role of audits and assessments in cloud security</li> </ul>
<b>3.</b>	<b>Identity and access management(IAM) in the cloud</b>
	<ul style="list-style-type: none"> <li>Principles of IAM (Authentication, Authorization, Accounting)</li> <li>Implementing IAM in cloud platforms (AWS IAM, Azure Active Directory)</li> <li>Best practices for managing identities and access controls</li> </ul>
<b>4.</b>	<b>Data protection and Encryption</b>
	<ul style="list-style-type: none"> <li>Techniques for data encryption at rest and in transit</li> <li>Key management practices in the cloud</li> <li>Data masking, tokenization, and anonymization methods</li> </ul>
<b>5.</b>	<b>Cloud Security Operation and Incident Response</b>
	<ul style="list-style-type: none"> <li>Monitoring and logging in cloud environment</li> <li>Incident detection and response strategies</li> <li>Disaster recovery and business continuity planning</li> </ul>

#### A. RECOMMENDED STUDY MATERIAL

S.No	Text Books:	Author	Edition	Publication
1.	Cloud Security and Privacy	Tim Mather, Subra Kumaraswamy, and Shahed Latif	Latest	John Wiley & Sons
2.	Cloud Security: A Comprehensive Guide to Secure Cloud Computing	Ronald L. Krutz and Russell Dean Vines	Latest	McGraw Hill, Indian edition
3.	Cloud Computing :Principles and Paradigms	Rajkumar Buyya	Latest	John Wiley&Sons,
S.No	Text Books:	Author	Edition	Publication
1.	Cloud Computing Bible	Barrie Sosinsky	Latest	John Wiley & Sons
2.	Cloud Computing: A Practical Approach	Velte Anthony T., Velte Toby J. and Elsenpeter Robert	Latest	McGraw Hill, Indian edition
Reference Book				
1	Cloud Computing: Principles and Paradigms, Rajkumar Buyya, John Wiley & Sons			
Online Resources				
1	<a href="https://onlinecourses.nptel.ac.in/noc22_cs20/preview">https://onlinecourses.nptel.ac.in/noc22_cs20/preview</a>			
2	<a href="https://www.w3schools.in/cloud-computing">https://www.w3schools.in/cloud-computing</a>			

**MAPPING OF CO VS PO/PSO**

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O 3	PS O 4
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO 3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	2	1	-	-	-	-	2	-	-	-	-	-	-	2	-
CO 5	-	-	2	2-	-	-	-	-	-	-	-	-	-	-	-	2

**Professional Elective: VIII**

**Specialization: General, AI&DS, AIML with SAS**

<b>Code: 24MCACCA3103</b>	<b>Cloud Computing</b>	<b>3Credits [LTP: 3-0-0]</b>
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**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Learn the core concepts of the cloud computing paradigm
CO2	Understand	Understand the underlying principles of Cloud Technology and various types of cloud Computing architecture and types.
CO3	Apply	Learn to evaluate between different cloud solutions offered by various providers based on their merits and demerits.
CO4	Analyze	Integrating the fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost.
CO5	Evaluate	Access various cloud programming models and apply them to solve problems on the cloud

**B. OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Cloud Technologies	08
2.	Cloud Computing Architecture and Service Models	08
3.	Virtualization	06
4.	Service Management in Cloud Computing	06
5.	Cloud Security	06

### C. DETAILED SYLLABUS

Unit	Unit Details
<b>1.</b>	<b>Introduction to Cloud Technologies</b>
	Overview of computing paradigm: Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing .History of Cloud Computing, Evolution of cloud computing - Business driver for adopting cloud computing, Cloud service providers. Properties, Characteristics & Disadvantages - Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing.
<b>2.</b>	<b>Cloud Computing Architecture</b>
	Cloud Computing Architecture: Cloud computing stack- Comparison with traditional computing architecture(client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services. Service Models (XaaS) - Infrastructure as a Service(IaaS), Platform as a Service (PaaS), Software as a Service(SaaS). Deployment Models, Public cloud, Private cloud, Hybrid cloud, Community cloud
<b>3.</b>	<b>Virtualization</b>
	Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine (VM). Resource Virtualization - Server, Storage, Network. Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service). Renting, EC2 Compute Unit, Platform and Storage, pricing, customers. Service Oriented Architecture(SOA). Cloud Platform and Management - computation Web services, Web2.0, WebOS
<b>4.</b>	<b>Service Management in Cloud Computing</b>
	Service Management in Cloud Computing :Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data - Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing
<b>5.</b>	<b>Cloud Security</b>
	Cloud Security: Infrastructure Security - Network level security, Host level security, Application level security. Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location: Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

### D. RECOMMENDED STUDY MATERIAL

S.No	Text Books:	Author	Edition	Publication
1.	Cloud Computing Bible	Barrie Sosinsky	Latest	John Wiley & Sons
2.	Cloud Computing :A Practical Approach	Velte Anthony T., Velte Toby J. and Elsenpeter Robert	Latest	McGraw Hill, Indian edition
3.	Cloud Computing :Principles and Paradigms	Rajkumar Buyya	Latest	John Wiley & Sons,
S.No	Text Books:	Author	Edition	Publication

1.	Cloud Computing Bible	Barrie Sosinsky	Latest	John Wiley & Sons
2.	Cloud Computing: A Practical Approach	Velte Anthony T., Velte Toby J. and Elsenpeter Robert	Latest	McGraw Hill, Indian edition
<b>Reference Book</b>				
1	Cloud Computing: Principles and Paradigms, Rajkumar Buyya, John Wiley & Sons			
<b>Online Resources</b>				
1	<a href="https://onlinecourses.nptel.ac.in/noc22_cs20/preview">https://onlinecourses.nptel.ac.in/noc22_cs20/preview</a>			
2	<a href="https://www.w3schools.in/cloud-computing">https://www.w3schools.in/cloud-computing</a>			

### MAPPING OF CO VS PO/PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO 3	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	2	1	-	-	-	-	2	-	-	-	-	-	-	2	-
CO 5	-	-	2	2-	-	-	-	-	-	-	-	-	-	-	-	2

<b>Code: 24MCAECA3113</b>	<b>Salesforce</b>	<b>3 Credits [LTP: 3-0-0]</b>
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### Course Outcome:

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	To understand the fundamental concepts of Customer Relationship Management (CRM) and Salesforce architecture.
CO2	Understand	To configure and customize Salesforce applications, including objects, fields, and data management.
CO3	Apply	To understand the security architecture of Salesforce and to apply security controls to protect data within Salesforce.
CO4	Analyze	To create and analyze reports and dashboards to support business decision-making
CO5	Evaluate	To implement process automation using workflows, process builder, and flows.

### A. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Cloud Computing & Salesforce and CRM basics	6
2.	Data Modelling and UI customization	8
3.	Data Security	8
4.	Reports And Dashboards	6

5.	Automation & Workflows	8
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## B. Detailed Syllabus

Unit	Unit Details
1.	<b>Cloud Computing &amp; Salesforce and CRM basics</b>
	<ul style="list-style-type: none"> <li>• Introduction to Cloud computing</li> <li>• Deployment models of cloud computing, Cloud service models Introduction to Salesforce, CRM, benefits of CRM</li> <li>• History and Evolution of Salesforce, Types of Salesforce Environments</li> </ul>
2.	<b>Data Modelling and UI customization</b>
	<ul style="list-style-type: none"> <li>• Apps &amp; Tabs in Salesforce</li> <li>• Fields in Salesforce, Global picklist and dependency in salesforce Introduction to Salesforce Objects: Standard objects &amp; custom objects Object Relationships (Master-Detail, Lookup, Junction)</li> <li>• Formula Fields &amp; Roll-up summary field., Managing Records: Creating and Editing Records</li> <li>• Page Layouts, Mini page layouts, Publisher Layouts, Search, List Views, and Reports</li> </ul>
3.	<b>Data Security</b>
	<ul style="list-style-type: none"> <li>• Introduction to Data Security concepts: encryption, authentication, and authorization.</li> <li>• Level of Data Access in Salesforce</li> <li>• User Management (Control Access to the Organization), Object Level Security in Salesforce (Profile Level)</li> <li>• Field Level Security in Salesforce, Record Level Security in Salesforce Managing Password Policies, Restrict Login Access by IP Address Restrict Login Access by Tim, Permission Sets in Salesforce Organization Wide Default in Salesforce (OWD)</li> <li>• Role Hierarchy in Salesforce, Sharing Rules in Salesforce, Manual Sharing.</li> </ul>
4.	<b>Reports And Dashboards</b>
	<ul style="list-style-type: none"> <li>• Introduction to Reports</li> <li>• Types of Reports (Tabular, Summary, Matrix, Joined)</li> <li>• Creating and Customizing Reports, Report Filters, Formulas, and Summaries Dashboards in Salesforce, Creating and Managing Dashboards</li> <li>• Adding and Customizing Dashboard Components</li> <li>• Dynamic Dashboards</li> </ul>
5.	<b>Automation and Workflows</b>
	<ul style="list-style-type: none"> <li>• Introduction to Process Automation Benefits of Automation in Salesforce Workflow Rules, Creating Workflow Rules</li> <li>• Workflow Actions (Email Alerts, Tasks, Field Updates) Time-Dependent Workflows, Approval Processes Creating Approval Processes, Approval Steps and Actions</li> <li>• Managing and Monitoring Approval Requests</li> </ul>

## C. RECOMMENDED STUDY MATERIAL:

S. No	Text Books:	Author	Edition	Publication
1.	Salesforce For Dummies	Tom Wong, Liz Kao, and Matt Kaufman	7th Edition	For Dummies
2.	Learning Salesforce Visual Workflow and Process Builder	Rakesh Gupta and Johann Furmann	1st Edition	Packt Publishing
3.	Salesforce Handbook	Wes Nolte and Jeff Douglas	1st Edition	CreateSpace Independent Publishing Platform
<b>Reference Book</b>				
1	"Practical Salesforce.com Development Without Code" by Philip Weinmeister			
2.	"Advanced Apex Programming for Salesforce.com and Force.com" by Dan Appleman			
<b>Online Resources</b>				
1	URL: <a href="#">Trailhead by Salesforce</a>			
2	URL: <a href="#">Salesforce Documentation</a>			

**D. MAPPING MATRIX OF CO, PO, & PSO**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	-	-	-	-	-	-	1	-	1	-
CO2	2	2	1	-	2	-	-	-	-	-	2	2	2	2	-
CO3	3	3	2	-	3	-	-	-	-	-	3	2	3	2	2
CO4	3	3	3	-	3	-	-	-	-	-	3	3	3	3	2
CO5	3	3	3	3	2	-	-	-	-	1	2	3	3	3	3
WT. AVG	<b>2.4</b>	<b>2.4</b>	<b>2.3</b>	<b>3.0</b>	<b>2.2</b>					<b>1.0</b>	<b>2.5</b>	<b>2.2</b>	<b>2.8</b>	<b>2.2</b>	<b>2.3</b>

### Specialization: Cyber Security

**Code: 25MCYECA3211 Vulnerability Assessment & Penetration Testing 3 Credits [LTP: 3-0-0]**

**COURSEOUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Understand	Develop expertise in conducting comprehensive vulnerability assessments to identify, prioritize, and mitigate security risks effectively in diverse environments.
CO2	Analyze	Master techniques for gathering intelligence and utilizing open-source tools effectively to gather information for cyber security purposes.
CO3	Analyze	Develop foundational skills to conduct vulnerability assessments, identify weaknesses, and recommend mitigation strategies for improved cyber security posture.
CO4	Analyze	Advance proficiency in vulnerability scanning, penetration testing, and risk analysis, enhancing the ability to secure systems against cyber threats effectively.
CO5	Evaluate	Equip students with skills to conduct thorough penetration tests, identify vulnerabilities, and provide actionable recommendations for improving security posture.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1	Introduction to Vulnerability assessment	07
2	Information Gathering and Open source tools	08
3	Vulnerability Assessment -I	08
4	Vulnerability Assessment -II	07
5	Penetration Testing	07

## B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Vulnerability assessment</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Overview of penetration testing</li> <li>● Difference between Vulnerability assessment &amp; Penetration Testing</li> <li>● Testing Scoping / Ethics / Basics</li> <li>● Passive reconnaissance - ways to obtain data on a target without ever hitting the target.</li> <li>● Active reconnaissance and building the overall picture</li> <li>● Conclusion of the Unit</li> </ul>
2.	<b>Information Gathering and Open source tools</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>Active reconnaissance. The art of active reconnaissance. Students will use nmap, nikto and other open-source tools to actively scan a target</li> <li>Establishing a target list. Students will take gathered information from their reconnaissance and build a target list that is focused</li> <li>● Vulnerability assessment.</li> <li>● Open source / free tools to assess the weakness and vulnerabilities of the systems on the target list.</li> <li>● Tools - Openvas, Nessus</li> <li>● Conclusion of the Unit</li> </ul>
3.	<b>Vulnerability Assessment -I</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Utilize open source tools to tamper with HTTP Headers and parameters.</li> <li>● Building upon skills learned from the brute force lecture, attempt to brute force headers to learn about the system they are attacking.</li> <li>● Cross site scripting, Learn what cross site scripting is, and how XSS can be used to further the attack process. Students will learn the difference how to gain further access into systems with XSS.</li> <li>● File Inclusion: Students will learn what file inclusion is, and how to perform advanced attacks utilizing file inclusion, including uploading web shells, backdoors, etc.</li> <li>● -Session hijacking. Students will utilize open source tools to perform MITM attacks and session hijacking. Students will learn how session fixation and hijacking can occur and how it can be used to bypass authentication systems</li> <li>● Conclusion of Unit</li> </ul>
4.	<b>Vulnerability Assessment -II</b>

	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Exploitation of vulnerabilities: Students will learn to identify weak and outdated software, and target attacks specifically to that software to gain a foothold within a network Metasploit and other open source tools will be used to further the attack process.</li> <li>● Privilege escalation: Students will learn how to escalate privileges on systems with Metasploit and also will learn about other techniques to gain higher level accounts on systems.</li> <li>● Vulnerability analysis with Metasploit framework</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Penetration Testing</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Penetration testing concepts</li> <li>● Types of penetration testing</li> <li>● Tools and techniques used in penetration testing</li> <li>● Nmap and live scanning on ports and networks</li> <li>● Web application assessment with nikto&amp; burp suite</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy	Patrick Engebretson	First Edition	2011
2.	Microsoft Log Parser Toolkit: A complete toolkit for Microsoft's undocumented log analysis tool	Gabriele Giuseppini	2nd Edition	2005
<b>Reference Book</b>				
1.	Cryptography and Information Security, V. K. Pachghare, Prentice Hall India, 2nd rev ed; 2015			
2.	Cryptography and Network Security, AtulKahate, McGraw Hill India, 3rd ed; July 2017			
<b>Online Resources</b>				
1.	<a href="https://www.edx.org/learn/cryptography">https://www.edx.org/learn/cryptography</a>			
2.	<a href="https://sopa.tulane.edu/blog/how-to-learn-cryptography">https://sopa.tulane.edu/blog/how-to-learn-cryptography</a>			
3.	<a href="https://www.youtube.com/watch?v=dz7Ntp7KQGA">https://www.youtube.com/watch?v=dz7Ntp7KQGA</a>			

### MAPPING OF CO VS PO/PSO

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	
<b>CO 1</b>	1	2	1					-	-	-	-	-	2	-	-	-
<b>CO 2</b>	1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	1
<b>CO 3</b>	1	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-
<b>CO 4</b>	2	1		2				-	-	-	-	-	2	-	1	1

CO 5	1	1	2	3	-	-	-	-	-	-	-	-	-1	-	-	-
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### Specialization: Cloud & DevOps

**Code: 25MCTECA3113      Infrastructure Automation & Infrastructure as code      3Credits [LTP: 3-0-0]**

#### A. COURSE OUTCOME

CO No.	Cognitive Ability	Course Outcomes
CO1	Remember	Recall basic infrastructure management, automation, and Infrastructure concepts as Code principles.
CO2	Understand	Describe the benefits and components of infrastructure automation and IaC tools and technologies.
CO3	Apply	Explain basic configurations and workflows in popular IaC tools for automating infrastructure provisioning.
CO4	Analyse	Explain workflows and best practices in infrastructure automation with IaC.
CO5	Evaluate	Assess different approaches and tools for infrastructure automation and their suitability for projects.

#### B. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time Required (Hours)
1	Introduction to Infrastructure Automation and IaC	06 Hours
2	Overview of Infrastructure as Code Tools	06 Hours
3	Declarative vs Imperative IaC, Version Control, and Workflows	06 Hours
4	Introduction to Terraform – Concepts and Architecture (Theory Focus)	09 Hours
5	Configuration Management Tools: Ansible Concepts and Best Practices	09 Hours

#### C. DETAILED SYLLABUS

UNIT	UNIT DETAILS
1.	<b>Introduction to Infrastructure Automation and IaC</b>
	<ul style="list-style-type: none"> <li>• What is Infrastructure Automation?</li> <li>• Challenges in traditional infrastructure management</li> <li>• Introduction to Infrastructure as Code (IaC)</li> <li>• Benefits of automation and IaC in modern IT environments</li> <li>• Key concepts: idempotency, immutability, versioning, and automation principles</li> </ul>
2.	<b>Overview of Infrastructure as Code Tools</b>

	<ul style="list-style-type: none"> <li>• Categories of IaC tools: provisioning vs configuration management</li> <li>• Popular tools overview: Terraform, AWS CloudFormation, Ansible, Puppet, Chef</li> <li>• Cloud provider tools (AWS, Azure, GCP) and their automation features overview</li> <li>• Emerging trends in infrastructure automation</li> </ul>
3.	<b>Declarative vs Imperative IaC, Version Control, and Workflows</b>
	<ul style="list-style-type: none"> <li>• Declarative vs imperative programming models in IaC</li> <li>• Infrastructure as Code in DevOps and CI/CD pipelines</li> <li>• Using version control systems (Git) with IaC code – benefits and best practices</li> <li>• Infrastructure lifecycle stages: plan, apply, modify, destroy</li> <li>• Collaboration workflows and code review processes</li> </ul>
4.	<b>Introduction to Terraform – Concepts and Architecture (Theory Focus)</b>
	<ul style="list-style-type: none"> <li>• What is Terraform? Purpose and benefits in IaC</li> <li>• Terraform architecture: CLI, providers, resources, and state management concepts</li> <li>• Conceptual workflow of Terraform: plan, apply, and destroy stages</li> <li>• Providers and resource abstractions explained</li> <li>• Concept of modules: reuse and maintainability</li> <li>• Importance and management of Terraform state</li> <li>• Terraform ecosystem and community tools overview</li> <li>• Best practices and common challenges with Terraform usage</li> </ul>
5.	<b>Configuration Management Tools: Ansible Concepts and Best Practices</b>
	<ul style="list-style-type: none"> <li>• What is Configuration Management and why is it needed?</li> <li>• Ansible architecture: components and how it works</li> <li>• Concepts of playbooks, inventories, modules</li> <li>• Understanding idempotency and declarative configurations in Ansible</li> <li>• Concepts of Ansible roles and modularity</li> <li>• Best practices and design patterns in configuration management</li> <li>• Comparison with other configuration management tools</li> </ul>

#### D. RECOMMENDED STUDY MATERIAL

S.No	Title	Author	Edition	Publication
1	Terraform: Up & Running	Yevgeniy Brikman	Latest	O'Reilly
2	Ansible for DevOps: Server and Configuration Management	Jeff Geerling	Latest	Leanpub
3	Infrastructure as Code: Managing Servers in the Cloud	Kief Morris	Latest	O'Reilly

<b>Reference Book</b>				
	Terraform: Up & Running	Yevgeniy Brikman	Latest	O'Reilly
<b>Online Resources</b>				
<a href="#">Cloud and Infrastructure Security - Amrita Vishwa Vidyapeetham</a> ( <a href="#">Wikipedia</a> , <a href="#">Amrita Vishwa Vidyapeetham</a> )				

## Professional Elective: IX

### Specialization: General

<b>Code: 25MCAECA3111 Advanced Frontend with Angular</b>	<b>3 Credits [LTP: 3-0-0]</b>
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• **COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recalling HTML, CSS, Java Script
CO2	Understand	Proficiency in Modern Web Development Expertise in React.js for Front-End Development
CO3	Apply	Strong Back-End Development Skills with Node.js
CO4	Analyze	Competence in Full-Stack Integration
CO5	Evaluate	Knowledge of Advanced Topics and Best Practices

#### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Modern Web Development	08
2.	Introduction to React.js	09
3.	<b>Server-Side Development with Node.js</b>	10
4.	Full-Stack Development	07
5.	Introduction to cross platform application development	06

#### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<p><b>Introduction Modern Web Development</b></p> <ul style="list-style-type: none"> <li>• Introduction to Modern Web Development</li> <li>• Overview of Web Technologies : Evolution of web development, Client-side vs. server-side, Single Page Applications (SPAs)</li> <li>• HTML5 and CSS3 Advanced Concepts :Semantic HTML, CSS Grid and Flexbox, Responsive design and media queries</li> <li>• JavaScript ES6+ Features: Arrow functions, classes, and modules, Destructuring and spread/rest operators, Promises and async/await</li> <li>• Development Tools and Workflow: Package managers (npm, yarn), Module bundlers (Webpack, Parcel),Code editors and IDEs (VS Code, WebStorm)</li> <li>• Version Control with Git : Basic commands and workflows, Branching and merging,Collaboration with GitHub/GitLab</li> <li>• Conclusion of Unit</li> </ul>
2.	<p><b>Introduction to React.js</b></p> <ul style="list-style-type: none"> <li>• Components, props, and state</li> <li>• JSX and Virtual DOM</li> </ul>

	<ul style="list-style-type: none"> <li>● Context API</li> <li>● Redux: Actions, reducers, and store</li> <li>● Redux middleware (Thunk, Saga)</li> <li>● React Router and Navigation</li> <li>● Setting up React Router, Route parameters and nested routes, Handling navigation programmatically</li> <li>● Hooks in React, Introduction to hooks, useState, useEffect, useContext, Custom hooks</li> <li>● Performance Optimization : Code splitting and lazy loading, Memoization techniques (useMemo, useCallback), Profiling and optimizing performance</li> <li>● Conclusion of the unit</li> </ul>
<b>3.</b>	<b>Server-Side Development with Node.js</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Node.js :Overview and features of Node.js, Asynchronous programming and event loop, Setting up a Node.js project, 3.2 Building RESTful APIs</li> <li>● REST architecture principles : Creating endpoints with Express.js, Handling requests and responses</li> <li>● Database Integration : Introduction to databases (SQL vs. NoSQL), Using MongoDB with Mongoose</li> <li>● CRUD operations and data validation</li> <li>● Authentication and Authorization : User authentication with JWT, Role-based access control, Securing API endpoints Error Handling and Debugging ,Error handling best practices ,Logging and monitoring</li> <li>● Debugging techniques and tools</li> </ul>
<b>4.</b>	<b>Full-Stack Development</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> </ul> <p>Connecting Front-End and Back-End ,Setting up a full-stack project, RESTful API integration with React.js, Handling CORS and API security,</p> <p>State Management with Redux and API, Fetching data from the server, Managing global state with Redux, Error handling and loading states</p> <p>Real-Time Applications with WebSockets: Introduction to WebSockets, Setting up Socket.io with Node.js,Real-time data updates in React.js, Testing and Quality Assurance, Unit testing with Jest and Enzyme,</p> <p>Conclusion of The uni</p>
<b>5.</b>	<b>Introduction to cross platform application development</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● GraphQL: Introduction to GraphQL, Setting up a GraphQL server with Node.js ,Consuming GraphQL API in React.js, Progressive Web Apps (PWAs)</li> <li>● PWA principles and benefits, Service workers and caching strategies, Converting a React app to a PWA Performance Optimization ,Server-side rendering (SSR) with Next.js</li> <li>● Code splitting and lazy loading</li> <li>● Optimizing database queries and indexing , Security Best Practices, Common web security vulnerabilities (OWASP Top Ten), Secure coding practices, Implementing HTTPS and SSL/TLS</li> <li>● 5.5 Industry Trends and Future Directions</li> <li>● Microservices architecture</li> <li>● Serverless computing</li> <li>● Emerging technologies and frameworks Conclusion of Unit</li> </ul>

### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	-	2	1	-	-	-	-	-	-	-	-	3	2	-	-
CO2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	1	2		-	-	-	-	-	-	-	-	1	-	-	-
CO4	1	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	3	-	-	-	-	-	-	-	-	2	1	-	-

## Specialization: Cloud & DevOps Technology

Code: 25MCTECA3112

Frontend with Angular for Cloud Professionals

3 Credits [LTP: 3-0-0]

### Course Outcome:

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recalling HTML, CSS, Java Script
CO2	Understand	Proficiency in Modern Web Development Expertise in React.js for Front-End Development
CO3	Apply	Strong Back-End Development Skills with Node.js
CO4	Analyze	Competence in Full-Stack Integration
CO5	Evaluate	Knowledge of Advanced Topics and Best Practices

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to HTML &amp; CSS</b>	<b>08</b>
2.	<b>JavaScript Fundamentals</b>	<b>09</b>
3.	<b>Advanced JavaScript &amp; Asynchronous Programming</b>	<b>10</b>
4.	<b>Introduction to Angular Framework</b>	<b>07</b>
5.	<b>Advanced Angular Concepts</b>	<b>06</b>

### B. DETAILED SYLLABUS

UNIT	UNIT DETAIL
1	<b>Introduction to HTML &amp; CSS</b>
	<ul style="list-style-type: none"> <li>Basics of HTML: Structure of an HTML document, elements, tags, attributes</li> <li>Common HTML tags: headings, paragraphs, links, images, lists, tables, forms</li> <li>Semantic HTML</li> <li>Introduction to CSS: Syntax, selectors, properties</li> <li>Styling text, colors, backgrounds, borders, margins, padding</li> <li>Box model concept</li> <li>CSS layout basics: display, position, float, flexbox (basic intro)</li> <li>Responsive design basics (media queries)</li> </ul>
2	<b>JavaScript Fundamentals</b>
	<ul style="list-style-type: none"> <li>Introduction to JavaScript: Data types, variables, operators</li> <li>Control structures: if-else, switch, loops (for, while)</li> <li>Functions and scope</li> <li>Arrays and objects</li> <li>DOM manipulation: selecting elements, modifying content and styles</li> <li>Event handling (click, submit, etc.)</li> <li>Basic form validation with JS</li> <li>Introduction to ES6 features (let/const, arrow functions, template literals)</li> </ul>

3	<b>Advanced JavaScript &amp; Asynchronous Programming</b> <ul style="list-style-type: none"> <li>• JavaScript objects and prototypes</li> <li>• JSON and AJAX basics</li> <li>• Promises and async/await</li> <li>• Introduction to JavaScript modules</li> <li>• Error handling and debugging techniques</li> </ul>
4	<b>Introduction to Angular Framework</b> <ul style="list-style-type: none"> <li>• Overview of Angular and its architecture</li> <li>• Angular CLI setup and project structure</li> <li>• Components and templates</li> <li>• Data binding (interpolation, property binding, event binding)</li> <li>• Directives (ngIf, ngFor, etc.)</li> <li>• Services and dependency injection</li> <li>• Routing basics</li> </ul>
5	<b>Advanced Angular Concepts</b> <ul style="list-style-type: none"> <li>• Forms in Angular (Template-driven and Reactive forms)</li> <li>• Pipes and custom pipes</li> <li>• HTTP Client and API integration</li> <li>• Angular modules and lazy loading</li> <li>• State management basics (using services)</li> <li>• Deployment basics of Angular applications</li> </ul>

### C. Text Books

S. No	Title	Author(s)	Edition	Publication
1	Web Technologies: HTML, CSS, JavaScript, and Angular	John Doe (example)	Latest	TechPress Publishing
2	Web Programming and Design	Jane Smith (example)	Latest	Pearson
3	Modern Web Development with Angular	Michael Brown (example)	Latest	Wiley

### D. Reference Books

S. No	Title	Author(s)	Publication	Edition
1	HTML and CSS: Design and Build Websites	Jon Duckett	Wiley	Latest
2	JavaScript: The Good Parts	Douglas Crockford	O'Reilly Media	Latest
3	Angular Up & Running	Shyam Seshadri	O'Reilly Media	Latest
<b>Online Resources</b>				
<ol style="list-style-type: none"> <li>1. W3Schools - HTML Tutorial</li> <li>2. Mozilla Developer Network (MDN) Web Docs</li> <li>3. TutorialsPoint Web Technologies</li> <li>4. Angular Official Documentation</li> </ol>				

5. freeCodeCamp Web Development Course

**Code: 25MCAECA3115 Mobile Application Development 3 Credits [LTP: 3-0-0]**

**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Identify basic features of mobile development tools and languages.
CO2	Understand	Explain the principles underlying mobile application development frameworks
CO3	Apply	Implement basic mobile app functionalities using appropriate development tools
CO4	Analyze	Assess the efficiency of various algorithms used in mobile development
CO5	Evaluate	Evaluate the security implications of different mobile development practices.

**C. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Android	08
2.	User Experience	09
3.	Background Processing	10
4.	Data Management	07
5.	Introduction to cross platform application development	06

**D. DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Introduction to Android</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to mobile application development</li> <li>● Android platform, Android Architecture</li> <li>● Android SDK , Android Development Tools (ADT)</li> <li>● Android Virtual Devices (AVDs)</li> <li>● Emulators , Dalvik Virtual Machine</li> <li>● Difference between JVM and DVM</li> <li>● Steps to install and configure Android Studio and SDK</li> <li>● understanding project structure</li> <li>● Installing and running applications on Android Studio</li> <li>● Conclusion of Unit</li> </ul>
2.	<b>User Experience</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Application Context, Activities, Services, Intents</li> <li>● Receiving and Broadcasting Intents</li> <li>● Android Manifest File and its common settings</li> <li>● Intent Filter, Permissions.</li> <li>● Layouts: Linear and Relative Layouts</li> <li>● Android User Input Controls : Button, Text Field, Seek bar, Checkbox, Radio Button, Toggle Button</li> <li>● Conclusion of Unit</li> </ul>
3	<b>Background Processing</b>

	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Creating background tasks: AsyncTask, AsyncTaskLoader;</li> <li>● Network Connections.</li> <li>● Programming paradigms</li> <li>● Application Components Part 2: Services – bound/unbound services, Starting and stopping</li> <li>● Services, Broadcast receivers, Content providers.</li> <li>● Triggering, scheduling and optimizing background tasks: Notifications, Alarms,</li> <li>● Transferring data between Activities</li> <li>● Google API</li> </ul> <p>Conclusion of Unit</p>
<b>4</b>	<b>Data Management</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Data Access and Storage: Shared Preferences</li> <li>● App settings, Files &amp; the Android File system,</li> <li>● SQLite Database, Loaders</li> <li>● Firebase. Programming paradigms</li> <li>● Content Providers and Content Resolvers</li> </ul> <p>Conclusion of Unit</p>
<b>5</b>	<b>● Introduction to cross platform application development</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Ionic and phonegap</li> <li>● Framework – Support and Features</li> <li>● Xamarin Studio for developing cross-platform Native Apps for Android and iOS</li> <li>● Understand the Xamarin functionality for designing the User Interface of the app</li> <li>● Conclusion of Unit</li> </ul>

#### E. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1	Android Programming: The Big Nerd Ranch Guide	Bill Phillips Chris Stewart Kristin Marsicano , Brian Gardner	4 <sup>th</sup> Edition	Big Nerd Ranch Guides
2	Android Cookbook	Ian F. Darwin	2 <sup>nd</sup> Edition	O'Reilly Media
3.	Pragmatic Flutter: Building Cross-Platform Mobile Apps for Android, iOS, Web & Desktop	PriyankaTyagi	1 <sup>st</sup> Edition	CRS press
<b>Reference Book</b>				
1.	Android Programming: The Big Nerd Ranch Guide			
2.	Pragmatic Flutter: Building Cross-Platform Mobile Apps for Android, iOS, Web & Desktop			
<b>Online Resources</b>				
1.	<a href="https://www.youtube.com/watch?v=fis26HvvDII">https://www.youtube.com/watch?v=fis26HvvDII</a>			
2.	<a href="https://www.mygreatlearning.com/mobile-app-development/free-courses">https://www.mygreatlearning.com/mobile-app-development/free-courses</a>			
3.	<a href="https://www.udacity.com/course/new-android-fundamentals--ud851">https://www.udacity.com/course/new-android-fundamentals--ud851</a>			

**MAPPING OF CO VS PO/PSO**

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2	PS O 3	
CO1	-	2	-	-	-	-	-	-	-	-	-	-	2	2	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-	2	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	2	2	-	2	-	-	-	-	-	-	-	-	3	-	2	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-

**Specialization: AI &DS , AIML with SAS**
**Code: 25MCDECA3111**
**NLP and Computer Vision**
**3Credits [LTP: 3-0-0]**
**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Memorizing the principles and Process of Human Languages such as English and other Indian Languages using computers.
CO2	Understand	Grouping semantics and pragmatics of English language for text processing. Perform POS tagging for a given natural language modelling and technique based on the structure of the language.
CO3	Apply	Experimenting CORPUS linguistics based on digestive approach, current methods for statistical approaches to machine translation.
CO4	Analyze	Analyzing and discuss a suitable language modelling technique based on the structure of the language. knowledge theory and method in image processing and computer vision.
CO5	Evaluate	Simulate method in image processing and computer vision formula's and solve problem. Develop a Statistical Methods for Real World Applications and explore deep learning based

**A. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit(Hours)
1.	Introduction to NLP	06
2.	Language Modelling: N-gram and POST agging	09
3.	Syntactic and Semantic Parsing	09
4.	Introduction to Computer Vision	07
5.	Deep Learning and computer Vision	09

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	Introduction to NLP

	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● What is NLP? Why NLP is Difficult?</li> <li>● History of NLP, Advantages of NLP, Disadvantages of NLP</li> <li>● Components of NLP, Applications of NLP</li> <li>● The problem of ambiguity</li> <li>● Phases of NLP</li> <li>● Why NLP is Difficult?</li> <li>● NLP APIs</li> <li>● NLP Libraries</li> <li>● Difference Between Natural language and Computer language</li> <li>● Conclusion of unit</li> </ul>
<b>2.</b>	<b>Language Modeling: N-gram and POSTagging</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Language Modeling with N-gram</li> <li>● Simple N-gram models, Smoothing (basic techniques)</li> <li>● Parts-of-speech Tagging</li> <li>● Rule based POSTagging</li> <li>● TBL POSTagging</li> <li>● POS tagging using HMM</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Syntactic and Semantic Parsing</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Basic concepts: top down and bottom up parsing</li> <li>● Treebank;</li> <li>● Syntactic parsing: CKY parsing;</li> <li>● Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.</li> <li>● Vector Semantics; Words and Vector;</li> <li>● Measuring Similarity; Semantics with dense vectors;</li> <li>● SVD and Latent Semantic Analysis;</li> <li>● Embedding from prediction: Skip-gram and CBOW</li> <li>● Introduction to Word Net</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Introduction to Computer Vision</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Cameras and optics</li> <li>● Pixels and image filters</li> <li>● Image Formation</li> <li>● Image pyramids and applications</li> <li>● Computer vision VS Image</li> <li>● Conclusion of Unit</li> </ul>



## Specialization: Cyber Security

**Code: 25MCYECA3112**

**Cyber Threat Intelligence and Bug Bounty**

**3Credits [LTP: 3-0-0]**

### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Memorizing the principles and Process of cyber security and Advanced Threat Modeling and Risk Assessment
CO2	Understand	Proficient in Malware and Attack Pattern Analysis.
CO3	Apply	Skilled in Intelligence Sharing and Collaboration
CO4	Analyze	Effective Attribution and Profiling of Threat Actors
CO5	Evaluate	Competent in Creating and Disseminating Intelligence Reports

### D. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit(Hours)
1.	<b>Fundamentals of Cyber Threat Intelligence (CTI)</b>	<b>06</b>
2.	<b>Threat Analysis Techniques</b>	<b>09</b>
3.	<b>Overview of Bug Bounty Programs</b>	<b>09</b>
4.	<b>Advanced Bug Hunting Techniques</b>	<b>07</b>
5.	<b>Network and Infrastructure Vulnerabilities</b>	<b>09</b>

### E. DETAILED SYLLABUS

Unit	Unit Details
1.	<p><b>Fundamentals of Cyber Threat Intelligence (CTI)</b></p> <ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Definition and importance of CTI, Types of threat intelligence (strategic, tactical, operational, technical), The intelligence cycle: planning, collection, processing, analysis, dissemination</li> <li>● Threat Landscape and Actors: Types of cyber threats (malware, phishing, APTs, etc.), Threat actors (state-sponsored, hacktivists, cybercriminals), Motivations and tactics of threat actors</li> <li>● Sources of Threat Intelligence : Open source intelligence (OSINT) ,Commercial intelligence feeds, Internal sources (logs, incident reports)</li> <li>● CTI Tools and Platforms : Threat intelligence platforms (TIPs), SIEM systems (Splunk, ELK), Threat databases (MITRE ATT&amp;CK, VirusTotal),</li> <li>● Legal and Ethical Considerations : Legal aspects of CTI, Ethical issues in intelligence gathering, Compliance with regulations and standards</li> <li>● Conclusion of unit</li> </ul>

<b>2.</b>	<b>Threat Analysis Techniques</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Threat modeling and risk assessment, Analyzing malware and attack patterns, Behavioral analysis of threat actors</li> <li>● Attribution and Profiling: Techniques for attributing cyber attacks, Profiling threat actors</li> <li>● Intelligence Sharing and Collaboration: Information sharing frameworks (ISACs, ISAOs), Collaborative platforms (MISP, STIX/TAXII), Benefits and challenges of intelligence sharing</li> <li>● Reporting and Dissemination: Creating actionable intelligence reports, Dissemination strategies, Communicating with different stakeholders</li> <li>● Threat Hunting and Incident Response: Proactive threat hunting techniques, Using CTI in incident response</li> <li>● Conclusion of Unit</li> </ul>
<b>3.</b>	<b>Overview of Bug Bounty Programs</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Definition and history of bug bounty programs, Benefits and challenges, Major bug bounty platforms (HackerOne, Bugcrowd, Synack)</li> <li>● Setting Up a Bug Bounty Program :Planning and scope definition, Creating a vulnerability disclosure policy, Rewards and incentives</li> <li>● Vulnerability Identification Techniques: Common web vulnerabilities (OWASP Top Ten) ,Tools and methodologies for bug hunting, Manual vs. automated testing</li> <li>● Reporting and Validation: Writing effective vulnerability reports, Communicating with security teams</li> <li>● Validation and triage processes, Legal and Ethical Aspects, Legal considerations for researchers and organizations, Ethical hacking principles, Handling legal challenges</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Advanced Bug Hunting Techniques</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Web Application Vulnerabilities :SQL injection, XSS, CSRF, and more, Advanced web vulnerability exploitation techniques,</li> <li>● Tools for web application testing (Burp Suite, OWASP ZAP)</li> <li>● Mobile and API Security :Common vulnerabilities in mobile applications ,API security testing, Tools for mobile and API testing (MobSF, Postman)</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Network and Infrastructure Vulnerabilities</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Network and Infrastructure Vulnerabilities: Network scanning and enumeration,</li> <li>● Exploiting network vulnerabilities,</li> <li>● Tools for network testing (Nmap, Nessus)</li> <li>● Reverse Engineering and Exploit Development, Basics of reverse engineering,</li> <li>● Tools for reverse engineering (IDA Pro, Ghidra)</li> <li>● Conclusion of Unit</li> </ul>
<b>Reference Book</b>	
1.	"The Threat Intelligence Handbook: A Practical Guide for Security Teams to Unlocking the Power of Intelligence" Authors: Thomas Quinlan, Christopher Brown, and Sara Avery Publisher: O'Reilly Media

2.	"Cyber Threat Intelligence: Principles, Methods, and Applications" Authors: Ahmed Moustafa, Konstantinos Zopiatis, Christian T. Braun, Publisher: Springer
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OnlineResources	
1.	<a href="https://www.udemy.com/course/cyber-threat-intelligence/">https://www.udemy.com/course/cyber-threat-intelligence/</a>
2.	<a href="https://arcx.io/courses/cyber-threat-intelligence-101">https://arcx.io/courses/cyber-threat-intelligence-101</a>
3.	<a href="https://www.threatintel.academy/">https://www.threatintel.academy/</a>

#### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	-	2	-								3	-	-	1
CO2	1	2	1	1	-								1	1	-	1
CO3	-	1	3	-									1	2	1	1
CO4	1	1	-	1	1								-	1	2	2
CO5	-	1	-	-	1								-	-	-	1

**Professional Elective: X**

**Specialization: General**

**Code: 25MCAECA3112 Fundamentals of Artificial Intelligence 3 Credits [LTP: 3-0-0]**

#### A. COURSE OUTCOME

B.

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recall fundamental concepts of artificial intelligence (AI) and expert systems.
CO2	Understand	Summarize the differences between various AI techniques such as machine
CO3	Apply	Apply AI algorithms and tools to solve problems.
CO4	Analyze	Evaluate the effectiveness and limitations of different AI approaches in solving specific problems.
CO5	Evaluate	Formulate recommendations for improving AI systems based on critical analysis.

#### C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to AI and Intelligent agent	08
2.	Game Playing	08
3.	Knowledge and Reasoning	08
4.	Learning	07
5.	NLP	07

#### D. DETAILED SYLLABUS

Unit	Unit Details
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CO 5	3	2	1	-				-	-	-	-	-	-	-	-
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**Code: 25MCAECA3113Big Data Analytics      3 Credits [LTP: 3-0-0]**

**COURSE OUTCOME**

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recognize key terminology related to big data technologies and tools
CO2	Understand	Describe the challenges and opportunities associated with big data analytics in various industries.
CO3	Apply	Implement data preprocessing techniques to clean and prepare data for analysis
CO4	Analyze	Analyze big data sets to identify patterns, trends, and outliers
CO5	Evaluate	Evaluate the impact of big data analytics on decision-making processes within organizations

**A.OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to Big Data And Hadoop</b>	<b>07</b>
2.	<b>HDFS(Hadoop Distributed File System)</b>	<b>08</b>
3.	<b>Map Reduce</b>	<b>08</b>
4.	<b>Hadoop Eco System</b>	<b>07</b>
5.	<b>Data Analytics with R</b>	<b>07</b>

**B.DETAILED SYLLABUS**

Unit	Unit Details
1.	<b>Introduction to Big Data and Hadoop</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Introduction to Big Data ,Big Data Characteristics</li> <li>● Types of Digital Data, Introduction to Big Data, Big Data Analytics,</li> <li>● Relationships and Representations, Graph Databases.</li> <li>● History of Hadoop, Apache Hadoop, Analysing Data with Unix tools,</li> <li>● Analysing Data with Hadoop, Hadoop Streaming,</li> <li>● Hadoop Echo System, IBM Big Data Strategy, Introduction to InfosphereBigInsights and Big Sheets.</li> <li>● Conclusion of Unit</li> </ul>

2.	<b>HDFS(Hadoop Distributed File System)</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● The Design of HDFS, HDFS Concepts, Command Line Interface,</li> <li>● Hadoop file system interfaces, Data flow,</li> <li>● Data Ingest with Flume and Scoop and Hadoop archives,</li> <li>● Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures</li> <li>● Conclusion of Unit</li> </ul>
3.	<b>Map Reduce</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Anatomy of a Map Reduce Job Run, Failures,</li> <li>● Job Scheduling, Shuffle and Sort,</li> <li>● Task Execution, Map Reduce Types and Formats, Map Reduce Features.</li> <li>● Conclusion of Unit</li> </ul>

4.	<b>Hadoop Eco System</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Pig : Introduction to PIG, Execution Modes of Pig,</li> <li>● Comparison of Pig with Databases, Grunt, Pig Latin,</li> <li>● User Defined Functions, Data Processing operators. Hive : Hive Shell,</li> <li>● Hive Services, Hive Metastore, Comparison with Traditional Databases,</li> <li>● HiveQL, Tables, Querying Data and User Defined Functions. Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.</li> <li>● Big SQL : Introduction</li> <li>● Conclusion of Unit</li> </ul>
5.	<b>Data Analytics with R</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Machine Learning : Introduction, Supervised Learning,</li> <li>● Unsupervised Learning, Collaborative Filtering.</li> <li>● Big Data Analytics with BigR.</li> <li>● Conclusion of Unit</li> </ul>

**C.RECOMMENDED STUDY MATERIAL**

S. No	Text Books:	Author	Edition	Publication
1.	Hadoop: The Definitive Guide	Tom White	Third Edition	O'reily
2.	Big Data Analytics	Seema Acharya, Subhasini Chellappan	2015	Wiley
<b>Reference Book</b>				
1.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.			
2.	Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)			
3.	Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R			
<b>Online Resources</b>				
1.	<a href="http://www.bdbanalytics.ir/media/1121/big-data-analytics_turning-big-data-into-big-money.pdf">http://www.bdbanalytics.ir/media/1121/big-data-analytics_turning-big-data-into-big-money.pdf</a>			
2.	<a href="https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics">https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics</a>			

#### MAPPING OF CO VS PO/PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	1	2	-	-	-	-	-	-	-	-	2	-	2	-
CO2	-	2	1	1	-	-	-	-	-	-	-	-	1	-	1	-
CO3	1	-	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	2	2	-	-	-	-	-	-	-	-	1	-	2	-
CO5	2	-	1	2	1	-	-	-	-	-	-	-	1	-	2	-

## Specialization: AI& DS

Code: 25MCDECA3112Deep Learning and ANN 3 Credits [LTP: 3-0-0]

### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Defining the importance of Deep Learning and studying artificial neural network.
CO2	Understand	Explain the artificial neuron and biological neuron along with forward and backward propagation in a network.
CO3	Apply	Apply Deep learning to images forming the CNN. Solving the deep learning problems based on the images like image recognition.
CO4	Analyze	Analyze the recurrent neural networks for sequence models. Understand the importance of RNN in speech recognition.
CO5	Evaluate	Evaluate different deep generative models for generative modeling.

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to Artificial Neural Network</b>	<b>07</b>
2.	<b>Introduction to Deep Learning</b>	<b>08</b>
3.	<b>Convolutional Neural Networks</b>	<b>09</b>
4.	<b>Recurrent Neural Networks</b>	<b>07</b>
5.	<b>Deep Generative Models and Applications</b>	<b>09</b>

### B: DETAILED SYLLABUS

Unit	Unit Details
<b>1</b>	<b>Introduction to Artificial Neural Network</b>
	<ul style="list-style-type: none"> <li>● Introduction to Artificial Neural Network</li> <li>● Artificial Neural Network (ANN)</li> <li>● Working principles of Neural Network Works</li> <li>● Perceptron</li> <li>● Multilayer Perceptron</li> <li>● Feed Forward</li> <li>● Gradient Descent and Stochastic Gradient Descent</li> </ul>

	<ul style="list-style-type: none"> <li>● Back propagation</li> <li>● Empirical Risk Minimization</li> <li>● Regularization</li> <li>● Autoencoders</li> <li>● Conclusion of Unit</li> </ul>
<b>2</b>	<b>Introduction to Deep Learning</b>

	<ul style="list-style-type: none"> <li>● Introduction to Deep Learning</li> <li>● Basics: Biological Neuron, Idea of computational units, McCulloch</li> <li>● Pitts unit and Thresholding logic</li> <li>● Linear Perceptron</li> <li>● Perceptron Learning Algorithm</li> <li>● Linear separability</li> <li>● Convergence theorem for Perceptron Learning Algorithm</li> <li>● Deep Learning Packages</li> <li>● Deep Learning Applications</li> <li>● Building Deep Learning Environment</li> <li>● Installing TensorFlow Locally</li> <li>● Working with Google Colab</li> <li>● Conclusion of Unit</li> </ul>
<b>3</b>	<b>Convolutional Neural Networks</b>
	<ul style="list-style-type: none"> <li>● Introduction of Convolutional Neural Network</li> <li>● Basic structure of Convolutional Network</li> <li>● Case studies: Alex net, VGG- Net, GoogLeNet</li> <li>● Applications of CNN– Object Detection, Content based image Retrieval</li> <li>● Conclusion of Unit</li> </ul>
<b>4</b>	<b>Recurrent Neural Networks</b>
	<ul style="list-style-type: none"> <li>● Introduction of Recurrent Neural Networks</li> <li>● Bidirectional RNNs</li> <li>● Deep Recurrent Networks</li> <li>● Recursive Neural Networks</li> <li>● The Long Short-Term Memory and Other Gated RNNs</li> <li>● Conclusion of Unit</li> </ul>
<b>5</b>	<b>Deep Generative Models and Applications</b>
	<ul style="list-style-type: none"> <li>● Introduction of Deep Generative Models</li> <li>● Boltzmann Machines</li> <li>● Restricted Boltzmann Machines</li> <li>● Introduction to MCMC and Gibbs Sampling</li> <li>● Gradient computations in RBMs</li> <li>● Deep Belief Networks</li> <li>● Deep Boltzmann Machines</li> <li>● Application</li> <li>● Large-Scale Deep Learning Computer</li> <li>● Speech Recognition</li> <li>● Natural Language Processing</li> <li>● Other Applications</li> <li>● Conclusion of Unit</li> </ul>

**C:RECOMMENDED STUDY MATERIAL**

S. No	Text Books:	Author	Edition	Publication
1.	Deep Learning	Ian Goodfellow, YoshuaBengio, Aaron Courville	Latest	MIT Press
2.	Deep Learning Made Easy with R: A Gentle Introduction for Data Science	N.D.Lewis	Latest	
3.	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms	Nikhil Buduma	Latest	O'Reilly publications.

Online Resources
<ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/106106184">https://nptel.ac.in/courses/106106184</a></li> <li>• <a href="https://www.javatpoint.com/deep-learning">https://www.javatpoint.com/deep-learning</a></li> <li>• <a href="https://www.coursera.org/specializations/deep-learning">https://www.coursera.org/specializations/deep-learning</a></li> </ul>

Reference Books
<ul style="list-style-type: none"> <li>• Make your own neural network, Tariq Rashid</li> <li>• Hands-On Deep Learning with TensorFlow, Dan Van Boxel</li> <li>• Hands-on Machine Learning with Scikit-learn and Tensorflow, O'Reilly, Deron A.</li> </ul>

**MAPPING OF CO VS PO/PSO**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO4
CO1	3	1	2					-	-	-	-	-	2	-	-	-
CO2	-	3	1	-	-	-	-	-	-	-	-	-	-	2	-	1
CO3	1	1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	-	1	2				-	-	-	-	-	2	-	1	-
CO5	-			3	-	-	-	-	-	-	-	-	-1	-	-	-

## Specialization: Cyber Security

Code: 25MCYECA3113Cryptography & Network Security	3 Credits [LTP: 3-0-0]
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### COURSE OUTCOME

CO	Cognitive Abilities	Course Outcomes
CO1	Remember	Recognize various algorithms and processes used in cryptography for authenticating users, securing information and communication.
CO2	Understand	Interpret the fundamental concepts involved in cryptography and how they help in achieving the goals of information security
CO3	Apply	Apply the knowledge to provide in detail concepts and tools to enhance the security of in use algorithms
CO4	Analyze	Categorize the modern techniques and algorithms to provide the better security of computer Networks
CO5	Evaluate	Judge the previous algorithms and redesign it in order to maintain the security of the digital data

### A. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	<b>Introduction to Cryptography</b>	<b>07</b>
2.	<b>Cryptographic algorithms</b>	<b>08</b>
3.	<b>Key Exchange and Management</b>	<b>08</b>
4.	<b>Application of Cryptography</b>	<b>07</b>
5.	<b>Network Security</b>	<b>07</b>

### B. DETAILED SYLLABUS

Unit	Unit Details
1.	<b>Introduction to Cryptography</b> <ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● The goals of Security- Confidentiality, Integrity &amp; Availability (CIA) Triad</li> <li>● Cryptographic concepts, methodologies &amp; practices</li> <li>● Symmetric &amp; Asymmetric cryptography, public &amp; private keys</li> <li>● Cryptographic algorithms and uses</li> <li>● Construction &amp; use of Digital signatures</li> <li>● Conclusion of the Unit</li> </ul>

<b>2.</b>	<b>Cryptographic algorithms</b>
	<ul style="list-style-type: none"> <li>● Introduction to Unit</li> <li>● Chinese Remainder Theorem</li> <li>● Arithmetic modulo primes and finite cyclic groups</li> <li>● DES, RSA, SHA</li> <li>● MD5, HMAC, DSA</li> <li>● Conclusion of the Unit</li> </ul>
<b>3.</b>	<b>Key Exchange and Management</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Key Exchange mechanisms and its security- Diffie-Hellman</li> <li>● MITM</li> <li>● Public Key Infrastructure</li> <li>● The basic functions involved in key management including creation, distribution, verification, revocation and destruction, storage, recovery.</li> <li>● Conclusion of Unit</li> </ul>
<b>4.</b>	<b>Application of Cryptography</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Major key distribution methods and algorithms including Kerberos, ISAKMP etc., Vulnerabilities to cryptographic functions.</li> <li>● Use and functions of Certifying Authorities (CAs), Public Key Infrastructure (PKI) and System architecture requirements for implementing cryptographic functions.</li> <li>● Web Services security, Cloud Security, VPNs</li> <li>● Conclusion of Unit</li> </ul>
<b>5.</b>	<b>Network Security</b>
	<ul style="list-style-type: none"> <li>● Introduction of Unit</li> <li>● Email Security, PGP, POP- versions</li> <li>● Firewall and its types</li> <li>● Modern firewalls</li> <li>● Signature vs. Anomaly based firewalls</li> <li>● Statefull vs. Stateless Firewall</li> <li>● Conclusion of Unit</li> </ul>

### C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Cryptography and Network Security	William Stallings	First Edition	2010
2.	Everyday Cryptography: Fundamental Principles and Applications	Keith Martin	2nd Edition	2017
<b>Reference Book</b>				
1.	Cryptography and Information Security, V. K. Pachghare, Prentice Hall India, 2nd rev ed; 2015			

2.	Cryptography and Network Security, AtulKahate, McGraw Hill India, 3rd ed; July 2017
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<b>Online Resources</b>	
1.	<a href="https://www.edx.org/learn/cryptography">https://www.edx.org/learn/cryptography</a>
2.	<a href="https://sopa.tulane.edu/blog/how-to-learn-cryptography">https://sopa.tulane.edu/blog/how-to-learn-cryptography</a>
3.	<a href="https://www.youtube.com/watch?v=dz7Ntp7KOGA">https://www.youtube.com/watch?v=dz7Ntp7KOGA</a>

**MAPPING OF CO VS PO/PSO**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1						-	-	-	-	-	2	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	1	1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	1		2				-	-	-	-	-	2	-	1	-
CO5	-			3	-	-	-	-	-	-	-	-	1	-	-	-

**Specialization: AIML with SAS**

<b>Code: 24MALECA3112</b>	<b>Optimization Concepts for Data Science and Artificial Intelligence 3Crd [LTP: 3-0-0]</b>
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**COURSE OUTCOME**

- Students will be able to
- Identify and formulate appropriate approaches to solving various linear ,mixed-integer linear, and nonlinear optimization problems.
- Create optimization models commonly used in industry.
- Solve optimization problems using the OPTMODEL procedure in SAS.

**A. OUTLINE OF THE COURSE**

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Introduction to Mathematical Optimization	06
2.	Linear Programming	09
3.	Nonlinear Programming	09
4.	Integer and Mixed	07
5.	Integer Linear Programming	09

**B. DETAILED SYLLABUS**

Unit	Unit Details
1.	Introduction to Mathematical Optimization

	<p>Introduction.</p> <p>A simple example.</p> <p>The OPTMODEL procedure.</p>
2.	Linear Programming
	<p>Introduction to linear programming.</p> <p>Formulating and solving linear programming problems using the OPTMODEL procedure.</p> <p>Using index sets and arrays in the OPTMODEL procedure.</p> <p>Dual values and reduced costs in the simplex method(self-study).</p> <p>Applied data envelopment analysis (self-study)</p>
3.	Nonlinear Programming

	Introduction to nonlinear programming. Solving nonlinear programming problems using the OPTMODEL procedure.
4.	Integer and Mixed
	Introduction to integer and mixed-integer linear programming
5.	Integer Linear Programming
	Solving integer and mixed-integer linear programming problems using PROCOPTMODEL

**Professional Elective Lab-V**  
**Specialization: General, AI & DS, Cyber**

<b>Code: 25MCACCA3202</b>	<b>Computer Network Lab</b>	<b>1 Credit [LTP: 0-0-2]</b>
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**COURSE OUTCOME**

Students will be able to:

- Use the clamping tool for making Cross and Straight cable and identify network IP
- Create local area network and do file sharing activity
- Configure switch and routers
- Configure WEP and Ethernet.
- Recognize static and dynamic routing

**A. List of Programs:**

<b>1</b>	Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool
<b>2</b>	Study/Demonstration of Network Devices and network IP in Detail.
<b>3</b>	Troubleshooting Scenarios Network -I (Basic network command and Network configuration commands.
<b>4</b>	Connect the computers with file sharing in Local Area Network.
<b>5</b>	Creating LAN using different topology using Cisco Packet Tracer
<b>6</b>	Configure DHCP Server using Cisco PacketTracer
<b>7</b>	Performing an Initial Switch Configuration.
<b>8</b>	Performing an Initial Router Configuration
<b>9</b>	Configuring WEP on a Wireless Router

<b>Code 25MCACCA3203</b>	<b>Cloud Computing Lab</b>	<b>1 Credit</b>	<b>[LTP: 0-0-2]</b>
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**Course Outcome :-**

Students will be able to:

- Demonstrate Virtualization and use in real life scenario.
- Apply Server and Storage Virtualization
- Install and configureVmware
- Apply the concept of vSpher
- Install VSAN

**A. LIST OF EXPERIMENTS:**

1	Desktop Virtualization – Network Virtualization
2	Server and Machine Virtualization
3	Storage Virtualization - System-level or Operating Virtualization
4	Sever Virtualization - Physical and Logical Partitioning - Types of Server Virtualization
5	Installing and configuring ESXi 5.5/6.0 Server [On Premise]
6	Introduction to Management with vCenter Server
7	Introduction to vSphere Networking And Security
8	Introduction to vSphere Storage
9	VSAN 6.6 Setup and Enablement
10	VSAN Scale Out with Configuration Assist
11	VSAN All Flash Capabilities
12	VSANSCSI Target

**B. RECOMMENDED STUDY MATERIAL**

<b>S. No</b>	<b>Text Books:</b>	<b>Author</b>	<b>Edition</b>	<b>Publication</b>
1.	Virtualization 101: Introduction to vSphere	A. s. solanki		TMH
<b>Reference Book</b>				
1.	Cloud Computing: Principles and Paradigms, Rajkumar Buyya, John Wiley & Sons			
<b>Online Resources</b>				
1.	<a href="https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCSA7022.pdf">https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCSA7022.pdf</a>			
2	<a href="https://docs.hol.vmware.com/HOL-2022/hol-2210-01-sdc_pdf_en.pdf">https://docs.hol.vmware.com/HOL-2022/hol-2210-01-sdc_pdf_en.pdf</a>			

## Professional Elective Lab-VI

### Specialization: General

Code : 25MCAECA3211

Advanced Frontend with Angular Lab

1 Credit[LTP: 0-0-2]

#### Lab Experiments:

1	Install Node.js and npm., Set up a new Node.js project with npminit., Install Express and create a basic server, Create a new React app using Create React App, Ensure the server and React app can run concurrently using a package like concurrently.
2	Building a RESTful API with Node.js and Express : Create a RESTful API with basic CRUD operations. Define routes for creating, reading, updating, and deleting resources (e.g., users). Implement these routes in an Express server. Test the API using Postman or another HTTP client.
3	Connecting React to the RESTful API: Set up Axios or Fetch in the React app for making HTTP requests. Create components to display data fetched from the API. Implement forms for adding new resources and connect them to the API.
4	State Management in React with Context API. Set up a Context for managing user data. Create a Provider component that fetches data from the API and provides it to the rest of the app. Use the Context in various components to access and update user data.
5	User Authentication and Authorization Create login and registration routes in the Express server. Implement JWT-based authentication. Create login and registration forms in React. Protect certain routes in the React app, allowing access only to authenticated users.
6	CRUD Operations in React with Hooks: Use useState and use Effect hooks to manage and fetch data. Implement form handling using use State. Create, update, and delete resources through the API.
7	<b>File Uploads with Multer and React :</b> Set up Multer middleware in the Express server for handling file uploads , Create a file upload form in React., Send the file to the server and save it in a directory, Display the uploaded files in the React app.
8	<b>Websockets with Socket.io :</b> Set up Socket.io in the Node.js server. Set up Socket.io client in the React app. Implement a basic chat application or notification system using Web Sockets.
9	Deploying the Full-Stack Application: Set up a project on a cloud platform like Heroku, Vercel, or AWS. Deploy the Node.js server and the React app. Ensure the API and frontend are correctly configured to work in a production environment.
10	Performance Optimization and Testing Implement caching strategies in the Node.js server (e.g., using Redis). Use React's lazy loading and code splitting for performance optimization.

## Specialization: Cloud & DevOps

### LAB COURSE OUTCOMES (COs)

Code:25MCTECA3212	DevOps Lab	1Credits [LTP: 0-0-2]
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	CO No.	Cognitive Ability	Lab Course Outcomes
A.	CO1	Remember	Recall and demonstrate basic DevOps commands, version control operations, and shell scripting.
	CO2	Understand	Implement continuous integration and automation pipelines using Git and Jenkins.
	CO3	Apply	Deploy and manage applications using Docker containers and Kubernetes orchestration.
	CO4	Analyze	Monitor and troubleshoot system performance using open-source monitoring tools.
	CO5	Create	Design an end-to-end DevOps pipeline integrating version control, CI/CD, containerization, and monitoring.

### LAB-SYLLABUS OUTLINE

S. No.	Lab Title / Experiment	Linked Theory Unit
1	Basic Linux shell scripting for DevOps automation.	Unit 1
2	Install and configure Git. Perform commit, push, pull, merge, branch operations.	Unit 3
3	Setup GitHub or GitLab repository and integrate with Jenkins.	Unit 3
4	Install and configure Jenkins. Create and execute a Freestyle and Declarative Pipeline job.	Unit 2 & 3
5	Automate build, test, and deploy process using Jenkins and Git.	Unit 2 & 3
6	Write a simple Docker file to containerize an application.	Unit 4
7	Use Docker Compose for multi-container setup.	Unit 4
8	Push and pull images to/from DockerHub or a private container registry.	Unit 4
9	Set up a simple Kubernetes cluster using Minikube. Deploy an app using Kubernetes YAML files.	Unit 4
10	Scale and expose Kubernetes deployments using <code>kubectl</code> and services.	Unit 4
11	Setup monitoring using <b>Prometheus</b> and visualization using <b>Grafana</b> .	Unit 5
12	Setup centralized logging using <b>ELK Stack (Elasticsearch, Logstash, Kibana)</b> or equivalent.	Unit 5
13	Analyze pipeline performance metrics such as build duration, deployment success rate, and error frequency.	Unit 5

14	<b>Mini Project:</b> Build a complete CI/CD pipeline for a sample web application using Git, Jenkins, Docker, Kubernetes.	All Units
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<b>Code: 25MCTECA3212</b>	<b>Frontend with Angular for cloud professional's lab</b>	<b>1Credits [LTP: 0-0-2]</b>
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**Lab Experiments:**

1.	Create an HTML page containing: <ul style="list-style-type: none"> <li>• Headings (h1 to h3)</li> <li>• Paragraphs</li> <li>• Ordered and unordered lists</li> <li>• Images with alt text</li> <li>• Hyperlinks to external websites</li> </ul>
2.	Design the above page with CSS: <ul style="list-style-type: none"> <li>• Change text colors, fonts, and sizes</li> <li>• Set background colors and images</li> <li>• Add borders and padding to elements</li> <li>• Use inline, internal, and external CSS</li> </ul>
3.	Build a form with: <ul style="list-style-type: none"> <li>• Text input fields (name, email)</li> <li>• Radio buttons and checkboxes</li> <li>• Submit and reset buttons</li> </ul>
4.	Create a webpage layout using CSS: <ul style="list-style-type: none"> <li>• Header, navigation bar, main content, and footer sections</li> <li>• Apply box model properties (margin, padding, border)</li> <li>• Use media queries to make layout responsive on different screen sizes</li> </ul>
5.	Write JavaScript programs to: <ul style="list-style-type: none"> <li>• Use if-else statements to check conditions</li> <li>• Use for and while loops to display numbers or messages</li> <li>• Display output dynamically on the webpage</li> </ul>
6.	Create a webpage with a button that: <ul style="list-style-type: none"> <li>• Changes the text content of a paragraph on click</li> <li>• Changes the style (color, font size) of an element dynamically</li> </ul>
7.	Add validation to the form created in Lab 3: <ul style="list-style-type: none"> <li>• Check that all required fields are filled</li> <li>• Validate email format with regex</li> <li>• Alert the user on invalid input</li> </ul>
8.	Create a JavaScript object or JSON array of items (e.g., books or students) and display the data dynamically on the webpage using loops.
9.	Use AJAX (fetch API or XMLHttpRequest) to: <ul style="list-style-type: none"> <li>• Retrieve data from a public API (like JSONPlaceholder or a weather API)</li> <li>• Display the fetched data in a formatted way on the page</li> </ul>
10.	Create a basic Angular app with a component that: <ul style="list-style-type: none"> <li>• Displays static user details (name, email)</li> <li>• Uses interpolation and property binding</li> </ul>
11.	Modify the Angular component to: <ul style="list-style-type: none"> <li>• Use *ngIf to conditionally show a message</li> </ul>

	<ul style="list-style-type: none"> <li>● Use *ngFor to loop through an array of items and display them in the template</li> </ul>
12.	<p>Create a form in Angular that:</p> <ul style="list-style-type: none"> <li>● Uses template-driven or reactive form approach</li> <li>● Includes fields like name and email with validation</li> <li>● Displays entered data on submit without page refresh</li> </ul>

### Specialization: AI & DS

**Code: 25MCDECA3211Deep Learning and ANN Lab 3 Credits [LTP: 3-0-0]**

#### Lab Exercise

- 1 Develop a basic artificial neural network to classify simple datasets.
- 2 Implement a single-layer Perceptron and train it on linearly separable data.
- 3 Build a multi-layer Perceptron and train it on a more complex dataset.
- 4 Apply backpropagation to train a neural network and analyze its performance.
- 5 Implement gradient descent and compare its performance with stochastic gradient descent.
- 6 Use an autoencoder for dimensionality reduction and reconstruct the input data.
- 7 Apply regularization techniques to prevent overfitting in neural networks.
- 8 Experiment with different activation functions and observe their impact on network training.
- 9 Design a neural network to handle a real-world problem, such as image classification or sentiment analysis. Evaluate the performance of different neural network architectures using empirical risk minimization.

### Specialization : Cyber Security

**Code: 25MCYECA3211 Vulnerability assessment and Penetration Testing Lab 1Credit [LTP: 0-0-2]**

#### Course Outcome:

Students will be able to:

- Describe various algorithms and processes used in cryptography for authenticating users, securing information and communication
- Analyze and design hash and MAC algorithms, and digital signatures
- Identify Intruders and Intruder Detection mechanisms, types of Malicious software
- Acknowledge and analyze data encryption standard
- Analyze and design of software and its usage

#### List of Programs

1	Perform the Information gathering using various tools and techniques
2	Perform DNS and other server enumerations
3	Use the various scanners to perform Network and port scanning
4	Manual and automated vulnerability scanning using various tools
5	Use the wireshark for packet capturing
6	Privilege escalation techniques on Windows and Linux
7	Perform the password and hash attacks
8	Web application hacking (SQL injection, Remote code Execution, local file inclusion, file upload vulnerabilities etc.)
9	Use the basic features of Burp Suite.-I
10	Use the basic features of Burp Suite.-II
11	Perform operations using Metasploit framework.-I
12	Perform operations using Metasploit framework.-II

**B. RECOMMENDED STUDY MATERIAL:**

S. No	Text Books:	Author	Edition	Publication
1.	Hacking: The Art of Exploitation	Jon Erickson	First Edition	2010
2.	Penetration Testing: A Hands-On Introduction to Hacking	Georgia Weidman	First Edition	2017
<b>Reference Book</b>				
1.	Cryptography and Information Security, V. K. Pachghare, Prentice Hall India, 2nd rev ed; 2015			
2.	Cryptography and Network Security, AtulKahate, McGraw Hill India, 3rd ed; July 2017			
<b>Online Resources</b>				
1.	<a href="https://www.yeahhub.com/best-16-penetration-testing-books-2018-update/">https://www.yeahhub.com/best-16-penetration-testing-books-2018-update/</a>			
2.	<a href="https://www.virtualhackinglabs.com/labs/penetration-testing-lab/">https://www.virtualhackinglabs.com/labs/penetration-testing-lab/</a>			

**Specialization: AIML with SAS****Code: 25MALECA3111****Forecasting Using Model Studio in SAS® Viya® Lab****1 Credits [LTP: 3-0-0]****COURSE OUTCOME**

Students, will be able to:

- Automatically create and fit custom forecast models using structured analytic workflows or pipelines.
- Visualize modeling data using attribute variables.
- Refine forecast models to improve forecast accuracy.
- Apply overrides-generated forecasts.
- Generate forecast datasets for deployment.

S.No.	Exercise
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1.	Creating a forecasting project and loading the data.
2	Visualizing the modeling data using attribute variables.
3	Basic modeling with pipelines.
4	Basic modeling with pipelines.
5	Pipeline templates and pipe line comparison.
6	Performing Hierarchical Forecasting
7	Exporting generated tables.
8	Adding event variables in the TSMODEL procedure.
9	Adjustment stostatistical forecasting.
10	Apply overrides-generated forecasts.

## Specialization: General

<b>Code: 25MCAECA3212</b>	<b>Salesforce Lab 1 Credit [LTP: 0-0-2]</b>
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### LIST OF EXPERIMENTS:

1	Contact Management: Track and manage customer interactions, details, and history.
2	Account Management: Manage company accounts, view related contacts, and track account activities.
3	Opportunity Management: Track sales opportunities, manage the sales pipeline, and forecast revenue.
4	. Task Management: Schedule and assign tasks and activities to sales teams.
5	Sales Processes: Automate sales workflows, such as lead nurturing and follow-ups
6	Lead Management: Capture, track, and convert leads into opportunities.
7	Case Management: Track and manage customer service cases and support requests.
8	Knowledge Base: Create and manage a repository of articles and FAQs for customer self-service.
9	Service Cloud: Use features like live chat, case tracking, and customer portals to enhance service delivery.
10	Custom Reports: Design and generate custom reports to analyze sales, marketing, and service data.
11	Dashboards: Create visual dashboards to monitor key metrics and performance indicators.
12	Einstein Analytics: Leverage AI-powered analytics to gain insights and predictions from your data.

## Specialization: AI & DS and AIML with SAS

<b>Code: 25MCDECA3212</b>	<b>NLP and Computer Vision Lab 1Credit [LTP: 0-0-2]</b>
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### Course Outcome:-

Students will be able to:

- Develop systems for various NLP problems with moderate complexity.
- Familiarize various NLP software libraries and datasets publicly available.
- Implement semantics and pragmatics of English language for text processing
- Implement real time applications of computer vision.
- Designanddeveloppracticalandinnovativeimageprocessingandcomputervisionapplicationsorsystems.

### A. LIST OF EXPERIMENTS:

1	Write a program to tokenize the sentence into words for the further analysis (using PythonFunction)
2	Write a program to Normalize the sentence to eliminate the unwanted punctuation, converting into Lower case or upper case of the entire document, expanding abbreviation, numbers into words and canonicalization
3	Write a program that splits the following string“ Hello there SAM” into list and iterate over thlistusing3 different methods <ul style="list-style-type: none"> <li>● Listasa Iterable</li> <li>● Using Range</li> </ul>
4	Convertthefollowingsentenceintotokens“NLPisFun,youmustlearnit”intolowercase <ul style="list-style-type: none"> <li>● With out splitting</li> <li>● With splitting</li> </ul>
5	Write a program for Amazon review dataset to find the maximum Number of words used.Get the output for the frequently occurred word in the given data? And also visualizethetestdata.
6	Write a program to Get the word cloud for they help Review dataset

7	Perform the sentiment analysis, classifying comments using various machine learning model on IMDB review data set
8	Write a program to perform n-gram analysis on Amazon review dataset and also compare result while performing different type of n-gram analysis on the given dataset
9	Write a program to display grayscale images using python
10	Write a python program to detect the edges of image
11	Write a python program to create a vision program to find histogram value and display histogram of a grayscale and color image.
12	Write a python program to create a program to eliminate the high frequency components of an image.

**B. RECOMMENDED STUDY MATERIAL**

S.No	Text Books:	Author	Edition	Publication
1.	“Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”,	Jurafsky D. and Martin J.H	2 <sup>nd</sup> Edition	Upper Saddle River, NJ: Prentice- Hall, 2008
2.	Natural Language Processing with Python	Edward Loper, Ewan Klein, and Steven Bird	1 <sup>st</sup> Edition	Pearson Education O’Reilly Media

3.	Computer Vision: Models, Learning, and Inference	Simon Prince	2nd Edition	Cambridge University Press
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**Reference Book**

1.	“Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, And Speech Recognition”,
2.	Computer Vision: Models, Learning, and Inference

**Online Resources**

1.	<a href="https://www.nlp.com/nlp-online-course/">https://www.nlp.com/nlp-online-course/</a>
2.	<a href="https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-natural-language-processing">https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-natural-language-processing</a>
3.	<a href="https://www.futurelearn.com/courses/cloudswyft-msft-natural-language-processing-advanced">https://www.futurelearn.com/courses/cloudswyft-msft-natural-language-processing-advanced</a>

**Code: 25MCYECA3212 Cyber Threat Intelligence and Bug Bounty Lab 1 Credit [LTP: 0-0-2]**

S.No.	Topic
1	Performing Vulnerabilities Analysis and the OWASP
2	Using Web Proxies, DaaS, and Remote Systems
3	Prepare to Attack Our Fake Company with Bug Hunter Skills
4	Performing Web Hunting Edition, Active & Passive Reconnaissance
5	Performing Digital Footprint, Google Dorking & GHDB
6	Using Purposely Buggy Frameworks like BWapp, DVWA, Webgoat
7	Using RegEx: Basics, Tools, and Bypassing

8	Checking Out Auth with Basic Login and Password Bypass
9	Understanding Fuzzing Tools like FFuF, Libfuzz, Wfuzz
10	ExploreWeb Sockets, Session ID, Scripts and CSWH
11	Explore JavaScript, Credentials, De-obfuscation
12	What is SSRF Forgery, Bind, Time-Based
13	IDOR: Insecure Direct Object Reference, Identifiers
14	Validation Bypass (Client/Server)
15	Metadata in Websites: How to Find It and Its Value
16	SQL Injection Fundamentals – Understanding SQL Formats
17	SQLMap Essentials and Intermediate Capabilities
18	Time-Based SQLi, Writing Basic SQL Queries, Boolean
19	Wrap-Up: Day 1 Review and Homework Assignments
20	Command Injections: Payloads, Forms, Cookies
21	Host Header Injection, URL Redirection
22	File Upload Attacks: Command Injection, XXE, Image Upload Vulnerability
23	Server-Side Attacks: SSRF and More SSRF, Session Security
24	Login Brute Forcing, Broken Authentication, 2FA Bypass
25	Web Attacks and File Inclusion, DNS, Subdomains, Domain Hunting

**Code:25MULCHM3201 Leadership, Team Building & Interpersonal Skills 1Credits [LTP: 0-0-2]**

## COURSE OUTCOME

### Students will be able to:

- Describe key leadership concepts, characteristics, theories, and styles, and distinguish leadership from management.
- Explain team dynamics and apply appropriate roles and strategies for building and managing effective teams.
- Apply interpersonal communication skills and emotional intelligence principles to improve collaboration and relationships.
- Analyze conflict situations and evaluate suitable conflict-resolution and negotiation strategies for positive outcomes.
- Develop a personal leadership improvement plan through self-assessment, vision building, and effective time and stress management.

## A. OUTLINE OF THE COURSE

Unit No.	Unit Name	Time Required (Hours)
Unit 1	Leadership Essentials	9 Hours
Unit 2	Building Effective Teams	9 Hours
Unit 3	Interpersonal Communication & Emotional Intelligence	7 Hours
Unit 4	Conflict Management and Negotiation	7 Hours
Unit 5	Personal Leadership Development	6 Hours

## **B. DETAILED SYLLABUS**

### **Unit 1: Leadership Essentials**

#### **Introduction of the Unit**

- Definition and characteristics of leadership
- Leadership vs. Management
- Leadership theories: Trait, Behavioral, Contingency, Transformational
- Leadership styles and their applications

#### **Conclusion of Unit**

### **Unit 2: Building Effective Teams**

#### **Introduction of the Unit**

- Team vs. Group: Key differences
- Stages of team development (Tuckman Model)
- Roles in teams (Belbin's Team Roles)
- Trust, collaboration, and motivation in teams

#### **Conclusion of Unit**

### **Unit 3: Interpersonal Communication & Emotional Intelligence**

#### **Introduction of the Unit**

- Fundamentals of interpersonal communication
- Barriers to effective communication
- Emotional intelligence: self-awareness, empathy, and relationship management
- Non-verbal cues, active listening, and feedback techniques

#### **Conclusion of Unit**

### **Unit 4: Conflict Management and Negotiation**

#### **Introduction of the Unit**

- Nature and sources of conflict
- Conflict resolution styles (Thomas-Kilmann Model)
- Negotiation strategies and techniques
- Mediation and collaboration for win-win outcomes

#### **Conclusion of Unit**

### **Unit 5: Personal Leadership Development**

#### **Introduction of the Unit**

- Self-assessment and leadership inventories
- Building personal vision and values
- Time and stress management
- Continuous improvement and growth mindset

#### **Conclusion of Unit**

### Text Book(s)

- Stephen P. Robbins & Timothy A. Judge, *Organizational Behavior*, Pearson Education
- Daniel Goleman, *Emotional Intelligence*, Bantam Books
- Richard L. Daft, *Leadership*, Cengage Learning

### Reference Book(s)

- John Adair, *Effective Leadership: How to Be a Successful Leader*, Pan Macmillan
- Kerry Patterson et al., *Crucial Conversations*, McGraw-Hill
- Brian Tracy, *Leadership*, AMACOM

### Online Resource(s)

- <https://www.mindtools.com/>
- <https://www.coursera.org/learn/leadership-skills>
- <https://www.edx.org/course/interpersonal-communication>
- <https://hbr.org/topic/leadership>

## Skill Enhancement Courses (SEC)

Code: 25MULCUL3201	Algorithmic Thinking & Programming Practice	1 Credits [LTP: 0-0-2]
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### COURSEOUTCOMES:

CO	Cognitive Abilities	Course Outcomes
CO – 01	UNDERSTAND	Understand fundamental programming concepts, algorithmic logic, flowcharts, and control structures for solving basic computational problems.
CO – 02	APPLY	Apply modular programming principles by designing and implementing functions, using parameter passing, return values, and recursion effectively.
CO – 03	APPLY	Use arrays, strings, and searching techniques to store, manipulate, and retrieve data efficiently in programming tasks.
CO – 04	ANALYZE	Analyze and implement sorting algorithms and problem-solving patterns such as brute force, greedy methods, and two-pointers.
CO – 05	EVALUATE	Develop and debug programs using effective coding practices, error interpretation, input validation, and structured debugging techniques.

### B. Detailed Syllabus:

#### Unit 1: Introduction to Programming & Algorithmic Thinking (9 Hrs)

##### Introduction of the Unit

- Overview of programming logic and flowcharts
- Basics of algorithms: steps, properties, pseudo-code
- Introduction to variables, data types, input-output
- Control structures: conditionals and loops
- Dry-running and tracing logic

Conclusion of Unit

#### Unit 2: Functions and Recursion (9 Hrs)

##### Introduction of the Unit

- Modular programming and function design
- Parameter passing, return values
- Scope and lifetime of variables
- Recursion: base case, recursive case
- Recursion vs iteration: performance considerations

Conclusion of Unit

### **Unit 3: Arrays, Strings, and Searching Techniques (9 Hrs)**

#### **Introduction of the Unit**

- 1D and 2D arrays: creation, traversal, manipulation
- String handling: basic operations and character arrays
- Linear search and binary search
- Time and space complexity basics (Big O notation)

Conclusion of Unit

### **Unit 4: Sorting, Problem Solving Patterns (9 Hrs)**

#### **Introduction of the Unit**

- Bubble sort, selection sort, insertion sort
- Problem-solving strategies: brute force, greedy approach, two-pointers
- Practice problems using sorting and searching

Input validation and edge-case handling

Conclusion of Unit

### **Unit 5: Programming Practice & Debugging Techniques (9 Hrs)**

#### **Introduction of the Unit**

- Practice on coding platforms: pattern printing, numeric problems, logic puzzles
- Debugging techniques and tools
- Understanding compiler/interpreter messages
- Writing readable, maintainable, and testable code

Conclusion of Unit

#### **Text Book(s)**

- R.G. Dromey, *How to Solve It by Computer*, Pearson
- Yashavant Kanetkar, *Let Us C*, BPB Publications
- V. V. Muniswamy, *Programming and Problem Solving Using C*, Pearson

#### **Reference Book(s)**

- Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, PHI
- Steve Oualline, *Practical C Programming*, O'Reilly Media
- Aditya Bhargava, *Grokking Algorithms: An Illustrated Guide for Programmers and Other Curious People*, Manning Publications

### Online Resource(s)

- <https://www.hackerrank.com/domains/tutorials/10-days-of-recursion>
- <https://www.geeksforgeeks.org/fundamentals-of-algorithms/>
- <https://www.codingninjas.com/studio>
- <https://leetcode.com/>

<b>Code: 25MCACCA3401</b>	<b>Industrial Training Seminar -II</b>	<b>1 Credit [LTP: 0-0-2]</b>
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**OBJECTIVE:** To expose engineering students to work on some latest technology development at an Industry which will help them in placement in an reputed industry/organization. To provide practical experience in solving open ended problems in real work setting so as to cause transfer of college based knowledge and skills to solve practical problems and thereby develop confidence in the students in the analysis, synthesis and evaluation of practical problems leading to creative thinking.

At the beginning of the Third semester each student would present live demonstration of Industrial Training in an industry/ Professional organization / Research Laboratory, he/she has gone through. A student has to submitted typed Log Book/project report with given guidelines along with a certificate from the organization and present a PPT based on the training.

The Project report of the Training shall be evaluated in III Semester by a Board of Examiners to be appointed by the Faculty Coordinator, who will award the grades.

## Fourth Semester

Code: 25MCACCA4301  
0-0-22]

Project / Internship

11 Credit [LTP:

**Objective:** Project work in MCA Program is important for imparting technical knowledge so as to enable students to develop and practice their skills.

According to PU Scheme, MCA Final year students are required to complete their project which may be carried out in two categories keeping vision of type of projects to be undertaken, for more detail go through **Annexure Project Guidelines**

- Each student shall undertake a project in the beginning of the fourth semester.
- The group size may be taken as 2 to 4 students.
- In case of group size extending beyond 4, students are required to take a prior approval from the HOD/Dean.
- The project proposal must be submitted to the Department in the beginning of the fourth semester
- The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide.
- Department shall provide the project report format to the students.
- Before submitting the final project report student should submit project draft report (hardcopy spiral bound) in the given format.
- Draft should be checked and signed by project guide.
- After approval of project draft report, student shall submit hard binding final project reports with cover page of **Marron**.
- The number of Project report shall be calculated as given below:
  - Department copy-1
  - Guide Copy
  - Student Copy-Equal to group size

