



KARNATAK LAW SOCIETY'S  
**GOGTE INSTITUTE OF TECHNOLOGY**  
"JNANA GANGA" UDYAMBAG, BELAGAVI-  
590008, KARNATAKA, INDIA.



Approved by AICTE and UGC  
Permanently Affiliated and Autonomous Institution  
Under  
Visvesvaraya Technological University, Belagavi

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**Master of Technology**  
**(Computer Science & Engineering)**  
**Scheme and Syllabus (2024 Scheme)**  
**(1<sup>st</sup> to 4<sup>th</sup> Semester)**

### **INSTITUTION VISION**

- Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

### **MISSION**

- To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

### **QUALITY POLICY**

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

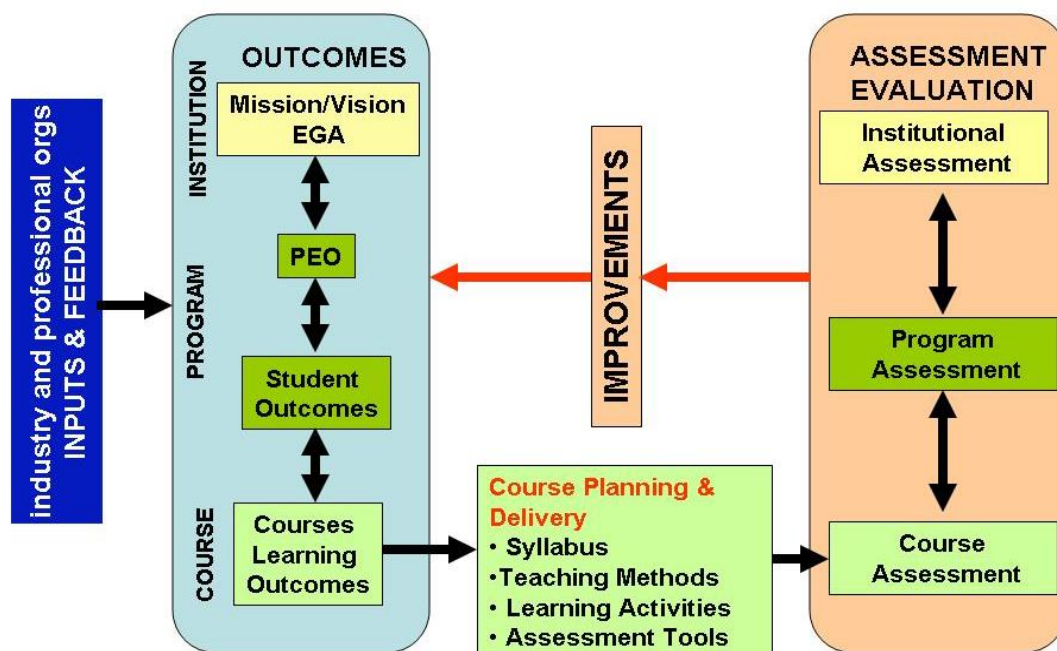
### **DEPARTMENT VISION**

To be a center of Excellence for Education, Research and Entrepreneurship in Computer Science and Engineering in creating professionals who are competent to meet emerging challenges to benefit society.

### **DEPARTMENT MISSION**

To impart and strengthen fundamental knowledge of students, enabling them to cultivate professional skills, entrepreneurial and research mindset with right attitude and aptitude.

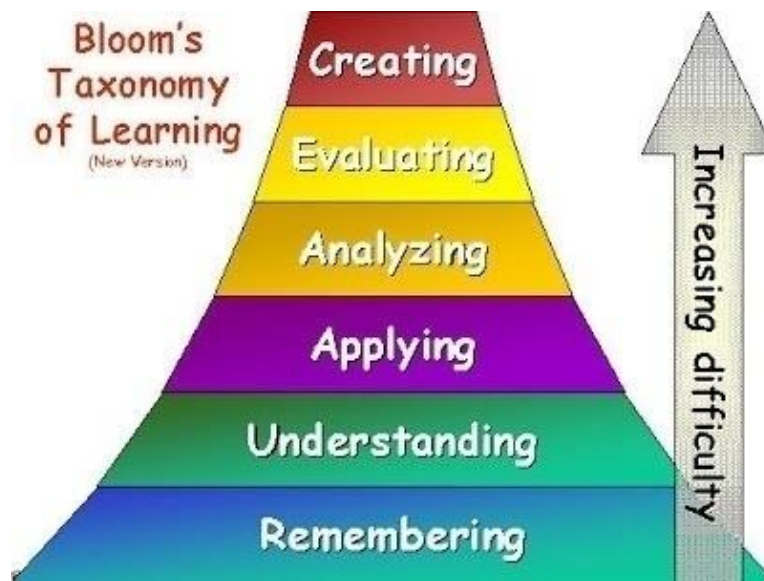
## OUTCOME BASED EDUCATION (OBE)



## BLOOM'S TAXONOMY OF LEARNING OBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21<sup>st</sup> century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills (LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written, and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills (HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the component to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
1.	The graduates will acquire core competence in basic science and engineering fundamentals necessary to formulate, analyze and solve engineering problems and to pursue advanced study.
2.	The graduates will acquire necessary techno-managerial and life-long learning skills to succeed as computer engineering professionals with an aptitude for higher education and entrepreneurship.
3.	The graduates will maintain high professionalism and ethical standards and also develop the ability to work in teams on IT as well as multidisciplinary domains.

PROGRAM OUTCOMES (POs)	
1.	An ability to independently carry out research /investigation and development work to solve practical problems.
2.	An ability to write and present a substantial technical report/document.
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PROGRAM SPECIFIC OUTCOMES (PSOs)	
1.	<b>Analyzing and Modeling skills:</b> Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.
2.	<b>Develop Research Aptitude:</b> Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.
3.	<b>Professional skills and Entrepreneurship:</b> Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.

## 2024 Scheme of Teaching and Examination

1<sup>st</sup> to 4<sup>th</sup> Semester M. Tech. (Computer Science & Engineering)

**Total credits for M.Tech. Program: 80**

	Semester	Credits per Sem	Total credits
1st year	1	18	40
	2	22	
2nd year	3	20	40
	4	20	
	<b>Total</b>	<b>80</b>	<b>80</b>

### Curriculum frame work:

Sl. No.	Course		Credits	% (Percentage)
1	Professional Core Course(PB)	PCC(PB)	06	7.5%
2	Integrated Professional Core Courses	IPCC	08	10%
3	Professional Core Course	PCC	12	15%
4	Professional Elective Courses	PEC	06	7.5%
5	Professional Core Course Laboratory	PCCL	04	5%
6	Multidisciplinary Courses	MDC	03	3.75%
7	Ability/Skill Enhancement Course	AEC/SEC	01	1.25%
8	Non Credit Mandatory Course	NCMC	00	0%
9	Internship	INT	11	13.75%
10	Project work phase	PROJECT	20	25%
11	(Online Course) (12 weeks courses)	MDC/PEC	09	11.25%
<b>Total</b>			<b>80</b>	<b>100%</b>

**I SEMESTER (M.Tech in Computer Science and Engineering)**

Sl. No	Course Type	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Tutorial/SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	MSCS101	Natural Language Processing	3	0	0	03	100	100	200	3
2	IPCC	MSCS102	Data Science & Visualization	3	2	0	05	100	100	200	4
3	PCC	MSCS103	Blockchain Technology	3	0	0	03	100	100	200	3
4	PCC	MSCS104	Artificial Intelligence and Machine Learning	3	0	0	03	100	100	200	3
5	PCC (PB)	MSCS105	Cyber Security and Cyber Law	2	2	0	04	100	100	200	3
6	PCCL	MSCS106	Artificial Intelligence and Machine Learning Laboratory	0	2	2	04	50	50	100	2
7	NCMC	MRMI107	Research Methodology and IPR (Online)	Online courses (online.vtu.ac.in)							PP
								<b>550</b>	<b>550</b>	<b>1100</b>	<b>18</b>

Note: **BSC**-Basic Science Courses, **PCC**: Professional core. **IPCC**-Integrated Professional Core Courses, **PCC(PB)**: Professional Core Courses (Project Based), **PCCL**-Professional Core Course lab, **NCMC**- None Credit Mandatory Course, **L**-Lecture, **P**-Practical, **T/SDA**-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students) **MRMI19**- Research Methodology and IPR (**Online**) for the students who have **not studied** this course in the Undergraduate level. This course is not counted for vertical progression; Students have to qualify for the award of the master's degree.

**M**- Master program **xx** – **ME** for Mechanical Engineering Stream, **CV** for Civil Engineering Stream, **EE** – Electrical & Electronics Engineering Stream, **EC**- Electronics and Communication Engineering Stream, **CS**- Computer Science and Engineering **BA**- Business Administration **AR**- Architecture- etc.

**BSC: Basic Science Courses:** Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide. **PCC: Professional Core Course:** Courses related to the stream of engineering, which will have both CIE and SEE components, students have to qualify in the course for the award of the degree. **Integrated Professional Core Course (IPCC):** Refers to a Professional Theory Core Course Integrated with practicals of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. **Project Based Learning Course (PCC(PB)):** Project Based Learning course is a professional core Course Only Students have to complete a project out of learning from the course and SEE will be viva voce on project work. **PCCL: Professional Core Course Laboratory:** Practical courses whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

**Skill development activities: Under Skill development activities** in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in the modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc. Students and the course instructor/s are to be involved either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant

technical –activities that will enhance their skills. The prepared report shall be evaluated for CIE marks.

**MRMI19-Research Methodology and IPR-** None Credit Mandatory Course (NMC) if students have not studied this course in their undergraduate program then he /she has to take this course at <http://online.vtu.ac.in> and to qualify for this course is compulsory before completion of the minimum duration of the program (Two years), however, this course will not be considered for vertical progression.

<b>II SEMESTER (M.Tech in Computer Science and Engineering)</b>												
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits	
				Theory	Practical/ Seminar	Tutorial/ Skill Development	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	P	T/SDA						
1	PCC	MSCS201	Internet of Things and Applications	3	0	0	03	100	100	200	3	
2	IPCC	MSCS202	Cloud Computing Technology	3	2	0	05	100	100	200	4	
3	PCC(PB)	MSCS203	Big Data Analytics	2	2	0	03	100	100	200	3	
4	PEC	MSCS211X	Professional elective 1	3	0	0	03	100	100	200	3	
5	PEC	MSCS212X	Professional elective 2	3	0	0	03	100	100	200	3	
6	MDC	MSCS251A	Robotic Process Automation	0	2	2	04	100	100	200	3	
7	AEC/SEC	MSCS252X	Ability/Skill Enhancement Course (Offline/Online)	00	02	---	02	50	50	100	1	
				01	00	----	01					
8	PCCL	MSCSL208	Internet of Things and Applications Lab	2	0	2	04	50	50	100	2	
<b>TOTAL</b>								<b>700</b>	<b>700</b>	<b>1400</b>	<b>22</b>	
<p>Note: <b>PCC</b>: Professional core. <b>IPCC</b>-Integrated Professional Core Courses, <b>PCC(PB)</b>: Professional Core Courses (Project Based), <b>PCCL</b>-Professional Core Course lab, <b>PEC</b>- Professional Elective Courses, <b>MDC</b>- Multi-Disciplinary Courses , <b>L-Lecture</b>, <b>P-Practical</b>, <b>T/SDA-Tutorial / Skill Development Activities</b> (Hours are for Interaction between faculty and students)</p> <p><b>L-Lecture</b>, <b>P-Practical</b>, <b>T/SDA-Tutorial / Skill Development Activities</b> (Hours are for Interaction between faculty and students) <b>PBLC</b>: Project Based Learning Course,</p> <p>Note: <b>xxx</b> means specialization code for example <b>MDE- Design</b> Engineering, <b>LDN-</b> Digital Communication and Networking, <b>SCE-</b> Computer Engineering, <b>CCT-</b> Construction Technology, <b>AUD-</b> Urban Design, <b>MBA-</b> Master of Business</p>												
<b>Professional elective 1</b>						<b>Professional elective 2</b>						
<b>Course Code</b>		<b>Course title</b>				<b>Course Code</b>		<b>Course title</b>				
MSCS211A		Relational Database Management Systems				MSCS212A		Cryptography and Network Security				
MSCS211B		Digital Image Processing and Computer Vision				MSCS212B		Advances in Storage Area Networks				
MSCS211C		Business Intelligence and its Applications				MSCS212C		Advances in Computer Networks				
MSCS211D		Advances in Operating system				MSCS212D		5G Technology				
<b>Ability / Skill Enhancement Courses</b>												
<b>Course Code</b>		<b>Course title</b>				<b>L</b>	<b>P</b>	<b>T/SDA</b>				
MSCS252A		Project Management				0	2	0				
MSCS252B		Prompt Engineering				0	2	0				

**Ability Enhancement Courses (AEC):** These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behavior, human rights, and the law. **Skill Enhancement Course (SEC):** Skill Enhancement Course means a course designed to provide value-based or skill-based knowledge and should contain both theory and lab/hands-on/training/fieldwork. The main purpose of these courses is to provide students with life skills in the hands-on mode to increase their employability.

**If AEC/SEC courses are ONLINE (MOOCs) courses** suggested by the concerned board of studies. These courses will be

**For the students who are willing to take up a two-semester duration Industry/Research Internship Leading to Project work /start-up**

<b>III SEMESTER (M.Tech in Computer Science and Engineering) (A)</b>											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Mini-Project/	Tutorial/ Skill Development	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PEC/MDC	MSCS311	(Online Courses) 12 weeks duration						100	3	
2		MSCS312	(Online Courses)12 weeks duration						100	3	
		MSCS313	(Online Courses)12 weeks duration						100	3	
3	INT	<b>MINT384</b>	Research Internship /Industry-Internship leading to project work/ Startup	Two-semester duration, SEE in the IV semester which leads to project work /start-up			03	100	---	100	3
<b>TOTAL</b>									<b>400</b>	<b>12</b>	

<b>IV SEMESTER (M.Tech in Computer Science and Engineering) (A)</b>										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical /Field	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	INT	MINT481	Research Internship / Industry Internship Leading to Project Work/Start-up	Two Semester		03	100	100	200	12
2	PROJ	MPROJ482	Project	Duration		03	100	100	200	16
<b>TOTAL</b>						<b>06</b>	<b>200</b>	<b>200</b>	<b>400</b>	<b>28</b>

**INT:** Industry/ Research Internship leading to the project work /startup **PROJ:** Project work outcome of Internship (Project Phase-II is Viva voce SEE)

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

**Mxxx303/403: 3 courses Online NPTEL can be cumbersome so one research article may be accepted/Published. Patent can be also one option. For Industry Internship/Track the 3 NPTEL courses shall be considered as mandatory.**

**Industry Internship:** The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

**Research Internship:** A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

**Research /Industry Internship:** In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3<sup>rd</sup> semester. At the beginning of the 4<sup>th</sup> semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

**Internship Leading to Start-up:** An internship that leads to a startup is an exciting pathway, blending real-world experience with entrepreneurial ambition. Here's a comprehensive guide to transitioning an internship experience into launching your startup: 1) Maximize your internship experience, 2) Identifying Viable Business Ideas, 3) Research and Validation 4) Building a Business Plan 5) Networking and Mentorship 6) Securing Funding 7) Establishing Startup 8) Launching and Marketing. By following these steps, you can effectively transition from an internship to launching a successful startup. This journey requires dedication, resilience, and a willingness to learn and adapt.

**Mxxx301/401 to 303/403:** MOOC courses of 12 weeks' duration are the courses suggested by the Board of Studies of the University and will be displayed on [www.online.vtu.ac.in](http://www.online.vtu.ac.in). The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree if they unintentionally select online courses that match previously finished courses. These courses are not considered for the vertical progression; however, qualifying for these courses and earning the credits is a must for the award of the degree. It is permitted to complete these online MOOC courses either in 3<sup>rd</sup> semester or in 4<sup>th</sup> semester.

**For the students who are willing to take an Industry Internship for one-semester duration and independent project work next semester**

KARNATAK LAW SOCIETY'S GOGTE INSTITUTE OF TECHNOLOGY Scheme of Teaching and Examinations – 2024 <b>M.TECH. IN COMPUTER SCIENCE AND ENGINEERING (CSE)</b> Choice Based Credit System (CBCS) and Outcome Based Education (OBE)											
<b>III SEMESTER (M.Tech in Computer Science and Engineering) (B)</b>											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Mini-Project/ Internship	Tutorial/ skill Development Activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	MDC/PEC	MSCS311	(Online Course) (12 weeks courses)						100	3	
		MSCS312	(Online Course) (12 weeks courses)						100	3	
2		MSCS313	(Online Courses) (12-week course)						100	3	
3	INT	MNT384	Industry Internship	One semester Duration			03	100	100	200	11
<b>TOTAL</b>				<b>06</b>	<b>00</b>	<b>00</b>			<b>500</b>	<b>20</b>	

<b>IV SEMESTER (M.Tech in Computer Science and Engineering) (B)</b>										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	MPROJ481	Project work	--	08	03	100	100	200	20
				<b>04</b>	<b>08</b>	<b>03</b>	<b>100</b>	<b>100</b>	<b>200</b>	<b>20</b>

**Industry Internship:** The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gains practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned. The students who take up a one-semester Internship in the Industry have to appear SEE at the institute at the end of the semester as per the examination calendar.

**Project Work:** Students in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through Power Point slides.
- Answer the queries and be involved in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussions to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident

**CIE marks** for the project report (20 marks), seminar (20 marks) and question and answer (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Principal. The committee shall consist of internal guide and a faculty from the department with the senior most acting as the Chairperson.

**Semester End Examination** SEE marks for the project report (30 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of the report and presentation skill,

participation in the question and answer session) by the examiners appointed by the University.

**Mxxx301/401 to 303/403:** MOOC courses of 12 weeks' duration are the courses suggested by the Board of Studies of the University and will be displayed on [www.online.vtu.ac.in](http://www.online.vtu.ac.in). The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree if they unintentionally select online courses that match previously finished courses. These courses are not considered for the vertical progression; however, qualifying for these courses and earning the credits is a must for the award of the degree. It is permitted to complete these online MOOC courses either in 3<sup>rd</sup> semester or in 4<sup>th</sup> semester.

For the students who are willing to take a research-leading paper publication in Q1/Q2/Q3 Journals and to a PhD Registration											
III SEMESTER (M.Tech in Computer Science and Engineering) (C)											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Mini-Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PCC/IPCC/ MDC/PEC	MSCS311	(Online Course) (12 weeks courses)						100	3	
		MSCS312	(Online Course) (12 weeks courses)						100	3	
2		MSCS313	(Online Courses) (12-week course)						100	3	
		MSCS314	(Online Courses) (12-week course)						100	3	
3	PROJ	MPROJ385	Project Phase-I	One semester Duration			03	100	---	100	6
<b>TOTAL</b>				<b>06</b>	<b>00</b>	<b>00</b>	<b>09</b>			<b>500</b>	<b>18</b>

IV SEMESTER (M.Tech in Computer Science and Engineering) (C)											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits	
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks	Viva voce		Total Marks
				L	P						
1	Project	MPROJ481	Project work	--	08	03	100	100	200	22	
				<b>04</b>	<b>08</b>	<b>03</b>	<b>100</b>	<b>100</b>	<b>200</b>	<b>22</b>	

The research section of the university has to announce the number of seats for M.Tech. students who are seeking PhD (research study) admission through a project leading to the publication of the paper in Q1/Q2/Q3 journals. Only full-time research work will be permitted in the university department or approved research centers of the affiliated colleges of the university (guidelines need to be set up). Based on seat availability, the students are permitted to register for project work leading to the publication of papers in Q1/Q2/Q3 journals and admission to research (PhD) in their 3<sup>rd</sup> semester of the M.Tech., program.

**Project Phase-1** Project Phase-I, typically the initial phase in any project, is crucial as it lays the foundation for the entire project. This phase involves defining the project's scope, objectives, and initial planning. Here's a structured approach to effectively carry out Project Phase-I:

- **Project Charter:** Outlines the project's purpose, objectives, and stakeholders.
- **Scope Statement:** Defines the project boundaries and deliverables.
- **Requirements Document:** Captures all project requirements.
- **Project Plan:** Details the approach, timeline, and resource allocation.
- **Risk Management Plan:** Identifies and plans for potential risks.
- **Feasibility Study Report:** Assesses technical, economic, and operational feasibility.

Students in consultation with the guide shall carry out literature survey/visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and be involved in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussions to foster a friendly and stimulating environment in which the students are motivated to reach high standard and become self-confident.

#### **Continuous Internal Evaluation (100 Marks).**

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer(20marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Principal. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

**Project Work Phase-II:** Each student shall be involved in carrying out the project work jointly in constant consultation with internal guide and external guide and prepare the project report as per the norms of the university to avoid plagiarism. Phase II of a project typically involves the detailed execution of the planned activities, continuous monitoring and control of the project's progress, and making necessary adjustments to ensure the project stays on track. Keep detailed records of all project activities, decisions, and changes. Ensure all project documentation is organized and accessible. Conduct a final project review to evaluate overall performance, achievements, and lessons learned. Document best practices and areas for improvement for future projects.

**Paper Publication Process:** Publishing a research paper based on your project in a Q1/Q2/Q3 journal involves several key steps, from writing the manuscript to navigating the peer review process. Here's a comprehensive guide:

Writing the Manuscript: **Choose a clear and concise title that accurately reflects the content.**

**Write an abstract summarizing the research question, methods, results, and conclusions.**

**Literature Review:** Review relevant existing research to establish the foundation of your study. Identify gaps that your research aims to fill.

**Methodology:** Describe the research design, methods, and procedures in detail. Include information on data collection, analysis, and any tools or software used.

**Results:** Present the findings of your research clearly and logically. Use tables, figures, and charts to illustrate key results.

**Discussion:** Interpret the results and explain their implications. Compare your findings with existing research and discuss any discrepancies or new insights.

**Conclusion:** Summarize the main findings and their significance. Suggest potential future research directions.

**References:** Cite all sources used in your research following the journal's citation style.

**Journal Selection:** Choose a journal that aligns with the scope and focus of your research. Consider the journal's impact factor (Q1, Q2, Q3) and audience.

**Review Journal Guidelines:** Carefully read the journal's submission guidelines and ensure your manuscript adheres to them.

**Prepare Your Manuscript:** Format your manuscript according to the journal's guidelines. Include all required sections and supplementary materials.

**Cover Letter:** Write a cover letter to the journal editor highlighting the significance of your research and why it fits the journal.

**Submit the Manuscript:** Use the journal's online submission system to submit your manuscript. Ensure all required information and documents are included.

**Semester End Examination** SEE marks for the project report (60 marks), seminar (20marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentations skill, participation in the question and answer session) by the examiners appointed by the University.

## NATURAL LANGUAGE PROCESSING

Course Code	MSCS101	Course type	PCC	Credits L-P-T	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	Understand the techniques in natural language processing.
2.	Familiar with concepts of natural language generation.
3.	Demonstrate Text Mining methods.
4.	Analyze the information retrieval techniques

**Pre-requisites:** Database Management Systems, Formal Languages

<b>Unit – I</b>	<b>Contact Hours = 8 Hours</b>
<b>OVERVIEW AND LANGUAGE MODELING:</b> Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.	

<b>Unit – II</b>	<b>Contact Hours = 8 Hours</b>
<b>WORD LEVEL AND SYNTACTIC ANALYSIS:</b> Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context free Grammar-Constituency- Parsing-Probabilistic Parsing.	

Unit – III	Contact Hours = 8 Hours
<b>Extracting Relations from Text: From Word Sequences to Dependency Paths:</b> Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.	

<b>Unit – IV</b>	<b>Contact Hours = 8 Hours</b>
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**Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models:** Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite- State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.

<b>Unit – V</b>	<b>Contact Hours = 8 Hours</b>
<b>INFORMATION RETRIEVAL AND LEXICAL RESOURCES:</b> Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora. Security	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	2	2	2	1

Unit No.	Self-Study Topics
2	Context free Grammar-Constituency- Parsing-Probabilistic Parsing.
3	Case Study: NLP Based web search -The GlobalSecurity.org Experience.
4	Evolving Explanatory Novel Patterns for Semantically-Based Text Mining

Books	
	Text Books:
1.	Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2.	Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer Verlag, London Limited 2007.
	Reference Books:
1.	Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.

2.	James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
3.	Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.
4.	Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python," Publisher: O'Reilly Media, June 2009
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://www.youtube.com/watch?v=fM4qTMfCoak&amp;list=PLZoTAE LR MX VM d J 5 sq b CK 2 Li M 0 H h Q V W N z m">https://www.youtube.com/watch?v=fM4qTMfCoak&amp;list=PLZoTAE LR MX VM d J 5 sq b CK 2 Li M 0 H h Q V W N z m</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	4.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Analyze the natural language text	L4	1,2	1,2
2.	Generate the natural language.	L2	1,3	1
3.	Demonstrate Text mining	L2	1,3	1,3
4.	Apply information retrieval techniques	L4	1,2,3	1,2,3

### Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments –(Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

#### IA Test:

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
- Remaining 20 marks questions in Part B & C should be descriptive

-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

**Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

**Scheme of Semester End Examination (SEE):**

1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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
1	M	H											M	H	L
2	L		L										L		
3	H		L										M		M
4	L	M	M										H	H	M
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding of NLP Fundamentals	Healthcare	NLP Engineer
2	Machine Learning Knowledge	Finance, Legal	Chatbot Developer
3	Information Extraction, Text Generation	Media and Entertainment	Data Scientist

Name & Signature of Faculty Members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Data Science & Visualization

Course Code	MSCS102	Course type	IPCC	Credits L-P-T	3 - 0 - 1
Hours/week: L - T- P	3 - 2 - 0			Total credits	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the fundamentals of Data Analytics life cycle
2.	To apply the data science concepts to solve the real-world problems.
3.	To analyze the functioning of supervised learning algorithms and their data processing cycle
4.	To analyze the data using statistical methods.

Required Knowledge of: Design and Analysis of Algorithms, Artificial intelligence, Probability and Statistics

Unit – I	Contact Hours = 8 Hours
Introduction: The Ascendance of data, what is data Science? What a data scientist actually do? Real world use cases of Data Science, Review of basic Data Analytic method using R Introduction to R, Exploratory Data Analytics, Statistical methods for evaluation	

Unit – II	Contact Hours = 8 Hours
Advanced Analytical theory and methods: Clustering: Overview of Clustering, K-means, Use Cases, Overview of the Method, Determining the Number of Clusters	

Unit – III	Contact Hours = 8 Hours
Regression: Linear Regression, Use Cases, Model Description, Diagnostics, Logistic Regression, Use Cases, Model Description, Diagnostics, Reasons to Choose and Cautions.	

Unit – IV	Contact Hours = 8 Hours
Classification: Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, evaluating a Decision Tree, Naive Bayes, Bayes' Theorem, Naïve Bayes Classifier, Smoothing, Diagnostics.	

Unit – V	Contact Hours = 8 Hours
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Thinking Statistically in Data Science: Statistics in data Science, types of statistical data /variables? Mean, Median and Mode, Basics of Probability, Statistical Distributions real world example, Statistical Inference and Hypothesis Testing.

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

#### List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	Basics of Language R Review of Basic Data Analytic Methods using R Introduction to R syntax.
2	1	Demonstrate the use of K-means clustering algorithm with suitable data set.
4	2	Demonstrate the application of Linear Regression model with suitable data set Demonstrate the application of Logistic Regression model with suitable data set
5	2	Demonstrate the use Decision Tree algorithm with the help of a suitable example. Demonstrate the use Naïve Bayes algorithm with the help of a suitable example

Unit No.	Self-Study Topics
I	Global Innovation Network and Analysis (GINA)
II	Diagnostics, Reasons to Choose and Cautions, Additional Algorithms
III	Transactions in a Grocery Store, Validation and Testing, Diagnostics
IV	Additional Regression Models.
V	Diagnostics of Classifiers, Additional Classification Methods

#### Books

	Text Books:
1.	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. by EMC Education Services (Editor), Wiley 2015 and above.
2.	Data Science from Scratch: Joel Grus, O'reilly Publication.
3.	Data Science with Jupiter: Prateek Gupta first edition 2019.
	Reference Books:

1.	Data Science for Business: Foster Provost.
2.	Doing Data Science - Cathy O'neil.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://nptel.ac.in/courses/106/106/106106212/">https://nptel.ac.in/courses/106/106/106106212/</a>
2.	<a href="https://swayam.gov.in/nd1_noc19_cs60/preview">https://swayam.gov.in/nd1_noc19_cs60/preview</a>
3.	<a href="https://nptel.ac.in/courses/110/106/110106072/">https://nptel.ac.in/courses/110/106/110106072/</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs ( if present)		

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Define, Understand and explain concepts of Data Science and Analytics subject	L1	1	1
2.	Apply machine learning and Statistics to find solutions to broad range of problem statements	L2,L3	1,2	1
3.	Analyze various machine learning and statistical inference methods for a given problem statement	L4	1,2,3	1,2,3
4.	Demonstrate experiments of data science using modern tools like R and Python.	L4	1,2,3	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab.**

THEORY (60 marks)		LAB (40 marks)		Total
IA test 1	IA test 2	Conduction	Lab test	
30 marks	30 marks	10 marks	30 marks	100 marks
IA Test:				
1. No objective part in IA question paper				
2. All questions descriptive				
-Certification earned by passing the standard Online MOOCs course (of atleast 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.				
Conduct of Lab:				
1. Conducting the experiment and journal: 5 marks				
2. Calculations, results, graph, conclusion and Outcome: 5 marks				

<p>Lab test: (Batchwise with 15 students/batch)</p> <ol style="list-style-type: none"> <li>1. Test will be conducted at the end of the semester</li> <li>2. Timetable, Batch details and examiners will be declared by Exam section</li> <li>3. Conducting the experiment and writing report: <b>5 marks</b></li> <li>4. Calculations, results, graph and conclusion: <b>15 marks</b></li> <li>5. Viva voce: <b>10 marks</b></li> </ol>
<p>Eligibility for SEE:</p> <ol style="list-style-type: none"> <li>1. Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests. Lack of minimum score in IA test will make the student Not Eligible for SEE</li> <li>2. Student should score minimum 50% of 30 marks (i.e. 15 marks) in Lab test &amp; should score 50% of 40 marks (i.e. 20 marks) in Lab component.</li> <li>3. Lab test is COMPULSORY</li> <li>4. Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.</li> <li>5. Not eligible in any one of the two components will make the student Not Eligible for SEE</li> </ol>

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 35$ &, however overall score of CIE+SEE should be $\geq 50\%$ .
3.	<p>Question paper contains three parts <b>A,B and C</b>. Students have to answer</p> <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	L												L		
2	M												M		
3	L	M	H										M	L	M
4	M		H											M	H
Tick mark the CO, PO and PSO mapping															
Sl No	Skill & competence enhanced after undergoing the course					Applicable Industry Sectors & domains				Job roles students can take up after undergoing the course					
1	statistical Analysis					Finance and Banking:				Data Scientist:					

2	Big Data Technologies:	Retail and E-commerce	Statistical Analyst:
3	Critical Thinking	Marketing and Advertising	Customer Insights Analyst

Name & Signature of Faculty members  
involved in designing the syllabus

Name & Signature of Faculty members  
verifying/approving the syllabus

Blockchain Technology					
Course Code	MSCS103	Course type	PCC	Credits L-P-T	3 – 0 – 0
Hours/week: L-P-T	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40Hrs; T = 00Hrs;P = 00Hrs Total = 40Hrs			CIE Marks	100
Flipped Classes content	10 Hrs			SEE Marks	100

Course learning objectives	
1.	To understand the concept of Blockchain and its relevance with cryptography.
2.	To acquire knowledge of various techniques used in Blockchain.
3.	To understand the Cryptocurrency and Cryptography used in Blockchain
4.	To apply the Blockchain concept in real life applications.

**Pre-requisites:** Cryptography and System Security

Unit – I	8 Hours
<b>Blockchain 101:</b> Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. <b>Decentralization:</b> Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.	

Unit – II	8 Hours
<b>Basic Crypto primitives and Distributed Computing:</b> Introduction, advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public Blockchain. <b>Smart Contracts and Ethereum 101:</b> Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts	

Unit – III	8 Hours
<b>Cryptocurrency:</b> History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin <b>Cryptography:</b> Cryptography and cryptocurrency : Algorithms & Techniques Public-Key Cryptography, Public key and private key combinations in Blockchain security, Hashing.	

Unit – IV	8 Hours
<b>Privacy, Security Issues in Blockchain:</b> Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms	

to prevent these attacks.	
<b>Unit – V</b>	<b>8 Hours</b>
<b>Blockchain Applications and Technology Contributions by Industries:</b> Applications of Blockchain in Healthcare, Automotive, Government, Insurance, Media and Entertainment. The Linux Foundation’s Hyperledger Fabric and Microsoft Azure’s Blockchain as a Service.	
<b>Books</b>	
<b>Text Books:</b>	
1.	S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan “Blockchain Technology: Cryptocurrency and Applications”, Oxford University, 2019
2.	Josh Thompson, - Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.
<b>Reference Books:</b>	
1.	Joseph Bonneau et al, SoK, “Research perspectives and challenges for Bitcoin and cryptocurrency”, IEEE Symposium on security and Privacy, 2015

Course delivery methods		Assessment methods	
1.	<b>Lecture</b>	1.	<b>IA</b>
2.	<b>Chalk and Board</b>	2.	<b>Seminar/Course Project</b>
3.	<b>PPT</b>	3.	<b>Assignment</b>

Course Outcome (COs)		Learning Level	PO(s)	PSO(s)
At the end of the course, the student will be able to				
1.	<b>Introduction</b> to Blockchain and Explore the blockchain decentralization.	L1	1, 2	1
2.	<b>Illustrate</b> the Basic Crypto primitives, Distributed Computing, Smart Contracts and Ethereum.	L2	1, 2	1, 2
3.	<b>Apply</b> and <b>analyze</b> the various Cryptocurrency and Cryptography algorithms used in Blockchain.	L3, L4	1, 2, 3	1
4.	<b>Illustrate</b> the various Privacy and Security Issues in Blockchain.	L2	1, 2	1
5.	<b>Make Use of</b> Blockchain for various Applications and Technology by Industries.	L3	1, 3	1, 3

#### Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

**IA Test:**

1. 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  2. Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

**Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

**Scheme of Semester End Examination (SEE):**

1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (Planned)				CO-PSO Mapping(Planned)		
CO	PO1	PO2	PO3	PSO1	PSO2	PSO3
1	M	L		M		
2	M	L		M	L	
3	H	M	L	M		
4	M	L		M		
5	M		L	M		L
<b>Tick mark the CO, PO and PSO mapping</b>						

## Artificial Intelligence and Machine Learning

Course Code	MSCS104	Course type	PCC	Credits L-P-T	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand different logical systems for inference over formal domain representations and trace how a particular inference algorithm works on a given problem specification
2.	To understand various artificial intelligence techniques and agent technology
3.	To Understand and apply appropriate game playing and planning strategies for a given problem specification

**Pre-requisites:** Discrete Mathematical Structures, Probability.

Unit – I	Contact Hours = 8 Hours
<b>Introduction to Artificial Intelligence:</b> Introduction, What is AI, Strong Methods and weak Methods. Uses and Limitations: <b>Knowledge Representation:</b> Need for good representation, semantic nets, Frames, Search Spaces, Semantics Tress, Search Trees, Combinatorial Explosion, Problem reduction, Goal Trees, Combinatorial Explosion	

Unit – II	Contact Hours = 8 Hours
<b>Search Methodologies:</b> Introduction, Problem solving as search, Data driven or goal driven search, Generate and test, Depth First Search, Breadth First Search, Properties of search methods, Implementing Depth-First and Breadth-First Search, Using Heuristics for Search, Hill Climbing, Best-First Search, Identifying Optimal Paths, Constraint Satisfaction search, Forward Checking, Local Search and Meta heuristics, Simulated Annealing. Genetic Algorithms for search, Real time A*, Bidirectional search	

Unit – III	Contact Hours = 8 Hours
<b>Game Playing:</b> Game Trees, Minimax, Alpha beta pruning, Checkers, Chess <b>Propositional and Predicate Logic:</b> Introduction, What is Logic, Why Logic is used in Artificial Intelligence, Logical Operators, Translating between English and Logic Notation, Truth Tables: Not, And, Or, Implies, if, Complex Truth Tables, Tautology, Equivalence, Propositional logic, Deduction, The deduction Theorem, Soundness, Completeness, Decidability, Monotonicity, Abduction and Inductive reasoning,	

Unit – IV	Contact Hours = 8 Hours
Introduction, Training Rote Learning, Learning Concepts, General-to-Specific Ordering, Version Spaces, Candidate Elimination, Inductive Bias, Decision-Tree Induction, The Problem of Overfitting, The Nearest Neighbor Algorithm, Backpropagation algorithms, Reinforcement Learning. Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks, Recurrent Networks, Unsupervised Learning Networks, Evolving Neural Networks. <b>Self-learning topics: Supervised Learning, Unsupervised Learning</b>	

Unit – V	Contact Hours = 8 Hours
Probabilistic Reasoning and Bayesian Belief Networks: Introduction, Probabilistic Reasoning, Joint Probability Distributions, Bayes’ Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Noisy-V Function, Bayes’ Optimal Classifier, The Naïve Bayes Classifier. <b>Self-learning topics: Collaborative Filtering</b>	

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	<b>Self-study topics</b>
I	Inheritance, Object Oriented Programming
II	Nondeterministic search, non-chronological backtracking
III	Modal logics and possible worlds, Dealing with change
IV	Backward Chaining, CYC
V	Braitenberg Vehicles

Books	
	<b>Text Books:</b>
1.	Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett Publishers, 1 <sup>st</sup> Edition, 2004 onwards
2.	<b>Reference Books:</b>
3.	Elaine Rich Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3 <sup>rd</sup> edition 2013 onwards
4.	Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3 <sup>rd</sup> edition 2013 onwards
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="https://nptel.ac.in/courses/106/105/106105077/">https://nptel.ac.in/courses/106/105/106105077/</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	<b>Design</b> intelligent agents for problem solving, reasoning, planning, decision making and learning for specific design and performance constraints and when needed, design variants of existing algorithms.	L4	1,2,3	1,3
2.	<b>Apply</b> AI techniques on current applications.	L3	1,2	2

3.	<b>Demonstrate</b> ability for problem solving, knowledge representation, reasoning and learning.	L3	1,2,3	1,2
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**Scheme of Continuous Internal Evaluation (CIE):**

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

**IA Test:**

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  - Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

**Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

**Scheme of Semester End Examination (SEE):**

1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	M		H										H	M	H
2	M	L											M		
3	H		M										M	H	M
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	<b>AI &amp; ML techniques</b>	<b>IT</b>	<b>AI engineer</b>
2	<b>Deep Learning</b>	<b>IT</b>	<b>ML Engineer</b>

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

### Cyber Security and Cyber Laws (Project based)

Course Code	MSCS105	Course type	Integrated Project based	Credits L-P-T	2-1-0
Hours/week: L - P- T	2 -2- 0			Total credits	3
Total Contact Hours	L = 30 Hrs; T = Hrs; P = 20 Hrs Total = 50 Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives	
1.	To introduce the concept of cybercrime and cyber offenses.
2.	To emphasize on security challenges of mobile devices and organizational measures to handle such threats.
3.	To explore the tools and methods used in cybercrime.
4.	To elaborate on the legal perspectives of cybercrimes in India.
5	To introduce the concept of Computer forensics

#### Required Knowledge of : Computer Networks & Knowledge of Internet

Unit – I	Contact Hours = 8 Hours
<b>Introduction to Cybercrime, Cyber offenses:</b> Definition and Origins of the Word Cybercrime, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes; How Criminals Plan the Attacks, Social Engineering, Cloud Computing. Textbook: Chapter 1.1-1.5, 2.1-2.3, 2.8	

Unit – II	Contact Hours = 8 Hours
<b>Cybercrime in case of Mobile and Wireless devices:</b> Phishing and Identity Theft Proliferation of Mobile and Wireless Devices, Trends in Mobility, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication Service Security, Attacks on Mobile/Cell phones, Mobile Devices- Security implications for organizations, Organizational measures for handling mobile devices-related security issues, Organizational security policies and measures in mobile computing era. Phishing; Identity theft Textbook: Chapter 3.1-3.3, 3.5-3.11, 5.1-5.3	

Unit – III	Contact Hours = 8 Hours
<b>Ethical Hacking Methodologies &amp; Tools and Methods Used in Cybercrime:</b> Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection. Case Studies and Tools in Kali Linux Textbook: Chapter 4.1-4.10	

Unit – IV	Contact Hours = 8 Hours
<b>Computer Forensics:</b> Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, approaching a Computer Forensics Investigation. Textbook: Chapter 7.1 –7.10	

Unit – V	Contact Hours = 8 Hours
<b>The Legal Perspectives:</b> Cybercrime and the Legal Landscape around the World, Why Do We Need Cyberlaws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Amendments to the Indian IT Act Textbook: Chapter 6.1-6.8	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

#### List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	Wireshark
2	1	Gophish
3	1	Proxycchains
4	1	MITRE ATT&CK
5	1	Autopsy

Unit No.	Self-Study Topics
1.	Snort

Books	
	Text Books:
1.	Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)
	Reference Books:
1.	Computer Forensics and Cyber Crime An Introduction by Marjie T. Britz ,Pearson publication, 2 <sup>nd</sup> edition
2.	
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://in.coursera.org/specializations/intro-cyber-security">https://in.coursera.org/specializations/intro-cyber-security</a>
2.	<a href="https://in.coursera.org/learn/cybersecurity-for-everyone">https://in.coursera.org/learn/cybersecurity-for-everyone</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs ( if present)		

Course Outcome (COs)						
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create						
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)	
1.	<b>Interpret</b> cyber offenses, concepts of Computer forensics, Phishing, Identity theft and Cybercrimes in case of Mobile and Wireless devices.			L2	1, 3	1
2.	<b>Make use of</b> tools and methods used in cybercrime and Computer forensics.			L3	1, 2, 3	1
3.	<b>Apply</b> the legal perspectives of cybercrimes.			L3	2	1,2
4.	<b>Examine</b> different techniques used in cybercrime, different aspects of organizational security policies and methods used in Cyberforensics.			L4	1, 2, 3	1, 2, 3

#### Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test (**COMPULSORY**) will be part of the CIE.

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
-Theory IA test should be of one-hour duration. -Lab IA test should be of two/three-hour duration. -Project batch will ideally consist of 2 students (maximum of 3). -Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. -Submission of Project report is compulsory. -Minimum score to be eligible for SEE: 50 OUT OF 100					
Eligibility for SEE: 1. 50% and above (20 marks and above) in theory component 2. 50% and above (30 marks and above) in project component 3. Not eligible in any one of the two components will make the student <b>Not Eligible</b> for SEE					

#### Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.			
2.	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)		50 marks	100 marks
	Project evaluation			
	a. Initial write up stating the objectives, methodology and the outcome		10 marks	
	b. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.		30 marks	
	c. Viva-voce		10 marks	
3.	<b>Minimum marks required in SEE to pass:</b> Score should be 40%, however overall score of			

	CIE + SEE should be > 50%.
4.	SEE will be conducted in project batches by <b>Internal &amp; External examiners</b> together.

CO-PO Mapping (Planned)				CO-PSO Mapping(Planned)		
CO	PO1	PO2	PO3	PSO1	PSO2	PSO3
1.	M		L	M		
2.	H	M	L	M		
3.		M		M	L	
4.	M	M	L	H	M	L
<b>Tick mark the CO, PO and PSO mapping</b>						

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	students will gain practical skills in identifying and mitigating various forms of cybercrime, understanding legal and forensic aspects of digital security, and developing strong technical expertise in cybersecurity tools and methodologies.	Banking and Financial Services	Cybersecurity Analyst
2	They will acquire competency in securing mobile and cloud environments, safeguarding against cyber threats, and implementing organizational policies for information security.	Government and Law Enforcement	Digital Forensics Investigator
3		Healthcare	Ethical Tester   Hacker / Penetration

**PG Detailed Syllabus Template for Lab course  
Artificial Intelligence and Machine Learning Laboratory**

<b>Course Code</b>	<b>MSCSL106</b>	<b>Course type</b>	<b>PCCL</b>	<b>Credits L-P-T/SDA</b>	<b>0 - 1 - 1</b>
<b>Hours/week: L - T- P</b>	0 - 2 - 2			<b>Total credits</b>	2
<b>Total Contact Hours</b>	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			<b>CIE Marks</b>	50
<b>Flipped Classes content</b>				<b>SEE Marks</b>	50

<b>Course learning objectives</b>	
1.	To understand various artificial intelligence techniques and agent technology
2.	To Understand and apply different machine learning algorithms for a given problem specification
3.	
4.	

<b>Required Knowledge of : Probability, Algorithms</b>
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<b>Lab Experiment – 1</b>	<b>Contact Hours = 2 Hours</b>
Implement DFID algorithm and compare its performance with DFS and BFS algorithm	
<b>Lab Experiment – 2</b>	<b>Contact Hours = 2 Hours</b>
Implement Best-First Search algorithm	
<b>Lab Experiment – 3</b>	<b>Contact Hours = 2 Hours</b>
Implementation of AND/OR Gate using single layer perceptron.	
<b>Lab Experiment – 4</b>	<b>Contact Hours = 2 Hours</b>
Implementation of XOR Gate using a) Multi-layer perceptron	
<b>Lab Experiment – 5</b>	<b>Contact Hours = 2 Hours</b>
Implementation of Hebbian learning rule	
<b>Lab Experiment – 6</b>	<b>Contact Hours = 2 Hours</b>
Implementation of Find-S algorithms	
<b>Lab Experiment – 7</b>	<b>Contact Hours = 2 Hours</b>

Build a linear regression model housing prices.	
<b>Lab Experiment – 8</b>	<b>Contact Hours = 2 Hours</b>
Implement spam detection using Naïve Bayes Algorithm	

Books	
	<b>Text Books:</b>
1.	Name of the author(s), Title of the Book, Publisher, Edition/Year _____ and onwards
2.	
3.	
4.	
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	
2.	

Course delivery methods		Assessment methods	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs ( if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		5.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	<b>Apply</b> AI techniques on current applications.	L3		
2.	<b>Demonstrate</b> ability for problem solving, knowledge representation, reasoning and learning.	L3		
3.				
4.				
5.				

#### Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended expt	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

#### Conduct of Lab:

1. Conduction of the experiment: 15 marks + Viva voce: 5 marks
2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks

3. Lab project/ Open ended expt: 10 marks
3. Lab Test: 15 marks
<b>Eligibility for SEE:</b>
1. 50% and above (25 marks and above)
2. <b>Lab test is COMPULSORY</b>

<b>Scheme of Semester End Examination (SEE):</b>			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE+SEE should be $\geq 50\%$ .		
2.	One or Two experiments to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	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
1	✓		✓										✓	✓	✓
2	✓	✓											✓		
3	✓		✓										✓	✓	✓
Tick mark the CO, PO and PSO mapping															
Sl No	Skill & competence enhanced after undergoing the course				Applicable Industry Sectors & domains				Job roles students can take up after undergoing the course						
1	AI & ML techniques				IT				AI engineer						
2									ML Engineer						
3															

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Internet of Things and Applications

Course Code	MSCS201	Course type	PCC	Credits L-P-T	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To equip students with a thorough understanding of the architecture and components of the Internet of Things (IoT).
2.	To develop students' ability to analyze IoT Sensing and Actuation Mechanisms
3.	To instruct students on how to explore IoT Communication Protocols
4.	To provide students with a comprehensive understanding of IoT Applications and Future Trends

Pre-requisites: Basic understanding of networking, embedded systems, and cloud computing.

<b>Unit – I Introduction to IoT</b>	Contact Hours = 8 Hours
Introduction, Evolution of IoT, Enabling IoT and Complex Interdependence of Technologies, IoT Networking components, Addressing Strategies in IoT.	

<b>Unit – II IoT Sensing and Actuation</b>	Contact Hours = 8 Hours
Introduction, sensors, sensor characteristics, sensorial deviations, sensing types, sensing considerations, actuators, actuator types, actuator characteristics.	

<b>Unit – III IoT Communication Protocols</b>	Contact Hours = 8 Hours
Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols.	

<b>Unit – IV Associated IoT Technologies</b>	Contact Hours = 8 Hours
Cloud Computing: Introduction, Virtualization, Cloud Models. Fog Computing and its Applications: Introduction, view of a Fog computing architecture, Fog computing in IoT.	

<b>Unit – V IoT Case Studies and Future Trends</b>	Contact Hours = 8 Hours
Agricultural IoT, Introduction, case study: smart irrigation management system, Vehicular IoT, case study: Crime assistance in a smart IoT transportation system, Healthcare IoT, case study: AmbuSens system.	

### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1	Addressing Strategies in IoT
2	Actuator characteristics
3	Semantic Protocols
4	Fog computing in IoT
5	Healthcare IoT, case study: AmbuSens system

Books	
	Text Books:
1.	Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, Cambridge University Press, 2021.
2.	Mayur Ramgir, Internet of Things- Architecture, Implementation, and Security, Pearson Education India, 2019.
	Reference Books:
1.	Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications," Wiley, 2013.
2.	Ovidiu Vermesan, Peter Friess, "Internet of Things: From Research and Innovation to Market Deployment," River Publishers, 2014.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://onlinecourses.nptel.ac.in/noc22_cs53/preview">https://onlinecourses.nptel.ac.in/noc22_cs53/preview</a>
2.	<a href="https://onlinecourses.swayam2.ac.in/arp19_ap52/preview">https://onlinecourses.swayam2.ac.in/arp19_ap52/preview</a>
3.	<a href="https://onlinecourses.nptel.ac.in/noc23_cs65/preview">https://onlinecourses.nptel.ac.in/noc23_cs65/preview</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Demonstrate Understanding of IoT Fundamentals	Un	1,2	1
2.	Analyze IoT Sensing and Actuation Technologies	An	1,2	1,2
3.	Apply IoT Communication Protocols	Ap	1,2,3	1,2
4.	Evaluate IoT Applications and Future Trends	Ev	1,2,3	1,2,3

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks.

-Minimum score to be eligible for SEE: 50 OUT OF 100

- CIE score will be reduced to 50% for SGPA calculation

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	H	H											M		
2	H	H											M	M	
3	M	H	M										M	M	
4	M	H	M										M	M	L
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	IoT System Design and Development	Smart Cities and Infrastructure,	IoT System Developer
2	Proficiency in IoT Protocols	Healthcare and Medical Devices,	IoT Network Engineer
3	Data Handling and Analytics	Agriculture,	IoT Data Analyst
4	Security in IoT Systems.	Manufacturing and Industrial Automation,	Embedded Systems Engineer
5	Cloud Integration	Transportation and Logistics	IoT Security Analyst

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Cloud Computing Technology

<b>Course Code</b>	<b>MSCS202</b>	<b>Course type</b>	<b>IPCC</b>	<b>Credits L-P-T</b>	3 - 1 - 0
<b>Hours/week: L - T- P</b>	3 - 2 - 0			<b>Total credits</b>	4
<b>Total Contact Hours</b>	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			<b>CIE Marks</b>	100
<b>Flipped Classes content</b>	10 Hours			<b>SEE Marks</b>	100

<b>Course learning objectives</b>	
1.	To understand various basic concepts related to cloud computing technologies.
2.	To learn how to use Cloud Services.
3.	To apply Map-Reduce concept to applications.
4.	To understand role of Virtualization and resource management in enabling Cloud Computing.

<b>Required Knowledge of : Distributed Computing</b>
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<b>Unit – I</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Evolution of Computing, Cloud Computing Basics</b>            Introduction to Mainframe architecture; Client-server architecture; Cluster Computing; Grid Computing; Parallel Computing and Distributed Computing; Evolution of sharing on the Internet; Utility Computing; Autonomic Computing; Cloud Computing; Introduction of Cloud Computing; Service Models; Deployment Models; Characteristics of Cloud Computing; Advantages and Obstacles in cloud computing; Ethical issues in cloud computing.</p>	

<b>Unit – II</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Cloud Infrastructure</b>            Cloud Vulnerabilities, NIST reference model, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in.</p>	

<b>Unit – III</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Cloud Computing: Application Paradigms.</b>            Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Grep The Web application, Cloud for science and engineering.</p>	

<b>Unit – IV</b>	<b>Contact Hours = 8 Hours</b>
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**Cloud Resource Virtualization**

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and para virtualization, Hardware support for virtualization, Case Study: Xen a VMM based para virtualization, The dark side of virtualization.

**Unit – V****Contact Hours = 8 Hours****Cloud Resource Management and Scheduling.**

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two level resource allocation architecture, Feedback control based on dynamic thresholds, Resourcing bundling: Combinatorial auctions for cloud resources ,Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud; scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling.

**Flipped Classroom Details**

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions			1	1	1

**List of Experiments**

**NOTE:** Simulate using object oriented programming, any available cloud environment (**Eg; Amazon cloud**) and **VMware** for resource virtualization.

Unit No.	No. of Experiments	Topic(s) related to Experiment
II	2	Create a Collaborative learning environment for a particular learning topic using Google Apps.
		Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim
III	1	Implement Map Reduce concept for a. Strassen’s Matrix Multiplication for a huge matrix. b. Computing the average number of citation index a researcher has according to age among some 1 billion journalarticles.
IV	2	Model a Cloud computing environment having Data center that had 100 hosts.
		Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage.

V	2	Performance analysis of various resource scheduling algorithms using CloudSim simulator.
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Unit No.	Self-Study Topics
II	Energy use and ecological impact, Service level agreements.
III	High-performance computing on a cloud, Cloud computing for Biology research
IV	vBlades: Performance comparison of virtual machines.
V	Introduction to Cloud Simulator.

Books	
	<b>Text Books:</b>
1.	Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011 and onwards.
2.	Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier (MK) 2013 and onwards.
	<b>Reference Books:</b>
1.	Cloud Computing Principles and Paradigms by Rajkumar Buyya, Wiley India 2011 and onwards.
2.	John W Rittinghouse, James F Ransome: Cloud Computing Implementation, Management and Security, CRC Press 2013
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs14/preview">https://onlinecourses.nptel.ac.in/noc21_cs14/preview</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs ( if present)		

Course Outcome (COs)					
Learning Levels:					
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create					
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)
1.	<b>Discuss</b> cloud computing and control considerations within cloud computing environments.		L2	1	1
2.	<b>Identify</b> various cloud services.		L2	1	1
3.	<b>Explain</b> various concepts related to virtualization.		L2	1	1,2
4.	<b>Apply</b> Map-Reduce concept		L3	1,3	1,2,3
5.	<b>Analyze</b> resource allocation and scheduling algorithms in		L3	2,3	1,2

cloud computing			
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**Scheme of Continuous Internal Evaluation (CIE):**

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test (**COMPULSORY**) will be part of the CIE. **No SEE for Lab.**

THEORY (60 marks)		LAB (40 marks)		Total
IA test 1	IA test 2	Conduction	Lab test	
30 marks	30 marks	10 marks	30 marks	100 marks
<b>IA Test:</b>				
1. No objective part in IA question paper				
2. All questions descriptive				
<b>-Certification earned by passing the standard Online MOOCs course (of atleast 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.</b>				
<b>Conduct of Lab:</b>				
1. Conducting the experiment and journal: 5 marks				
2. Calculations, results, graph, conclusion and Outcome: 5 marks				
<b>Lab test: (Batchwise with 15 students/batch)</b>				
1. Test will be conducted at the end of the semester				
2. Timetable, Batch details and examiners will be declared by Exam section				
3. Conducting the experiment and writing report: <b>5 marks</b>				
4. Calculations, results, graph and conclusion: <b>15 marks</b>				
5. Viva voce: <b>10 marks</b>				
<b>Eligibility for SEE:</b>				
1. Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests. Lack of minimum score in IA test will make the student Not Eligible for SEE				
2. Student should score minimum 50% of 30 marks (i.e. 15 marks) in Lab test & should score 50% of 40 marks (i.e. 20 marks) in Lab component.				
3. Lab test is COMPULSORY				
4. Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.				
5. Not eligible in any one of the two components will make the student <b>Not Eligible</b> for SEE				

<b>Scheme of Semester End Examination (SEE):</b>	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 35$ &, however overall score of CIE+SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>
4.	SEE score will be reduced to 50% for SGPA calculation

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	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
1	✓												✓		
2	✓												✓		
3	✓		✓										✓	✓	
4	✓		✓										✓	✓	✓
5		✓	✓											✓	
<b>Tick mark the CO, PO and PSO mapping</b>															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Cloud-based Development	DevOps & Automation	Cloud Engineer
2	Automation & DevOps	Data Analytics	Cloud Architect
3	Cloud Architecture & Design	Streaming Platforms	DevOps Engineer

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Big Data Analytics

Course Code	MSCS203	Course type	Integrated Project based	Credits L-P-T	2-1-0
Hours/week: L - T- P	2 - 2- 0			Total credits	3
Total Contact Hours	L = 30 Hrs; T = Hrs; P = 20 Hrs Total = 50 Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives	
1.	To familiarize the concept of Big data, its dimensions, its applications and analyse business case studies in Big Data Analytics.
2.	To explore Hadoop framework and architecture.
3.	Highlight the significance of the MapReduce framework.
4.	To acquire knowledge about the importance of Hive and Pig.
5.	To provide an understanding on basics of NoSQL.

Required Knowledge of : Database Management Systems.

Unit – I	Contact Hours = 8 Hours
Introduction: Big Data Definition, History of Data Management-Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data, Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities; Use of Big Data in Retail Industry.	

Unit – II	Contact Hours = 8 Hours
<b>Hadoop Ecosystem:</b> Understanding Hadoop Ecosystem, Hadoop Distributed File System: HDFS Architecture, Concept of Blocks in HDFS Architecture, NameNodes and Data Nodes, The Command-Line Interface, Using HDFS Files, Hadoop-Specific File System Types, HDFS Commands.	

Unit – III	Contact Hours = 8 Hours
<b>Understanding MapReduce:</b> The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions. <b>Apache Spark:</b> Introduction to Apache Spark, Apache spark architecture. <b>Apache Cassandra:</b> Introduction to Cassandra.	

Unit – IV	Contact Hours = 8 Hours
<b>Hadoop Related Tools:</b> Pig–Grunt–pig data model–Pig Latin–developing and testing PigLatin scripts.Hive–data types and file formats–Hive QLdata definition–HiveQL datamanipulation– HiveQL queries	

Unit – V	Contact Hours = 8 Hours
<b>NoSQL: Introduction to NoSQL:</b> Why NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL Data Models: Key-Value Data Model, Column-Oriented Data Model, Document Data Model, Graph Databases, Schemaless Databases, Materialized views, Distribution Models: CAP Theorem, Sharding, <b>NewSQL Databases:</b> Overview of NewSQL, Characteristics of NewSQL.	

### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

### List of Experiments

Unit No.	No.of Experiments	Topic(s) related to Experiment
1	1	To analyse sentiment trends on social media platforms like Twitter or Instagram using big data tools.
2	1	Hadoop Ecosystem
3	1	MapReduce, Apache Spark
4	1	Pig (Apache Pig)
5	1	Mongo-DB

Unit No.	Self-Study Topics
II	The org.apache.hadoop.io package
III	Basics of Scala

Books	
<b>Text Books:</b>	
1.	DT Editorial Services, "Big Data:Black Book ,Comprehensive Problem Solver", Dreamtech Press.2016 Edition.
2.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012.
3.	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012
4.	
<b>Reference Books:</b>	
1.	Seema. Acharya and Subhashini. C, "Big Data and Analytics", 1st Edition, Wiley India, 2015
2.	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>	
1.	Introduction to Big Data with Spark and Hadoop Course by IBM   Coursera
2.	Big Data Computing - Course (nptel.ac.in)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs ( if present)		

Course Outcome (COs)			
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)			
<b>Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create</b>	<b>Learning Level</b>	<b>PO(s)</b>	<b>PSO(s)</b>

1.	<b>Demonstrate the concept of data collection, processing, analysis, retrieval, mining, visualization, and prediction.</b>	Un	1,3	1
2.	<b>Analyze the Big Data framework like Hadoop, Map reduce and NOSQL to efficiently store and process Big Data to generate analytics.</b>	An	1,2,3	1
3.	<b>Apply Hadoop tools to solve data intensive problems and to generate analytics.</b>	Ap	1,2,3	1,2
4.	<b>Analyse the requirements for a real world problem or a specification and develop a course project as the solution</b>	An	1,2,3	1, 2, 3

#### Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test (**COMPULSORY**) will be part of the CIE.

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
-Theory IA test should be of one-hour duration. -Lab IA test should be of two/three-hour duration. -Project batch will ideally consist of 2 students (maximum of 3). -Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. -Submission of Project report is compulsory. -Minimum score to be eligible for SEE: 50 OUT OF 100					
Eligibility for SEE: 1. 50% and above (20 marks and above) in theory component 2. 50% and above (30 marks and above) in project component 3. Not eligible in any one of the two components will make the student <b>Not Eligible</b> for SEE					

#### Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.			
2.	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks	
	Project evaluation			
	a. Initial write up stating the objectives, methodology and the outcome	10 marks		
	b. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	30 marks		
	c. Viva-voce	10 marks		
3.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .			
4.	SEE will be conducted in project batches by <b>Internal &amp; External examiners</b> together.			

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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
1	√		√										√		
2	√	√	√										√		
3	√	√	√										√	√	
4	√	√	√										√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Hadoop	IT Sector	Big Data Administrator
2	HDFS, PIG, Hive	IT Sector	Big Data developer, Data analyst
3	NoSQL	IT SECTOR	Data Analyst

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Relational Database Management Systems

<b>Course Code</b>	<b>MSCS211A</b>	<b>Course type</b>	<b>PEC</b>	<b>Credits L-T-P</b>	3 – 0 – 0
<b>Hours/week: L - T- P</b>	3 – 0 – 0			<b>Total credits</b>	3
<b>Total Contact Hours</b>	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			<b>CIE Marks</b>	100
<b>Flipped Classes content</b>	10 Hours			<b>SEE Marks</b>	100

<b>Course learning objectives</b>	
1.	To discuss the concept of databases, ER Modeling and Schema mapping
2.	To understand the application of different query languages and query optimizations.
3.	To introduce a formal database design approach through various normal forms and study the importance of concurrent transactions and control algorithms.
4.	To discuss applications of Object Oriented database.
5.	To understand parallel and distributed databases and its applications.

**Pre-requisites : Database Management System.**

<b>Unit – I</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Introduction:</b> Introduction to database, Characteristics of Database approach, Advantages of using DBMS approach, Three-schema architecture and data independence, Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship types, Roles and Structural Constraints; Weak Entity Types. ER-Relational Mapping Rules.</p>	

<b>Unit – II</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Database Design:</b> Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form.</p> <p><b>Transaction Processing Concepts:</b> Introduction to Transaction processing, Transaction and System concepts, Desirable properties of Transactions and issues with concurrent transactions. 2PL and TSO algorithms</p>	

<b>Unit – III</b>	<b>Contact Hours = 8 Hours</b>
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**SQL: SQL** Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries; Nested and Correlated Queries, IN, ALL, EXIST operators. Insert, Delete and Update statements in SQL. Introduction to Query Optimization techniques;

<b>Unit – IV</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Object and Object-Relational Databases:</b> Overview of OOP; Complex objects; Identity, structure etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; syntax and demo examples.</p> <p><b>Introduction to PL/SQL:</b>          PL/SQL Block Structure, PL/SQL Variables, PL/SQL Function , PL/SQL Procedure, PL/SQL IF Statement , PL/SQL Loop Statement: PL/SQL WHILE Loop Statement, PL/SQL FOR Loop Statement.</p>	

<b>Unit – V</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Parallel and Distributed Databases:</b> Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Distributed transactions; Distributed Concurrency control and Recovery.</p>	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
<b>No. for Flipped Classroom Sessions</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

Unit No.	Self-Study Topics
I	Actors on the scene & workers behind the scene
II	Functional dependency
III	Complex queries
IV	Abstract data types
V	Updating distributed data

Books	
<b>Text Books:</b>	
1.	Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013 and onwards.
2.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013 and onwards.
<b>Reference Books:</b>	
1.	A.Silberschatz, H. Korth, S. Sudarshan, Database system concepts, 5/e, McGraw Hill, 2008 and onwards.

	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="https://nptel.ac.in/courses/106/106/106106095/">https://nptel.ac.in/courses/106/106/106106095/</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	<b>Analyze</b> the given database applications using E-R diagrams and apply the normalization to produce schema diagrams and relations.	L3	1	1
2.	<b>Explain</b> the concepts of object oriented databases , SQL concepts and transaction processing.	L2	1	1
3.	<b>Apply</b> SQL language to design different Database applications.	L3	1	1,2
4.	<b>Analyze</b> appropriate high performance database like parallel and distributed database	L4	1,3	1,2,3

#### Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

#### IA Test:

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  - Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

#### Eligibility for SEE:

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

<b>Scheme of Semester End Examination (SEE):</b>	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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
1	✓												✓		
2	✓												✓		
3	✓	✓	✓										✓	✓	✓
4	✓	✓	✓											✓	✓
<b>Tick mark the CO, PO and PSO mapping</b>															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Advanced SQL & Query Optimization	Enterprise Applications	Database Administrator (DBA)
2	Distributed Database Management	Data Integration Platforms	Data Analyst
3	Transaction Management & Concurrency Control	Core Banking Systems	Business Intelligence (BI) Developer

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Digital Image Processing and Computer Vision

Course Code	MSCS211B	Course type	PCC	Credits L-P-T	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the importance and applications of Digital Image Processing
2.	To understand the image representation and image formation in Gray.
3.	To understand the image fundamentals and mathematical transforms necessary for image processing and study the image enhancement techniques.
4.	To introduce the various image processing techniques in spatial and frequency domains.
5.	To understand core concepts of computer vision

Pre-requisites: Basics of Mathematical Analysis, Vectors, Matrices, Probability & Statistics, Computer Programming, Image Processing, Linear Algebra And Probability.

Unit – I	Contact Hours = 8 Hours
Introduction: What is Digital Image Processing, origins of digital image processing, examples of fields that use DIP., fundamental steps in digital image processing, components of a digital processing system.	

Unit – II	Contact Hours = 8 Hours
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	

Unit – III	Contact Hours = 8 Hours
Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters.	

Unit – IV	Contact Hours = 8 Hours
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Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering. Image Transforms Introduction, Need for transforms, Classification of Image transforms, Walsh transform, Hadamard Transform, HAAR transform.

Unit – V	Contact Hours = 8 Hours
Introduction To Image Formation And Processing: Computer Vision – Geometric primitives and transformations – Photometric image formation – The digital camera – Point operators – Linear filtering – More neighborhood operators – Fourier transforms – Pyramids and wavelets – Geometric transformations – Global optimization.	

### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions		1	1		1

Unit No.	Self-Study Topics
I	Structure of human eye and image formation in the eye.
III	Relationship between sampling and frequency intervals.
IV	Linear position invariant degradations & Applications of image transformations
V	Algorithms for Facial Recognition Technologies.

Books	
	Text Books:
1.	Rafael C. Gonzalez and Richard E. Woods: Digital Image Processing PHI 2nd Edition 2005.
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
	Reference Books:
1.	A.K.Jain: Fundamentals of Digital Image Processing Pearson, 2004..
2.	Scott E. Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
3.	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4.	S. Jayaraman S. Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd. 2013.
5.	Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://archive.nptel.ac.in/courses/117/105/117105135/">https://archive.nptel.ac.in/courses/117/105/117105135/</a>
2.	<a href="https://archive.nptel.ac.in/courses/106/105/106105216/">https://archive.nptel.ac.in/courses/106/105/106105216/</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
3.	Flipped Classes	2.	Open Assignment (OA)/ Certification
4.	Online classes	3.	Course Project
		4.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the importance of DIP and its applications.	L2	1,2	1,3
2.	Explain the image formation and representation of digital images.	L2	1,2,3	1,2
3.	Apply the spatial and frequency domain image processing techniques in gray & color.	L2	1,3	1,2,3,
4.	Explain the fundamentals of image processing and computer vision	L2	1,2	1

#### Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

#### IA Test:

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  - Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

#### Eligibility for SEE:

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

#### Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts A,B and C. Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit,</li> </ol>

each Question Carries 10 Marks.

3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
C O	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
1	✓												✓		✓
2	✓		✓										✓	✓	
3	✓	✓	✓										✓	✓	✓
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding of digital image processing principles, including image formation, representation, and enhancement techniques.	Information Technology and Software Development	Digital Image Processing Engineer
2	Ability to apply both spatial and frequency domain image processing methods.	Healthcare (e.g., medical imaging) Automotive (e.g., autonomous driving systems)	Computer Vision Specialist
3	Proficiency in core concepts of computer vision, such as geometric transformations and photometric image formation.	Surveillance and Security	Research Scientist in Artificial Intelligence and Computer Vision Data Scientist with a focus on visual data analysis
4	Practical skills in implementing algorithms related to image filtering, restoration, and transformation	Media and Entertainment (e.g., video editing, special effects)	Software Developer for Imaging Applications

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## Business Intelligence and its Applications

Course Code	MSCS211C	Course type	PEC	Credits L-P-T	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the introduction of Business Intelligence, data mining and data warehousing basic concepts .
2.	To understand the various technologies for data mining and data warehouse systems
3.	To apply various data warehousing and data mining techniques for dimensionality reduction
4.	To make use of various techniques for analyzing the predictive models .

Pre-requisites :data mining ,data science .

Unit – I	Contact Hours = 8 Hours
Introduction to Business Intelligence rational and Decision Support System, Data-Information-Knowledge-Decision Making-Action cycle. Basic definitions- Business Intelligence; Data warehousing, Business Intelligence architecture, Use and benefits of Business Intelligence. Knowledge Discovery in Databases: KDD process model, Data Pre-processing: Cleaning: Missing Values; Noisy Values; Inconsistent values; redundant values. Outliers, Integration, transformation, reduction, Discretization: Equal Width Binning; Equal Depth Binning, Normalization, Smoothing.	

Unit – II	Contact Hours = 8 Hours
Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities	

Unit – III	Contact Hours = 8 Hours
Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.	

Unit – IV	Contact Hours = 8 Hours
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Startup ecosystem: Introduction to Startups and Entrepreneurship, Idea Generation and Validation, Business Models and Revenue Streams, Product Development and Technology, Marketing and Growth Hacking.

Unit – V	Contact Hours = 8 Hours
Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1	KDD process model
2	Business Applications of BI
3	BI Technology
4	Multi-Criteria Decision Making With Pairwise Comparisons.
5	Development of Expert Systems.

Books	
	Text Books:
1.	Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10 <sup>th</sup> Edition, Pearson Global Edition, 2013
2.	David Loshin and David Loshin, "Business Intelligence", First Edition, 2003.
3.	Mike Biere, "Business intelligence for the enterprise", Pearson Publication, First Edition.
4.	<i>The Lean Startup</i> by Eric Ries, <i>Zero to One</i> by Peter Thiel, <i>Measure What Matters</i> by John Doerr
	Reference Books:
1.	Name of the author(s), Title of the Book, Publisher, Edition/Year _____ and onwards
2.	
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://www.youtube.com/watch?v=zbcCdoHeS4w">https://www.youtube.com/watch?v=zbcCdoHeS4w</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc24_cs65/preview">https://onlinecourses.nptel.ac.in/noc24_cs65/preview</a>

Course delivery methods	Assessment methods
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1.	Chalk and Talk	1.	IA tests
3.	Flipped Classes	2.	Open Assignment (OA)/ Certification
4.	Online classes	3.	Course Project
		4.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Able to analyze Business Intelligence, Analytics and Decision Support	L2	1,2,3	1
2.	Explain the technologies for Decision making	L2	2,3	1,2
3.	Apply predictive modelling techniques (can be attained through assignment or CIE)	L3	1,2,3	2,3
4.	Apply sentiment analysis techniques (can be attained through assignment or CIE)	L3	1,2,3	1,2,3

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

**- IA Test:**

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
- Remaining 20 marks questions in Part B & C should be descriptive

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

**Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	L												L	M	
2		M											M		H
3		H	H											M	H
4	L	M											M	H	
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	<b>Data Analysis</b>	<b>Finance and Banking:</b>	<b>Data Engineer</b>
2	<b>Statistical Knowledge</b>	<b>Marketing and Advertising:</b>	<b>Market Research Analyst</b>
3	<b>Predictive Analytics</b>	<b>Logistics and Supply Chain</b>	<b>Business Analyst:</b>

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

### Advances in Operating system

<b>Course Code:</b>	MSCS211D	<b>Course type</b>	PEC	<b>Credits L-P-T</b>	3 – 0 - 0
<b>Hours/week: L - T- P</b>	3 – 0 – 0			<b>Total credits</b>	3
<b>Total Contact Hours</b>	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			<b>CIE Marks</b>	100
<b>Flipped Classes content</b>	10 Hours			<b>SEE Marks</b>	100

<b>Course learning objectives</b>	
1.	Introduce the fundamentals of Operating System.
2.	Present the concepts of distributed operating system that includes Architecture, Mutual Exclusion Algorithms, Deadlock Detection Algorithms and Agreement Protocols.
3.	Discuss distributed resource management components including algorithms for implementation of distributed shared memory, recovery and commit protocols
4.	Identify the components and management aspects of Real time, Mobile operating Systems.

**Pre-requisites : Computer Concepts & Programming, Computer Organization.**

<b>Unit – I</b>	<b>Contact Hours = 8 Hours</b>
<b>Operating System Overview, Process description &amp; Control:</b> Operating System Objectives and Functions, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems,	

<b>Unit – II</b>	<b>Contact Hours = 8 Hours</b>
<b>Threads, SMP, and Microkernel, Virtual Memory:</b> Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures.	

<b>Unit – III</b>	<b>Contact Hours = 8 Hours</b>
<b>Multiprocessor and Real-Time Scheduling:</b> Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSI Scheduling, Windows Vista Hours Scheduling,	

<b>Unit – IV</b>	<b>Contact Hours = 8 Hours</b>
<b>Embedded Operating Systems:</b> Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders.	

<b>Unit – V</b>	<b>Contact Hours = 8 Hours</b>
<b>Kernel Organization:</b> Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine , Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management. The windows	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
<b>No. for Flipped Classroom Sessions</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

Unit No.	Self-Study Topics
1	The Evolution of Operating Systems.
2	Windows Vista Memory Management, Summary
3	Distributed Deadlock.
4	Malicious Software Overview, Viruses, Worms, and Bots, Rootkits
5	The cache Manager Kernel local procedure calls and IPC, The native API, subsystems

Books	
	<b>Text Books:</b>
1.	William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2.	Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.
	<b>Reference Books:</b>
1.	Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2.	Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="https://nptel.ac.in/courses/106/106/106106144/">https://nptel.ac.in/courses/106/106/106106144/</a>
2.	<a href="https://www.cse.iitb.ac.in/~mythili/os/">https://www.cse.iitb.ac.in/~mythili/os/</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning

level.)				
<b>Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create</b>		<b>Learning Level</b>	<b>PO(s)</b>	<b>PSO(s)</b>
1.	Demonstrate the Mutual Exclusion, Deadlock Detection and Agreement Protocols of Distributed Operating System	L3	1,2	1,2
2.	Explain the various resource management techniques for distributed systems.	L2	1,2	1,2
3.	Identify the different features of real time and mobile operating system.	L4	1,2,3	1,2,3
4.	Modify existing open source kernels in terms of functionality or features used.	L4	1,2,3	1,2,3

#### **Scheme of Continuous Internal Evaluation (CIE):**

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

#### **IA Test:**

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  - Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

#### **Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

#### **Scheme of Semester End Examination (SEE):**

1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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
1	M	M	-	-	-	-	-	-	-	-	-	-	M	M	-
2	L	M	-	-	-	-	-	-	-	-	-	-	L	L	-
3	H	H	L	-	-	-	-	-	-	-	-	-	M	M	L
4	M	M	H	-	-	-	-	-	-	-	-	-	M	M	L
5					-	-	-	-	-	-	-	-			
<b>Tick mark the CO, PO and PSO mapping</b>															

Name & Signature of Faculty members  
involved in designing the syllabus

Name & Signature of Faculty members  
verifying/approving the syllabus

## Cryptography and Network Security

<b>Course Code</b>	<b>MSCS212A</b>	<b>Course type</b>	<b>PEC</b>	<b>Credits L-P-T</b>	3 – 0 - 0
<b>Hours/week: L - T- P</b>	3 – 0 – 0			<b>Total credits</b>	3
<b>Total Contact Hours</b>	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			<b>CIE Marks</b>	100
<b>Flipped Classes content</b>	10 Hours			<b>SEE Marks</b>	100

<b>Course learning objectives</b>	
1.	Explain standard algorithms that provide confidentiality, integrity, and authenticity.
2.	Describe and compare standard asymmetric encryption algorithms.
3.	Demonstrate encryption techniques to secure data in transit across networks.
4.	Implement security applications in Information Technology to protect data and systems.

**Pre-requisites :** Fundamentals of Computer Networks

<b>Unit – I</b>	<b>Contact Hours = 8 Hours</b>
<b>Classical Encryption Techniques Symmetric Cipher Model:</b> Symmetric cipher model, security attacks, security services, security mechanisms, Substitution Techniques, transposition techniques The data encryption standard, Feistel cipher structure, Block cipher design Principles.	

<b>Unit – II</b>	<b>Contact Hours = 8 Hours</b>
<b>Public-Key Cryptography and RSA: Principles of public-key cryptosystems:</b> Public key cryptosystems. Applications for public-key cryptosystems, requirements for public key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.	

<b>Unit – III</b>	<b>Contact Hours = 8 Hours</b>
<b>Key management and distribution:</b> Symmetric key distribution using Symmetric encryption, Symmetric key distribution using asymmetric encryption, distribution of public keys, x.509 certificates.	

<b>Unit – IV</b>	<b>Contact Hours = 8 Hours</b>
<b>Wireless network security and Transport layer security:</b> Wireless security, mobile device security, IEEE 802.11 Wireless LAN overview, Web Security Considerations, Secure Sockets Layer and transport layer security.	

<b>Unit – V</b>	<b>Contact Hours = 8 Hours</b>
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**Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1.	AES
2.	Kerberos , SHA algorithm, Hash Function Application, Digital Signatures

Books	
	<b>Text Books:</b>
1.	William Stallings, Cryptography and Network Security, Pearson 6 edition onwards
	<b>Reference Books:</b>
1.	Atul Kahate: Cryptography and Network Security McGraw-Hill Second edition onwards
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="#">Cryptography - Course</a>
2.	<a href="#">Information Security - Course</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
3.	Flipped Classes	2.	Open Assignment (OA)/ Certification
4.	Online classes	3.	Course Project
		4.	Semester End Examination

Course Outcome (COs)					
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)					
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create			Learning Level	PO(s)	PSO(s)
1.	Explain the different Symmetric and Asymmetric encryption techniques.	Un	2	1,2,3	
2.	Analyze the given encryption techniques and Apply the security measures on network.	An	1,2,3	1,3	
3.	Apply x.509,IEEE 802.11,S/MIME and DKIM functionalities to provide security to wireless, Transport and Electronic mail systems.	Ap	1,2,3	2	
4.	Analyze the requirements for a real world problem or a	An	1,2,3	1,3	

specification and develop a course project as the solution or present a course seminar			
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Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

**IA Test:**

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
- Remaining 20 marks questions in Part B & C should be descriptive -Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

**Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

**Scheme of Semester End Examination (SEE):**

- It will be conducted for 100 marks of 3 hours duration.
- Minimum marks required in SEE to pass:** Score should be  $\geq 40\%$ , however overall score of CIE + SEE should be  $\geq 50\%$ .
- Question paper contains three parts **A,B and C**. Students have to answer
  - From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.
  - From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.
  - From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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
1	M	H											M	H	L
2	H	M	H										M		H
3	M	L	M											L	
4	H	M	H										M		H
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
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1.	Students can apply appropriate security model for wireless network security.	Network Security Surveillance	Security Architect Security Consultant
2	Have a knowledge about Network Security Control and Cloud Security	Software Security	Chief Information Security Officer
3	Students can apply security applications in the field of Information technology	Planning for disaster recovery and business continuity Software Development	Cryptographer Security Analyst

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

### Storage Area Networks

<b>Course Code</b>	MSCS212B	<b>Course type</b>	<b>PEC</b>	<b>Credits L-T-P</b>	3 – 0 – 0
<b>Hours/week: L-P-T</b>	3 – 0 – 0			<b>Total credits</b>	3
<b>Total Contact Hours</b>	L = 40 Hrs; T = 00Hrs;P = 00Hrs Total = 40Hrs			<b>CIE Marks</b>	100
<b>Flipped Classes content</b>	10 Hrs			<b>SEE Marks</b>	100

<b>Course learning objectives</b>	
1.	To study Storage Area Networks characteristics and its components.
2.	Introduce storage virtualization and bring out its importance.
3.	Analyzedifferentnetworkedstorageoptionsfordifferentapplicationenvironments

**Pre-requisites** :Networks, Operating Systems

<b>Unit – I</b>	<b>8 Hours</b>
<b>Introduction:</b> Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its Advantages. Case study: Replacing a server with Storage networks The Data Storage and Data access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels;	
Self-learning topics:	

<b>Unit – II</b>	<b>8 Hours</b>
<b>I/O Techniques:</b> The Physical I/O path from the CPU to the Storage System; SCSI; Fiber Channel Protocol Stack; Fiber Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS Hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. Comparison of Fiber Channel and NAS	

<b>Unit – III</b>	<b>8 Hours</b>
<b>Storage Virtualization:</b> Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network.	

<b>Unit – IV</b>	<b>8 Hours</b>
<b>SAN Architecture and Hardware devices:</b> Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers.	

Unit – V	<b>8 Hours</b>
<b>Management of Storage Network:</b> System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management; In-band Management.: SNMP, CIM and WBEM.	

Books	
	Text Books:
1.	Storage Networks Explained Ulf Troppens, Rainer Erkens and Wolfgang Muller Wiley India 2013
	Reference Books:
1.	Storage Networks the Complete Reference Robert Spalding Tata McGraw- Hill 2011.
2.	Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems Marc Farley Cisco Press, 2005
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	
2.	

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Semester End Examination
4.	Practice session/Demonstrations in Labs		
5.	Virtual Labs ( if present)		

Course Outcome (COs)					
<b>Learning Levels:</b>					
<b>Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create</b>					
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)
1.	Identify the need for performance evaluation and the metrics used for it		L4	1, 2, 3	1, 3
2.	Apply the techniques used for data maintenance.		L3	1, 2	1, 2
3.	Realize strong virtualization concepts		L4	1, 3	1, 3

**Scheme of Continuous Internal Evaluation (CIE):**

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

**IA Test:**

1. 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  2. Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

**Eligibility for SEE:**

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

**Scheme of Semester End Examination (SEE):**

1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

Rubrics:Levels	Target
<b>1(Low)</b>	<b>60% of the students score Less than 50 % of the total marks.</b>
<b>2(Medium)</b>	<b>60% of the students score 50 – 70 % of the total marks.</b>
<b>3(High)</b>	<b>60% of the students score More than 70 % of the total marks.</b>

CO-PO Mapping (Planned)				CO-PSO Mapping(Planned)		
CO	PO1	PO2	PO3	PSO1	PSO2	PSO3
1	M	L	L	M		L
2	H	M		M	L	
3	H		L	M		L
<b>Tick mark the CO, PO and PSO mapping</b>						

## Advanced Computer Networks

Course Code	MSCS212C	Course type	PEC	Credits L-P-T	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the advanced concepts in computer networks.
2.	To analyze and design network protocols and architectures.
3.	To Evaluate the vulnerabilities affecting the computer networks.
4.	To explore the latest trends and technologies in computer networking.

Pre-requisites: Computer Networks

Unit – I	Contact Hours = 8 Hours
<p>Introduction to Advanced Networking Concepts:</p> <p><b>Overview of Computer Networks:</b> Review of OSI and TCP/IP Models, Network Types (LAN, WAN, MAN).</p> <p><b>Network Protocols and Standards:</b> Protocol Layers and Data Flow, Standardization Bodies (IETF, IEEE, ITU).</p> <p><b>Network Architecture:</b> Overview of Network Design Principles, Evolution of Computer Networks.</p>	

Unit – II	Contact Hours = 8 Hours
<p>Network Protocols and Routing:</p> <p><b>Routing Algorithms and Protocols:</b> Static vs. Dynamic Routing, Distance Vector and Link State Algorithms Interior and Exterior Gateway Protocols: RIP, OSPF, BGP</p> <p><b>Advanced Topics in Routing:</b> Software-Defined Networking (SDN), Routing Security and Best Practices.</p>	

Unit – III	Contact Hours = 8 Hours
<p>Network Security and Management:</p> <p><b>Fundamentals of Network Security:</b> Threats, Vulnerabilities, and Attacks, Cryptography and Security Protocols (SSL/TLS, IPsec).</p> <p><b>Network Security Architecture:</b> Firewalls, Intrusion Detection Systems (IDS), and Intrusion Prevention Systems (IPS).</p> <p><b>Network Management Protocols:</b> SNMP (Simple Network Management Protocol), Network Monitoring and Performance Management.</p>	

Unit – IV	Contact Hours = 8 Hours
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Wireless and Mobile Networks:  
**Wireless Communication Principles:** Frequency Bands, Modulation Techniques.  
**Wireless Networking Standards:** IEEE 802.11 (Wi-Fi), Bluetooth, Zigbee.  
**Mobile Network Architectures:** 4G, 5G Technologies, Mobile IP and its Challenges.

Unit – V	Contact Hours = 8 Hours
Emerging Trends in Networking: <b>Internet of Things (IoT):</b> IoT Architectures and Protocols, Applications of IoT in Networking. <b>Network Function Virtualization (NFV):</b> Concepts and Implementation, Benefits and Challenges of NFV. <b>Future Directions:</b> Quantum Networking, Network Automation and Artificial Intelligence in Networking	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Unit No.	Self-Study Topics
1.	Comparison of Network Models, Network Design Principles
2.	In-depth Study of Routing Protocols through case studies or simulations.
3.	Evaluate popular network management tools like Wireshark, SolarWinds
4.	Wireless Communication Standards
5.	MQTT, CoAP, NFV principles

Books	
	Text Books:
1.	Tanenbaum, A. S., & Wetherall, D. J. (2011). Computer Networking (5th ed.). Prentice Hall.
2.	Kurose, J. F., & Ross, K. W. (2017). Computer Networking: A Top-Down Approach (7th ed.). Pearson.
	Reference Books:
1.	Forouzan, B. A. (2017). Data Communications and Networking (5th ed.). McGraw-Hill.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://onlinecourses.nptel.ac.in/noc23_cs35/preview">https://onlinecourses.nptel.ac.in/noc23_cs35/preview</a>
2.	<a href="https://archive.nptel.ac.in/courses/106/105/106105183/">https://archive.nptel.ac.in/courses/106/105/106105183/</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
3.	Flipped Classes	2.	Open Assignment (OA)/ Certification
4.	Online classes	3.	Course Project
		4.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	A thorough <b>understanding</b> of advanced computer network architectures, models, and protocols, including the OSI and TCP/IP models, and their application in modern networking environments.	<b>Un</b>	<b>1, 2, 3</b>	<b>1</b>
2.	<b>Analyze</b> and <b>evaluate</b> various routing algorithms and protocols, including dynamic routing protocols, to effectively manage and optimize data traffic across complex network infrastructures.	<b>An</b>	<b>2, 3</b>	<b>1</b>
3.	<b>Apply</b> principles of network security to identify potential vulnerabilities, threats, and attacks, and <b>evaluate</b> appropriate countermeasures, including the use of security protocols and network management tools.	<b>Ap</b>	<b>1, 2, 3</b>	<b>2</b>
4.	<b>Understand</b> the fundamental concepts of wireless and mobile networks, including standards and protocols, and assess the challenges and technologies associated with their deployment and management.	<b>Un</b>	<b>1, 3</b>	<b>3</b>
5.	<b>Evaluate</b> and discuss emerging trends in networking, such as IoT, SDN, NFV, and network automation, and critically <b>analyze</b> their implications for future network design, management, and security.	<b>Ev</b>	<b>1, 2, 3</b>	<b>3</b>

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

**IA Test:**

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  - Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 45\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A, B and C</b> . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.

	<p>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</p> <p>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</p>
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CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	✓	✓	✓										✓		
2		✓	✓										✓		
3	✓	✓	✓											✓	
4	✓		✓												✓
5	✓	✓	✓												✓
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Network Design and Architecture	N/W, Security	Network Engineer, Network Security Specialist
2	System Architecture		Systems Administrator, Cloud Network Architect
3	R&D Engg		IoT Solutions Engineer, Research and Development Engineer in Networking

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## 5G Technology

Course Code	MSCS212D	Course type	PEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the evolution of wireless technologies from 1G to 5G.
2.	To learn the requirements of 5G communication technology in the present industry applications.
3.	To understand the need of Multi-type and Device-to-Device (D2D) Communications in the 5G wireless Systems
4.	To illustrate the mode of multiple access in 5G technologies.

**Pre-requisites :** Concept of Computer Networks and wireless communication.

Unit – I: Introduction	Contact Hours = 8 Hours
Historical background: Industrial and technological revolution: from steam engines to the Internet, Mobile communications generations: from 1G to 4G, From mobile broadband (MBB) to extreme MBB, IoT: relation to 5G. From ICT to the whole economy. Rationale of 5G: high data volume, twenty-five billion connected devices and wide requirements, Security. Global initiatives: METIS and the 5G-PPP, China: 5G promotion group, Korea: 5G Forum, Japan: ARIB 2020 and Beyond Ad Hoc,	

Unit – II: 5G use cases and system concept:	Contact Hours = 8 Hours
5G Use cases and requirements: Use cases, Requirements and key performance indicators. 5G system concept: Concept overview, Extreme mobile broadband, Massive machine-type communication, Ultra-reliable machine-type communication, Dynamic radio access network.	

Unit – III: The 5G architecture:	Contact Hours = 8 Hours
Introduction: NFV and SDN, Basics about RAN architecture. High-level requirements for the 5G architecture, Functional architecture and 5G flexibility: Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G requirements, Enhanced Multi-RAT coordination features. Physical architecture and 5G deployment: Deployment enablers.	

Unit – IV: Machine-type communications:	Contact Hours = 8 Hours
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Introduction: Use cases and categorization of MTC, MTC requirements. Fundamental techniques for MTC: Data and control for short packets, Non-orthogonal access protocols. Massive MTC: Design principles.

Unit – V: The 5G radio-access technologies:	Contact Hours = 8 Hours
Access design principles for multi-user communications: Orthogonal multiple-access systems, Spread spectrum multiple-access systems, Capacity limits of multiple-access methods. Multi-carrier with filtering: a new waveform: Filter-bank based multi-carrier, Universal filtered OFDM. Non-orthogonal schemes for efficient multiple access: Non-orthogonal multiple access (NOMA).	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Unit No.	Self-Study Topics
1	Other 5G activities, IoT activities, Standardization activities: ITU-R, 3GPP, IEEE
2	Lean system control plane, Localized contents and traffic flows.
3	Flexible function placement in 5G deployments.
4	MTC Technology components and 5G D2D RRM concept: an example.
5	Sparse code multiple access (SCMA), Interleave division multiple access (IDMA).

Books	
	Text Books:
1.	AfifOsseiran, Jose F. Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, Edition 1/year 2016 and onwards
	Reference Books:
1.	Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley Publishing, Inc., Indianapolis, Indiana, 2003 and onwards
2.	Raj kamal: Mobile Computing, Oxford University Press, 2007 and onwards.
	ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009 and onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	<a href="https://onlinecourses.nptel.ac.in/noc19_ee48/preview">https://onlinecourses.nptel.ac.in/noc19_ee48/preview</a>
2.	

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project

4.	Online classes	4.	Semester End Examination
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Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the <b>action verb</b> representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Demonstrate the Growth of wireless communication till 5G	L3	1	1
2.	Elucidate the need of 5G in latest communication requirements	L2	1	1
3.	Explore the futuristic communication technologies like Multi-type and Device-to-Device (D2D) Communications in the 5G wireless Systems	L3	1,2,3	1,2,3
4.	Illustrate the mode of multiple accesses in 5G communication technologies	L2	2,3	2,3

#### Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

#### IA Test:

- 10 marks questions in Part A of IA question paper should also include an OBE related question (max 2 marks).
  - Remaining 20 marks questions in Part B & C should be descriptive
- Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

#### Eligibility for SEE:

- Student should score minimum 50% of 60 marks (i.e. 30 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE.
- Minimum score in CIE to be eligible for SEE: 50 OUT OF 100.

#### Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .
3.	Question paper contains three parts <b>A,B and C</b> . Students have to answer <ol style="list-style-type: none"> <li>1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks.</li> <li>2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks.</li> <li>3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.</li> </ol>

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	✓												✓		
2	✓												✓		
3	✓	✓	✓										✓	✓	✓
4		✓	✓											✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1			
2			
3			

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### Internet of Things and Applications Lab

<b>Course Code</b>	<b>MSCSL208</b>	<b>Course type</b>	<b>PCCL</b>	<b>Credits L-P-T/SDA</b>	0 - 1 - 1
<b>Hours/week: L - T- P</b>	0 - 2 - 2			<b>Total credits</b>	2
<b>Total Contact Hours</b>	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			<b>CIE Marks</b>	50
<b>Flipped Classes content</b>	--			<b>SEE Marks</b>	50

<b>Course learning objectives</b>	
1.	To introduce students to Internet of Things (IoT) concepts using Arduino UNO and Raspberry Pi platforms.
2.	To familiarize students with sensor interfacing and real-time data collection from various sensors.
3.	To design and develop basic IoT applications using various sensors .
4.	To interface sensors with Raspberry Pi and implement simple I/O operations and sensor interfacing.

#### Required Knowledge of : Embedded Systems & IoT, Programming Knowledge

<b>Lab Experiment – 1</b>	<b>Contact Hours = 2 Hours</b>
<b>Introduction to Arduino UNO, installing Arduino IDE, basic programming structure, and interfacing an LED.</b>	
<b>Lab Experiment – 2</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing DHT11 temperature and humidity sensor with Arduino UNO, collecting data and visualizing it on a serial monitor.</b>	
<b>Lab Experiment – 3</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing an LDR (Light Dependent Resistor) with Arduino UNO to measure light intensity.</b>	
<b>Lab Experiment – 4</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing an ultrasonic sensor with Arduino UNO for distance measurement.</b>	
<b>Lab Experiment – 5</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing a gas sensor with Arduino UNO for air quality monitoring.</b>	
<b>Lab Experiment – 6</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing a relay with Arduino UNO.</b>	
<b>Lab Experiment – 7</b>	<b>Contact Hours = 2 Hours</b>

<b>Interfacing a buzzer with Arduino UNO.</b>	
<b>Lab Experiment – 8</b>	<b>Contact Hours = 2 Hours</b>
<b>Basic I/O operations with Raspberry Pi: controlling an LED with Python.</b>	
<b>Lab Experiment – 9</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing DHT11 sensor with Raspberry Pi and collecting temperature and humidity data.</b>	
<b>Lab Experiment – 10</b>	<b>Contact Hours = 2 Hours</b>
<b>Interfacing LDR sensor with Raspberry Pi to measure light intensity.</b>	

<b>Books</b>	
	<b>Text Books:</b>
1.	Matt Richardson and Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly, 3rd Edition, 2021.
2.	Simon Monk, Programming Arduino: Getting Started with Sketches, McGraw-Hill, 2nd Edition, 2016.
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</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://onlinecourses.swayam2.ac.in/arp19_ap52/preview">https://onlinecourses.swayam2.ac.in/arp19_ap52/preview</a>
3.	<a href="https://onlinecourses.nptel.ac.in/noc23_cs65/preview">https://onlinecourses.nptel.ac.in/noc23_cs65/preview</a>

<b>Course delivery methods</b>		<b>Assessment methods</b>	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs ( if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.			Semester End Examination

<b>Course Outcome (COs)</b>					
<b>Learning Levels:</b>					
<b>Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create</b>					
At the end of the course, the student will be able to			<b>Learning Level</b>	<b>PO(s)</b>	<b>PSO(s)</b>
1.	<b>Understand and implement basic I/O operations and sensor interfacing with Arduino UNO and Raspberry Pi.</b>		Un	1,2	1,2
2.	<b>Apply IoT concepts to design simple real-time applications.</b>		Ap	1,2,3	1,2
3.	<b>Analyze sensor data collected from IoT devices for practical applications.</b>		An	1,2,3	1,2,3

**Scheme of Continuous Internal Evaluation (CIE):**

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended expt	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks
<b>Conduct of Lab:</b>				
1 Conduction of the experiment: 15 marks + Viva voce: 5 marks				
2 Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks				
3 Lab project/ Open ended expt: 10 marks				
4 Lab Test: 15 marks				
<b>Eligibility for SEE:</b>				
5. 50% and above (25 marks and above)				
6. Lab test is <b>COMPULSORY</b>				

<b>Scheme of Semester End Examination (SEE):</b>			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE+SEE should be $\geq 50\%$ .		
2.	One or Two experiments to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	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
1	M	H											M	M	
2	M	H	M										M	L	
3	M	H	L										M	L	L
Tick mark the CO, PO and PSO mapping															

SI No	Skill & competence enhanced	Applicable Industry	Job roles students can take up
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	after undergoing the course	Sectors & domains	after undergoing the course
<b>1</b>	<b>IoT System Design</b>	<b>Smart Cities &amp; Smart Homes, Healthcare, Agriculture, Automotive Industries.</b>	<b>IoT Developer/Engineer</b>
<b>2</b>	<b>Sensor Interfacing</b>		<b>Embedded Systems Engineer</b>
<b>3</b>	<b>Embedded System Programming</b>		<b>IoT Application Developer</b>

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## Project Management (AEC)

<b>Course Code</b>	<b>MSCS252A</b>	<b>Course type</b>	<b>AEC</b>	<b>Credits L-T-P</b>	0 - 1- 0
<b>Hours/week: L - P- T</b>	0- 2 - 0			<b>Total credits</b>	1
<b>Total Contact Hours</b>	15			<b>CIE Marks</b>	50
				<b>SEE Marks</b>	50

<b>Course learning objectives</b>	
1.	To <b>demonstrate</b> hands-on experience with project management tools and techniques.
2.	To <b>develop</b> practical skills in planning, executing, and managing IT projects.
3.	To <b>make use of</b> real-world project management roles in software development and technology.
4.	<b>Apply</b> and <b>develop</b> Agile and Scrum framework practices for software projects effectively.

### Required Knowledge of : Software Engineering

<b>Unit – I</b>	<b>Contact Hours = 3 Hours</b>
<b>Introduction to Project Management and Tools</b>	
<ul style="list-style-type: none"> <li>• Overview of Project Management (PM) methodologies: Agile, Waterfall, Scrum, Kanban.</li> <li>• Introduction to project management software (e.g., JIRA, MS Project, Trello).</li> <li>• Forming project teams and selecting a sample IT project for hands-on practice.</li> </ul>	
(Text 1, Chap 1)	

<b>Unit – II</b>	<b>Contact Hours = 3 Hours</b>
<b>Project Planning and Requirement Gathering:</b>	
<ul style="list-style-type: none"> <li>• Requirement gathering techniques: User stories, interviews, surveys.</li> <li>• Creating a Work Breakdown Structure (WBS) and task prioritization.</li> <li>• Task estimation and dependency mapping.</li> </ul>	
(Text 2,Chap 2 & 3)	

<b>Unit – III</b>	<b>Contact Hours = 3 Hours</b>
<b>Agile Project Management - Sprint Planning and Execution:</b>	
<ul style="list-style-type: none"> <li>• Agile project management fundamentals: Sprint Planning, Daily Stand-ups, and Retrospectives.</li> <li>• Tracking project scope changes and managing scope creep.</li> </ul>	
(Text 3,Chap 1 & 2)	

<b>Unit – IV</b>	<b>Contact Hours = 3 Hours</b>
<b>Risk Management and Quality Assurance:</b>	
<ul style="list-style-type: none"> <li>• Identifying, analyzing, and mitigating project risks.</li> <li>• Basics of Quality Assurance (QA) in software projects: Quality metrics and testing frameworks.</li> </ul>	
(Text 1, Chap 12)	

<b>Unit – V</b>	<b>Contact Hours = 3 Hours</b>
<b>Project Closing and Presentation:</b> <ul style="list-style-type: none"> <li>Finalizing project deliverables and documentation.</li> <li>Conducting project retrospectives to capture lessons learned.</li> <li>Preparing a project closure report and final presentation.</li> </ul>	

#### List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	<ul style="list-style-type: none"> <li>Hands-on setup of a PM tool like JIRA.</li> <li>Drafting a Project Charter.</li> </ul>
2	2	<ul style="list-style-type: none"> <li>Documenting requirements as user stories.</li> <li>Building a WBS using Lucidchart or MS Project or Leantime or OpenProject and Creating a Gantt chart with task dependencies.</li> </ul>
3	2	<ul style="list-style-type: none"> <li>Conducting a mock sprint planning session and creating a sprint backlog, tracking sprint progress using burndown charts and JIRA.</li> <li>Simulating a daily stand-up meeting.</li> </ul>
4	2	<ul style="list-style-type: none"> <li>Conducting a risk assessment and creating a risk register.</li> <li>Setting/ Drafting up a quality management plan , QA checklist and mock tests for the sample project with key quality metrics.</li> </ul>
5	2	<ul style="list-style-type: none"> <li>Drafting a project closure report with outcomes, challenges, and resolutions.</li> <li>Presenting project achievements, challenges, and learning points, Peer review and feedback to reinforce learning.</li> </ul>

#### Books

Books	
	<b>Text Books:</b>
1.	Harold Kerzner , :Project Management: A Systems Approach to Planning, Scheduling, and Controlling", John Wiley & Sons, 2017 onwards.
2.	Mike Cohn, "Agile Estimating and Planning", Prentice Hall Professional Technical Reference, 2010 onwards.
3.	Ken Schwaber, "Agile Project Management with Scrum", Microsoft, 2009 onwards.
4.	"The Standard for Project Management and A Guide to the Project Management Body of Knowledge", Project Management Body of Knowledge (PMBOK guide), Project Management Institute, 2021.
	<b>Reference Books:</b>
1.	Joseph Phillips, "PMP Project Management Professional All-in-One Exam Guide", McGraw Hill, 2021 onwards.
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="https://onlinecourses.nptel.ac.in/noc24_mg116/preview">https://onlinecourses.nptel.ac.in/noc24_mg116/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc24_mg01/preview">https://onlinecourses.nptel.ac.in/noc24_mg01/preview</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs ( if present)		

Course Outcome (COs)					
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create					
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)
1.	Understand and demonstrate the basic terms and concepts of software project management.		Un	1, 2	1, 3
2.	Apply and Develop the AGILE-SCRUM software development and software project management		Ap	1, 2	1, 3
3.	Analyze the requirements for a real world problem or a specification and develop a course project as the solution.		An	1, 2, 3	1, 2, 3

#### Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests / Two Phase	Course project (CP)/ Case study etc	Total Marks
Marks	15+15 = 30	20 marks (with report& presentation)	50
-Minimum score to be eligible for SEE: 25 OUT OF 50			

#### Scheme of Semester End Examination (SEE):

1.	It will be conducted for 50 marks of 2 hours' duration.
2.	<b>Split-up of marks</b> Write-up - 10M PPT - 15M Demonstration - 25M
2.	<b>Minimum marks required in SEE to pass: 25 out of 50</b>

Rubrics: Levels	Target
1 (Low)	60% of the students score Less than 50 % of the total marks.
2 (Medium)	60% of the students score 50 – 70 % of the total marks.
3 (High)	60% of the students score More than 70 % of the total marks.

CO-PO Mapping (planned)				CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PSO 1	PSO 2	PSO 3
1	M	L		L		L
2	H		M	M		L
3	H	H	M	H	M	M
Tick mark the CO, PO and PSO mapping						

**Ability Enhancement Course (AEC)**  
**Prompt Engineering**

<b>Course Code</b>	<b>MSCS252B</b>	<b>Course type</b>	<b>AEC</b>	<b>Credits L-T-P</b>	1 - 0 - 0
<b>Hours/week: L - T - P</b>	1 - 0 - 0			<b>Total credits</b>	1
<b>Total Contact Hours</b>	15			<b>CIE Marks</b>	50
				<b>SEE Marks</b>	50

<b>Course learning objectives</b>	
1.	Understand the principles and techniques of prompt engineering, including the designs of effective prompts
2.	Explore the capabilities of large language models for text generations and to leverage the creation of engaging content
3.	Gain practical experience in crafting prompts and generating text using AI tools and platforms
4.	<b>Develop critical thinking and evaluation skills</b> to assess prompt effectiveness and refine prompts based on model responses, improving output quality through iterative experimentation.

**Required Knowledge of : Basic Programming Skills**

<b>Unit – I</b>	<b>Contact Hours = 3 Hours</b>
Introduction to LLM and Prompting Introduction to Large Language Models What are Text Generation Models and Large Language Models A Brief History of Language Models, LLMs in the Market	

<b>Unit – II</b>	<b>Contact Hours = 3 Hours</b>
Getting to know GPT-based AI tools Prompt Engineering Basics English as a new programming language	

<b>Unit – III</b>	<b>Contact Hours = 3 Hours</b>
The Naive Prompting Approach and the Persona Pattern The Interview Pattern The Chain-of-Thought Approach in Prompt Engineering	

<b>Unit – IV</b>	<b>Contact Hours = 3 Hours</b>
The Tree-of-Thought Approach in Prompt Engineering Controlling Verbosity and the Nova System Getting to Know “ IBM Watsonx “ Prompt	

<b>Unit – V</b>	<b>Contact Hours = 3 Hours</b>
Building AI Powered Applications AI Blog Writing, Topic Research, Expert Interview, Generate Outline, Text Generation, Writing Style, Title Optimization, AI Blog Images, User Interface, Ethical Considerations of Using AI for Text Generation Final Project	

### List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
	<b>1</b>	Basic experiments with prompts
	<b>2</b>	Getting to know GPT-based AI tool The Naive Prompting Approach and the Persona Pattern The Interview Pattern The Chain-of-Thought Approach in Prompt Engineering
	<b>2</b>	The Tree-of-Thought Approach in Prompt Engineering Controlling Verbosity and the Nova System Getting to Know <b>IBM watsonx Prompt Lab</b>
	<b>2</b>	AI Blog Writing, Topic Research, Expert Interview, Generate Outline, Text Generation, Writing Style, Title Optimization, AI Blog Images, User Interface, Ethical Considerations of Using AI for Text Generation

Unit No.	Self-Study Topics
1	<b>Listing and study Prompt tools available</b>
2	<b>Study of ChatGPT Tool</b>
3	<b>Study of Image Generation Tools</b>

<b>Books</b>	
<b>Text Books:</b>	
1.	James Phoenix, Mike Taylor, "Prompt Engineering for Generative AI", O'Reilly, May 2024. <a href="https://www.oreilly.com/library/view/prompt-engineering-for/9781098153427/">https://www.oreilly.com/library/view/prompt-engineering-for/9781098153427/</a>
2.	Gilbert Mizrahi, "Unlocking the Secrets of Prompt Engineering: Master the Art of Creative Language Generation to Accelerate Your Journey from Novice to Pro", January 2024 <a href="https://www.packtpub.com/en-in/product/unlocking-the-secrets-of-prompt-engineering-9781835083833">https://www.packtpub.com/en-in/product/unlocking-the-secrets-of-prompt-engineering-9781835083833</a>
3.	IBM Skills Network : Prompt Engineering for Everyone <a href="https://cognitiveclass.ai/courses/prompt-engineering-for-everyone">https://cognitiveclass.ai/courses/prompt-engineering-for-everyone</a>
<b>Reference Books:</b>	
1.	Michael Ferguson, "Prompt Engineering: The Future of Language Generation", January 2023 <a href="https://books.apple.com/us/book/prompt-engineering-the-future-of-language-generation/id6445529200">https://books.apple.com/us/book/prompt-engineering-the-future-of-language-generation/id6445529200</a>
<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>	
1.	IBM Skills Network : Prompt Engineering for Everyone <a href="https://cognitiveclass.ai/courses/prompt-engineering-for-everyone">https://cognitiveclass.ai/courses/prompt-engineering-for-everyone</a>

<b>Course delivery methods</b>		<b>Assessment methods</b>	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs ( if present)		

<b>Course Outcome (COs)</b>					
<b>Learning Levels:</b>					
<b>Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create</b>					
At the end of the course, the student will be able to			<b>Learning Level</b>	<b>PO(s)</b>	<b>PSO(s)</b>
1.	Design clear, concise, and relevant prompts following the standard principles of prompt engineering		L2	1	1
2.	Utilize LLMs to generate text for designing more effective content and design		L3	2	2
3.	Analyze existing prompts and make strategic combinations for enhanced prompts		L4	3	1

**Scheme of Continuous Internal Evaluation (CIE):**

Components	Addition of two IA tests /two Phase	Course project (CP)/ Case study etc	Total Marks
Marks	15+15 = 30	20 marks (with report & presentation)	50
-Minimum score to be eligible for SEE: 25 OUT OF 50			

**Scheme of Semester End Examination (SEE):**

1	It will be conducted for 50 marks of 2 hours' duration.
2	<b>Split-up of marks</b> Write-up - 10M PPT - 15M Demonstration - 25M
2	<b>Minimum marks required in SEE to pass: 25 out of 50</b>

Rubrics: Levels	Target
<b>1 (Low)</b>	<b>60% of the students score Less than 50 % of the total marks.</b>
<b>2 (Medium)</b>	<b>60% of the students score 50 – 70 % of the total marks.</b>
<b>3 (High)</b>	<b>60% of the students score More than 70 % of the total marks.</b>

CO-PO Mapping (Planned)				CO-PSO Mapping(Planned)		
CO	PO1	PO2	PO3	PSO1	PSO2	PSO3
1	M			M		
2		L	L			
3	M	L				L
4	M		L	M	L	

## Robotic Process Automation

<b>Course Code</b>	MSCS251A	<b>Course type</b>	MDC	<b>Credits L-P-T</b>	2 - 0 - 1
<b>Hours/week: L - T- P</b>	2- 2 - 0			<b>Total credits</b>	3
<b>Total Contact Hours</b>	L = 30 Hrs; T = 0 Hrs; P = 15 Hrs Total = 45 Hrs			<b>CIE Marks</b>	100
<b>Flipped Classes content</b>	10 Hours			<b>SEE Marks</b>	100

<b>Course learning objectives</b>	
1.	To Describe Robotic Process Automation (RPA) and its benefits
2.	To understand and use sequences / flowcharts to build automation
3.	To Explain and apply data manipulation
4.	To utilize the concept of selectors, descriptors to build UI automation
5.	To Describe version control system and orchestrator functionalities.

**Required Knowledge of : Basics of logical reasoning and programming**

<b>Unit – I : Introduction to Robotic Process Automation (RPA)</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Robotic Process Automation (RPA) concepts, tools and fundamentals of implementation: Robotic Process Automation (RPA) and its benefits, UiPath Business Automation Platform, the UiPath core RPA components (Studio, Orchestrator and Robot with Assistant), two types of UiPath robots—attended and unattended, the key components of the UiPath Studio user interface, modern vs classic design, variables in an automation project , common data types used in UiPath Studio and conversion methods, arguments in an automation project, Invoke Workflow File Activity to chain workflow execution and pass data through arguments, Automation best practices, global constants and global variables in your automation projects</b></p>	

<b>Unit – II : Control flow, common RPA implementations, Exception handling and Debugging</b>	<b>Contact Hours = 8 Hours</b>
<p><b>Sequences and Flowcharts, control flow statements for decisions and iterations, Excel and Workbook activities, different types of exceptions, best practices for error and exception handling , file and folder activities - selecting, creating, deleting, moving and renaming files and folders, UiPath Studio integration capabilities - Gmail account, retrieve, work with emails, Microsoft Office 365 activities, working with PDF files, debugging actions</b></p>	

<b>Unit – III: Data Manipulation: Explain and apply data manipulation:</b>	<b>Contact Hours = 8 Hours</b>
<p><b>VB.NET methods to manipulate string variables, RegEx builder in UiPath Studio, string activities in Studio, Lists and data manipulation on Lists, Invoke and String Conversion methods, Arrays and Lists, dictionary variables and data manipulation, Working with Datatable variable in Studio, comparison of worksheet and a data table</b></p>	

<b>Unit – IV: UI Automation, Descriptors and Selectors</b>	<b>Contact Hours = 8 Hours</b>
Synchronizing activities in automation workflows, Check App State activity and Verify Execution feature, Pick Branch activity, Targeting methods used in UI automation and characteristics ,Validate target elements, Fine-tune descriptors using the 'Dynamic Text Target' option, wildcards, variables, and making adjustments to enhance image accuracy, the structure and type of selectors in the context of web development, the functionality and purpose of the Property Explorer tool during editing selectors	

<b>Unit – V: Version Control System, Orchestrator resources and Project organization:</b>	<b>Contact Hours = 8 Hours</b>
Orchestrator capabilities and entities, tenant context and the folder context, Orchestrators resources, Benefits and challenges of using version control systems, basic GIT features for version control, project layout for an automation process, split complex automation project into functional workflows that can be developed separately, benefits of utilizing best practices for project organization	

#### Flipped Classroom Details

Unit No.	I	II	III	IV	V
<b>No. for Flipped Classroom Sessions</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

#### List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	4	Basic automation Example
2	2	Control Flow, Excel/Workbook, Email Automation
3	2	Data manipulation, Data tables
4	2	UI Automation, Selectors
5	2	Version control, Orchestrator

Unit No.	Self-Study Topics
1	Programming fundamentals
3	Practical exercises on conditional statements and loops
5	Exercises on exception handling

Books	
	<b>Text Books:</b>
1.	Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940
	<b>Reference Books:</b>
1.	Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston

	(Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2.	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3.	Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
	<b>E-resources (NPTEL/SWAYAM.. Any Other)- mention links</b>
1.	<a href="https://www.uipath.com/rpa/robotic-process-automation">https://www.uipath.com/rpa/robotic-process-automation</a>

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs ( if present)		

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	<b>Explain and utilize the fundamentals of Robotic Process Automation</b>	Un	1,3	1
2.	<b>Develop familiarity and deep understanding of UiPath tools</b>	Ap	1	1
3.	<b>Develop the ability to independently design and create robots for business processes</b>	Ap	1	1,2
4.	<b>Prepare for UiPath Certified Professional Automation Developer Associate exam by further learning</b>	Ap	1,2,3,	1,2,3

#### Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE.

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
-Theory IA test should be of one-hour duration. -Lab IA test should be of two/three-hour duration. -Project batch will ideally consist of 2 students (maximum of 3). -Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will					

<p>be conducted after 13 weeks from the start of the semester.</p> <p>-Submission of Project report is compulsory.</p> <p>-Minimum score to be eligible for SEE: 50 OUT OF 100</p>
<p>Eligibility for SEE:</p> <ol style="list-style-type: none"> <li>50% and above (20 marks and above) in theory component</li> <li>50% and above (30 marks and above) in project component</li> <li>Not eligible in any one of the two components will make the student <b>Not Eligible</b> for SEE</li> </ol>

**Semester End Examination (SEE):**

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation	10 marks	
	<ol style="list-style-type: none"> <li>Initial write up stating the objectives, methodology and the outcome</li> <li>Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.</li> </ol>	30 marks	
	c. Viva-voce	10 marks	
3.	<b>Minimum marks required in SEE to pass:</b> Score should be $\geq 40\%$ , however overall score of CIE + SEE should be $\geq 50\%$ .		
4.	SEE will be conducted in project batches by <b>Internal &amp; External examiners</b> together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	✓		✓										✓		
2	✓												✓		
3	✓												✓	✓	
4	✓	✓	✓										✓	✓	✓
<b>Tick mark the CO, PO and PSO mapping</b>															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Robotic Process Automation with UiPath	HealthCare, Finance, Banking, Education etc	RPA solution architect, RPA developer, RPA Evangelist, RPA Subject Matter Expert etc

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

For the students who are willing to take up a two-semester duration Industry/Research Internship Leading to Project work /start-up

M.Tech in Computer Science and Engineering (CSE)  
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)  
(Effective from the academic year 2024 - 25)

SEMESTER – III (A)

PROFESSIONAL ELECTIVE V & VI

<b>Course Code</b>	<b>MSCS311, MSCS312 &amp; MSCS313</b>	<b>Course type</b>	<b>Online PE</b>	<b>Total credits</b>	<b>3</b>
<b>Credits L-T-P</b>	<b>3 – 0 – 0</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>12 weeks</b>			<b>SEE Marks</b>	<b>---</b>

**Course learning objectives**

This course will enable students to:

- Develop a foundational understanding of key concepts, theories, and principles relevant to the course subject.
- Enhance analytical skills by evaluating information, identifying biases, and making informed decisions based on evidence.
- Apply learned theories and concepts to real-world scenarios through projects, case studies, or simulations.
- Cultivate the ability to locate, evaluate, and utilize credible sources for academic writing and projects.
- Improve written and verbal communication skills through discussions, presentations, and collaborative projects.
- Gain proficiency in utilizing various digital tools and platforms relevant to the course content.
- Foster the ability to work effectively in virtual teams, respecting diverse perspectives and contributions.
- Encourage independent study habits and self-motivation to pursue additional resources beyond the course material.
- Understand and apply ethical principles related to the field of study, including issues of integrity and responsibility.
- Develop skills in giving and receiving constructive feedback, and engage in self-reflection to enhance personal and academic growth.

NPTEL/SWAYAM/Industry offered courses of 12 weeks duration are the courses suggested by the Board of Studies of the College and will be displayed on the Department website. The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree even if they unintentionally select online courses that match previously finished courses.

**Course Outcomes (COs)**

CO1: Apply advanced concepts and techniques from the course to analyze and solve complex engineering or

research problems.

CO2: Develop and demonstrate the ability to analyze, implement, and evaluate computer science concepts and solutions.

CO3: Exhibit mastery over course topics through independent learning and performance in assignments and exams.

### Professional Elective

SI No	Course Name	Platform	Duration	Course Details
1	Generative AI for Everyday Life	NPTEL	12 weeks	<a href="https://onlinecourses.swayam2.ac.in/nou25_ma05/preview">https://onlinecourses.swayam2.ac.in/nou25_ma05/preview</a>
2	Advanced R Programming for Data Analytics in Business	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_mg154/preview">https://onlinecourses.nptel.ac.in/noc25_mg154/preview</a>
3	Advanced Distributed Systems	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs84/preview">https://onlinecourses.nptel.ac.in/noc25_cs84/preview</a>
4	Real-Time Systems	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs156/preview">https://onlinecourses.nptel.ac.in/noc25_cs156/preview</a>
5	Software Project Management	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs109/preview">https://onlinecourses.nptel.ac.in/noc25_cs109/preview</a>
6	Social Network Analysis	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs100/preview">https://onlinecourses.nptel.ac.in/noc25_cs100/preview</a>
7	Social Networks	VTU-MOOC	12 weeks	<a href="https://online.vtu.ac.in/course-details/Social-Networks">https://online.vtu.ac.in/course-details/Social-Networks</a>
8	Object Oriented System Development Using UML, Java And Patterns	VTU-MOOC	12 weeks	<a href="https://online.vtu.ac.in/course-details/Object-Oriented-System-Development-Using-UML-Java-And-Patterns">https://online.vtu.ac.in/course-details/Object-Oriented-System-Development-Using-UML-Java-And-Patterns</a>

### MDC

SI No	Course Name	Platform	Duration	Course Details
1	The Joy of Computing using Python	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs103/preview">https://onlinecourses.nptel.ac.in/noc25_cs103/preview</a>
2	Introduction to Machine Learning	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs91/preview">https://onlinecourses.nptel.ac.in/noc25_cs91/preview</a>

**Scheme of Continuous Internal Evaluation (CIE)****Minimum score in CIE to pass the course: 50 OUT OF 100.**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	2	3									3	3	2
2	2	3	2									2	3	2
3	3	2	3									3	2	3
Tick mark the CO, PO and PSO mapping														

Name & Signature of Faculty members  
involved in designing the syllabus

Name & Signature of Faculty members  
verifying/approving the syllabus

**Research Internship /Industry-Internship leading to project work/ Startup**

<b>Course Code</b>	<b>MINT384</b>	<b>Course type</b>	<b>INT</b>	<b>Total credits</b>	<b>3</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 3</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>Two-semester duration, SEE in the IV semester which leads to project work/start-up. Contact hours/week: 0-0-6</b>			<b>SEE Marks</b>	<b>---</b>

**Course learning objectives**

This course will enable students to gain hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objectives are:

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

**Industry Internship:** The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

**Research Internship:** A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies.

**Research /Industry Internship:** In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3<sup>rd</sup> semester. At the beginning of the 4<sup>th</sup> semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

Internship Leading to Start-up: An internship that leads to a startup is an exciting pathway, blending real-world experience with entrepreneurial ambition. Here's a comprehensive guide to transitioning an internship experience into launching a startup:

1) Maximize the internship experience, 2) Identifying Viable Business Ideas, 3) Research and Validation 4) Building a Business Plan 5) Networking and Mentor-ship 6) Securing Funding 7) Establishing Startup 8) Launching and Marketing. By following these steps, one can effectively transition from an internship to launching a successful startup. This journey requires dedication, resilience, and a willingness to learn and adapt.

**Continuous Internal Evaluation (100 Marks):**

CIE marks for the project report (60 marks), seminar (20 marks) and question & answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

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

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics

**Scheme of Continuous Internal Evaluation (CIE)**

Minimum score in CIE to pass the course: 50 OUT OF 100.

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	1	2									2	3	3
2	3	2	3									3	2	2
3	1	3	2									1	1	3
Tick mark the CO, PO and PSO mapping														

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

# For the students who are willing to take up a two-semester duration Industry/Research Internship Leading to Project work /start-up

**M.Tech in Computer Science and Engineering (CSE)**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**(Effective from the academic year 2024 - 25)**

## SEMESTER – IV (A)

### Research Internship /Industry-Internship leading to project work/ Startup

<b>Course Code</b>	<b>MINT481</b>	<b>Course type</b>	<b>INT</b>	<b>Total credits</b>	<b>12</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 12</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>Two-semester duration Contact hours/week: 0-0-24</b>			<b>SEE Marks</b>	<b>100</b>

#### **Course learning objectives**

This course will enable students to: gain hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objectives are:

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently

Taking up a two-semester Industry/Research Internship that leads to project work or a start-up can be a highly rewarding experience for students. It allows them to apply theoretical knowledge in practical settings, gain valuable industry or research experience, and potentially develop innovative solutions or business ideas. Here are some key steps and considerations for students pursuing such an internship:

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**Research /Industry Internship:** In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks at the end of the 3<sup>rd</sup> semester. At the beginning of the 4<sup>th</sup> semester, students have to define the project topic out of the learning due to the Internship, upon completion of the project work he/she has to attend the SEE at the parent Institute.

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#### Continuous Internal Evaluation (100 Marks):

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer (20marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

#### Semester End Examination (100 Marks):

SEE marks for the project report (60 marks), seminar (20 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the College.

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

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics

#### **Scheme of Continuous Internal Evaluation (CIE) & Semester End Examination (SEE)**

**Minimum score in CIE to pass the course: 50 OUT OF 100.**

**Minimum score in SEE to pass the course: 50 OUT OF 100.**

**However overall score of CIE+SEE should be  $\geq$  50%.**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	1	2									2	3	3
2	3	2	3									3	2	2
3	1	3	2									1	1	3
Tick mark the CO, PO and PSO mapping														

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

## PROJECT

<b>Course Code</b>	<b>MPROJ482</b>	<b>Course type</b>	<b>PRJ</b>	<b>Total credits</b>	<b>16</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 16</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>Two-semester duration</b> <b>Contact hours/week: 0-0-32</b>			<b>SEE Marks</b>	<b>100</b>

### Course learning objectives

This course will enable students:

- To encourage independent learning and the innovative attitude of the students.
- To develop an interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team work.
- To expand intellectual capacity, credibility, judgment, and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involved in group discussions to present and exchange ideas.

Project Work: Students in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through Power Point slides.
- Answer the queries and be involved in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussions to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident

Continuous Internal Evaluation (100 Marks):

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

Semester End Examination (100 Marks):

SEE marks for the project report (60 marks), seminar (20 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the College.

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

- Present the project and be able to defend it.

- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

**Scheme of Continuous Internal Evaluation (CIE) & Semester End Examination (SEE)**

**Minimum score in CIE to pass the course: 50 OUT OF 100.**

**Minimum score in SEE to pass the course: 50 OUT OF 100.**

**However overall score of CIE+SEE should be  $\geq 50\%$ .**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	2	3	2									1	2	3
2	3	2	3									3	3	2
3	2	2	1									2	1	3
Tick mark the CO, PO and PSO mapping														

**Name & Signature of Faculty members involved in designing the syllabus**

**Name & Signature of Faculty members verifying/approving the syllabus**

For the students who are willing to take an Industry  
Internship for one-semester duration and independent  
project work next semester

**M.Tech in Computer Science and Engineering (CSE)**

**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

**(Effective from the academic year 2024 - 25)**

**SEMESTER – III (B)**

**PROFESSIONAL ELECTIVE V & VI**

<b>Course Code</b>	<b>MSCS311, MSCS312 &amp; MSCS313</b>	<b>Course type</b>	<b>Online PE</b>	<b>Total credits</b>	<b>3</b>
<b>Credits L-T-P</b>	<b>3 – 0 – 0</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>12 weeks</b>			<b>SEE Marks</b>	<b>---</b>

**Course learning objectives**

This course will enable students to:

- Develop a foundational understanding of key concepts, theories, and principles relevant to the course subject.
- Enhance analytical skills by evaluating information, identifying biases, and making informed decisions based on evidence.
- Apply learned theories and concepts to real-world scenarios through projects, case studies, or simulations.
- Cultivate the ability to locate, evaluate, and utilize credible sources for academic writing and projects.
- Improve written and verbal communication skills through discussions, presentations, and collaborative projects.
- Gain proficiency in utilizing various digital tools and platforms relevant to the course content.
- Foster the ability to work effectively in virtual teams, respecting diverse perspectives and contributions.
- Encourage independent study habits and self-motivation to pursue additional resources beyond the course material.
- Understand and apply ethical principles related to the field of study, including issues of integrity and responsibility.
- Develop skills in giving and receiving constructive feedback, and engage in self-reflection to enhance personal and academic growth.

NPTEL/SWAYAM/Industry offered courses of 12 weeks duration are the courses suggested by the Board of Studies of the College and will be displayed on the Department website. The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree even if they unintentionally select online courses that match previously finished courses.

Course Outcomes (COs)

CO1: Apply advanced concepts and techniques from the course to analyze and solve complex engineering or research problems.

CO2: Develop and demonstrate the ability to analyze, implement, and evaluate computer science concepts and solutions.

CO3: Exhibit mastery over course topics through independent learning and performance in assignments and exams.

### Professional Elective

Sl No	Course Name	Platform	Duration	Course Details
1	Generative AI for Everyday Life	NPTEL	12 weeks	<a href="https://onlinecourses.swayam2.ac.in/nou25_ma05/preview">https://onlinecourses.swayam2.ac.in/nou25_ma05/preview</a>
2	Advanced R Programming for Data Analytics in Business	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_mg154/preview">https://onlinecourses.nptel.ac.in/noc25_mg154/preview</a>
3	Advanced Distributed Systems	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs84/preview">https://onlinecourses.nptel.ac.in/noc25_cs84/preview</a>
4	Real-Time Systems	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs156/preview">https://onlinecourses.nptel.ac.in/noc25_cs156/preview</a>
5	Software Project Management	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs109/preview">https://onlinecourses.nptel.ac.in/noc25_cs109/preview</a>
6	Social Network Analysis	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs100/preview">https://onlinecourses.nptel.ac.in/noc25_cs100/preview</a>
7	Social Networks	VTU-MOOC	12 weeks	<a href="https://online.vtu.ac.in/course-details/Social-Networks">https://online.vtu.ac.in/course-details/Social-Networks</a>
8	Object Oriented System Development Using UML, Java And Patterns	VTU-MOOC	12 weeks	<a href="https://online.vtu.ac.in/course-details/Object-Oriented-System-Development-Using-UML-Java-And-Patterns">https://online.vtu.ac.in/course-details/Object-Oriented-System-Development-Using-UML-Java-And-Patterns</a>

### MDC

Sl No	Course Name	Platform	Duration	Course Details
1	The Joy of Computing using Python	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs103/preview">https://onlinecourses.nptel.ac.in/noc25_cs103/preview</a>
2	Introduction to Machine Learning	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs91/preview">https://onlinecourses.nptel.ac.in/noc25_cs91/preview</a>

**Scheme of Continuous Internal Evaluation (CIE)**

**Minimum score in CIE to pass the course: 50 OUT OF 100.**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	2	3									3	3	2
2	2	3	2									2	3	2
3	3	2	3									3	2	3
Tick mark the CO, PO and PSO mapping														

**Name & Signature of Faculty members  
involved in designing the syllabus**

**Name & Signature of Faculty members  
verifying/approving the syllabus**

### Industry-Internship

<b>Course Code</b>	<b>MINT384</b>	<b>Course type</b>	<b>INT</b>	<b>Total credits</b>	<b>11</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 11</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>One-semester duration Contact hours/week: 0-0-22</b>			<b>SEE Marks</b>	<b>100</b>

#### **Course learning objectives**

This course will enable students to: gain hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objectives are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently

**Industry Internship:** The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gains practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned. The students who take up a one-semester Internship in the Industry have to appear SEE at the institute at the end of the semester as per the examination calendar.

#### **Continuous Internal Evaluation (100 Marks):**

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

#### **Semester End Examination (100 Marks):**

SEE marks for the project report (60 marks), seminar (20 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the College.

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

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal

career goals.

- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics

**Scheme of Continuous Internal Evaluation (CIE) & Semester End Examination (SEE)**

**Minimum score in CIE to pass the course: 50 OUT OF 100.**

**Minimum score in SEE to pass the course: 50 OUT OF 100.**

**However overall score of CIE+SEE should be  $\geq 50\%$ .**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	1	2									2	3	3
2	3	2	3									3	2	2
3	1	3	2									1	1	3
Tick mark the CO, PO and PSO mapping														

**Name & Signature of Faculty members  
involved in designing the syllabus**

**Name & Signature of Faculty members  
verifying/approving the syllabus**

For the students who are willing to take an Industry Internship  
for one-semester duration and independent project work next  
semester

**M.Tech in Computer Science and Engineering (CSE)**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**(Effective from the academic year 2024 - 25)**  
**SEMESTER – IV (B)**

**PROJECT**

<b>Course Code</b>	<b>MPROJ481</b>	<b>Course type</b>	<b>PRJ</b>	<b>Total credits</b>	<b>20</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 20</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>One semester duration</b> <b>Contact hours/week: 0-0-40</b>			<b>SEE Marks</b>	<b>100</b>

**Course learning objectives**

This course will enable students:

- To encourage independent learning and the innovative attitude of the students.
- To develop an interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team work.
- To expand intellectual capacity, credibility, judgment, and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involved in group discussions to present and exchange ideas.

Project Work: Students in consultation with the guide shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through Power Point slides.
- Answer the queries and be involved in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussions to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident

Continuous Internal Evaluation (100 Marks):

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

Semester End Examination (100 Marks):

SEE marks for the project report (60 marks), seminar (20 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the College.

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

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

### Scheme of Continuous Internal Evaluation (CIE) & Semester End Examination (SEE)

Minimum score in CIE to pass the course: 50 OUT OF 100.

Minimum score in SEE to pass the course: 50 OUT OF 100.

However overall score of CIE+SEE should be  $\geq 50\%$ .

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	2	3	2									1	2	3
2	3	2	3									3	3	2
3	2	2	1									2	1	3
Tick mark the CO, PO and PSO mapping														

Name & Signature of Faculty members  
involved in designing the syllabus

Name & Signature of Faculty members  
verifying/approving the syllabus

For the students who are willing to take a research-leading  
paper publication in Q1/Q2/Q3 Journals and to a PhD  
Registration

**M.Tech in Computer Science and Engineering (CSE)**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**(Effective from the academic year 2024 - 25)**

**SEMESTER – III (C)**  
**PROFESSIONAL ELECTIVE V & VI**

<b>Course Code</b>	<b>MSCS311, MSCS312 MSCS313 &amp; MSCS314</b>	<b>Course type</b>	<b>Online PE</b>	<b>Total credits</b>	<b>3</b>
<b>Credits L-T-P</b>	<b>3 – 0 – 0</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>12 weeks</b>			<b>SEE Marks</b>	<b>---</b>

**Course learning objectives**

This course will enable students to:

- Develop a foundational understanding of key concepts, theories, and principles relevant to the course subject.
- Enhance analytical skills by evaluating information, identifying biases, and making informed decisions based on evidence.
- Apply learned theories and concepts to real-world scenarios through projects, case studies, or simulations.
- Cultivate the ability to locate, evaluate, and utilize credible sources for academic writing and projects.
- Improve written and verbal communication skills through discussions, presentations, and collaborative projects.
- Gain proficiency in utilizing various digital tools and platforms relevant to the course content.
- Foster the ability to work effectively in virtual teams, respecting diverse perspectives and contributions.
- Encourage independent study habits and self-motivation to pursue additional resources beyond the course material.
- Understand and apply ethical principles related to the field of study, including issues of integrity and responsibility.
- Develop skills in giving and receiving constructive feedback, and engage in self-reflection to enhance personal and academic growth.

NPTEL/SWAYAM/Industry offered courses of 12 weeks duration are the courses suggested by the Board of Studies of the College and will be displayed on the Department website. The online courses selected should not be the same as those studied in the first and second semesters of the program. The student will not be eligible to get their degree even if they unintentionally select online courses that match previously finished courses.

Course Outcomes (COs)

CO1: Apply advanced concepts and techniques from the course to analyze and solve complex engineering or research problems.

CO2: Develop and demonstrate the ability to analyze, implement, and evaluate computer science concepts and solutions.

CO3: Exhibit mastery over course topics through independent learning and performance in assignments and exams.

### Professional Elective

Sl No	Course Name	Platform	Duration	Course Details
1	Generative AI for Everyday Life	NPTEL	12 weeks	<a href="https://onlinecourses.swayam2.ac.in/nou25_ma05/preview">https://onlinecourses.swayam2.ac.in/nou25_ma05/preview</a>
2	Advanced R Programming for Data Analytics in Business	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_mg154/preview">https://onlinecourses.nptel.ac.in/noc25_mg154/preview</a>
3	Advanced Distributed Systems	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs84/preview">https://onlinecourses.nptel.ac.in/noc25_cs84/preview</a>
4	Real-Time Systems	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs156/preview">https://onlinecourses.nptel.ac.in/noc25_cs156/preview</a>
5	Software Project Management	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs109/preview">https://onlinecourses.nptel.ac.in/noc25_cs109/preview</a>
6	Social Network Analysis	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs100/preview">https://onlinecourses.nptel.ac.in/noc25_cs100/preview</a>
7	Social Networks	VTU-MOOC	12 weeks	<a href="https://online.vtu.ac.in/course-details/Social-Networks">https://online.vtu.ac.in/course-details/Social-Networks</a>
8	Object Oriented System Development Using UML, Java And Patterns	VTU-MOOC	12 weeks	<a href="https://online.vtu.ac.in/course-details/Object-Oriented-System-Development-Using-UML-Java-And-Patterns">https://online.vtu.ac.in/course-details/Object-Oriented-System-Development-Using-UML-Java-And-Patterns</a>

### MDC

Sl No	Course Name	Platform	Duration	Course Details
1	The Joy of Computing using Python	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs103/preview">https://onlinecourses.nptel.ac.in/noc25_cs103/preview</a>
2	Introduction to Machine Learning	NPTEL	12 weeks	<a href="https://onlinecourses.nptel.ac.in/noc25_cs91/preview">https://onlinecourses.nptel.ac.in/noc25_cs91/preview</a>

**Scheme of Continuous Internal Evaluation (CIE)****Minimum score in CIE to pass the course: 50 OUT OF 100.**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	3	2	3									3	3	2
2	2	3	2									2	3	2
3	3	2	3									3	2	3
Tick mark the CO, PO and PSO mapping														

**Name & Signature of Faculty members  
involved in designing the syllabus****Name & Signature of Faculty members  
verifying/approving the syllabus**

**PROJECT PHASE -I**

<b>Course Code</b>	<b>MPROJ385</b>	<b>Course type</b>	<b>PRJ</b>	<b>Total credits</b>	<b>6</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 6</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>One semester duration Contact hours/week: 0-0-12</b>			<b>SEE Marks</b>	<b>---</b>

**Course learning objectives**

This course will enable students:

- To encourage independent learning and the innovative attitude of the students.
- To develop an interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team work.
- To expand intellectual capacity, credibility, judgment, and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involved in group discussions to present and exchange ideas.

The research section of the College has to announce the number of seats for M.Tech. Students who are seeking Ph.D (research study) admission through a project leading to the publication of the paper in Q1/Q2/Q3 journals. Only full-time research work will be permitted in the approved research centers of the affiliated colleges of the university (guidelines need to be set up). Based on seat availability, the students are permitted to register for project work leading to the publication of papers in Q1/Q2/Q3 journals and admission to research (Ph.D) in their 3rd semester of the M.Tech program.

Project Phase-1 Project Phase-I, typically the initial phase in any project, is crucial as it lays the foundation for the entire project. This phase involves defining the project's scope, objectives, and initial planning. Here's a structured approach to effectively carry out Project Phase-I:

- Project Charter: Outlines the project's purpose, objectives, and stakeholders.
- Scope Statement: Defines the project boundaries and deliverables.
- Requirements Document: Captures all project requirements.
- Project Plan: Details the approach, timeline, and resource allocation.
- Risk Management Plan: Identifies and plans for potential risks.
- Feasibility Study Report: Assesses technical, economic, and operational feasibility.

Students in consultation with the guide shall carry out literature survey/visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare a synopsis, and narrate the methodology to carry out the project work. Each student, under the guidance of a faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and be involved in debate/discussion.
- Submit two copies of the typed report with a list of references.
- The participants shall take part in discussions to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Continuous Internal Evaluation (100 Marks).

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

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

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

**Scheme of Continuous Internal Evaluation (CIE)**

**Minimum score in CIE to pass the course: 50 OUT OF 100.**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	2	3	2									1	2	3
2	3	2	3									3	3	2
3	2	2	1									2	1	3
Tick mark the CO, PO and PSO mapping														

**Name & Signature of Faculty members involved in designing the syllabus**

**Name & Signature of Faculty members verifying/approving the syllabus**

# For the students who are willing to take a research-leading paper publication in Q1/Q2/Q3 Journals and to a PhD Registration

**M.Tech in Computer Science and Engineering (CSE)  
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)  
(Effective from the academic year 2024 - 25)**

**SEMESTER – IV (C)**

**PROJECT PHASE -II**

<b>Course Code</b>	<b>MPROJ481</b>	<b>Course type</b>	<b>PRJ</b>	<b>Total credits</b>	<b>22</b>
<b>Credits L-T-P</b>	<b>0 – 0 – 22</b>			<b>CIE Marks</b>	<b>100</b>
<b>Total Contact Hours</b>	<b>One semester duration Contact hours/week: 0-0-44</b>			<b>SEE Marks</b>	<b>100</b>

## **Course learning objectives**

Course Learning objectives: This course will enable students:

- To encourage independent learning and the innovative attitude of the students.
- To develop an interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team work.
- To expand intellectual capacity, credibility, judgment, and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involved in group discussions to present and exchange ideas.

**Project Work Phase-II:** Each student shall be involved in carrying out the project work jointly in constant consultation with internal guide and external guide and prepare the project report as per the norms of the College to avoid plagiarism. Phase II of a project typically involves the detailed execution of the planned activities, continuous monitoring and control of the project's progress, and making necessary adjustments to ensure the project stays on track. Keep detailed records of all project activities, decisions, and changes. Ensure all project documentation is organized and accessible. Conduct a final project review to evaluate overall performance, achievements, and lessons learned. Document best practices and areas for improvement for future projects.

**Paper Publication Process:** Publishing a research paper based on your project in a Q1/Q2/Q3 journal involves several key steps, from writing the manuscript to navigating the peer review process. Here's a comprehensive guide:

**Writing the Manuscript:** Choose a clear and concise title that accurately reflects the content. Write an abstract summarizing the research question, methods, results, and conclusions.

**Literature Review:** Review relevant existing research to establish the foundation of your study. Identify gaps that your research aims to fill.

**Methodology:** Describe the research design, methods, and procedures in detail. Include

information on data collection, analysis, and any tools or software used.

Results: Present the findings of your research clearly and logically. Use tables, figures, and charts to illustrate key results.

Discussion: Interpret the results and explain their implications. Compare your findings with existing research and discuss any discrepancies or new insights.

Conclusion: Summarize the main findings and their significance. Suggest potential future research directions.

References: Cite all sources used in your research following the journal's citation style.

Journal Selection: Choose a journal that aligns with the scope and focus of your research. Consider the journal's impact factor (Q1, Q2, Q3) and audience.

Review Journal Guidelines: Carefully read the journal's submission guidelines and ensure your manuscript adheres to them.

Prepare Your Manuscript: Format your manuscript according to the journal's guidelines. Include all required sections and supplementary materials.

Cover Letter: Write a cover letter to the journal editor highlighting the significance of your research and why it fits the journal.

Submit the Manuscript: Use the journal's online submission system to submit your manuscript.

Ensure all required information and documents are included.

### Continuous Internal Evaluation (100 Marks):

CIE marks for the project report (60 marks), seminar (20 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the HOD. The committee shall consist of an internal guide and a faculty from the department with the senior most acting as the Chairperson.

### Semester End Examination (100 Marks):

SEE marks for the project report (60 marks), seminar (20 marks) and question and answer session (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the College.

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

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

### **Scheme of Continuous Internal Evaluation (CIE) & Semester End Examination (SEE)**

**Minimum score in CIE to pass the course: 50 OUT OF 100.**

**Minimum score in SEE to pass the course: 50 OUT OF 100.**

**However overall score of CIE+SEE should be  $\geq 50\%$ .**

CO-PO Mapping (Planned)												CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
1	2	3	2									1	2	3
2	3	2	3									3	3	2
3	2	2	1									2	1	3
Tick mark the CO, PO and PSO mapping														

Name & Signature of Faculty members  
involved in designing the syllabus

Name & Signature of Faculty members  
verifying/approving the syllabus