



**Dr. G. Y. Pathrikar College of
Computer Science and Information Technology
Chhatrapati Sambhajinagar**

**B.Sc. (Hons. /Hons. with Research) Computer Science
First, Second, Third & Fourth Year (Syllabus)
With Effect from: ACADEMIC YEAR: 2023-24**

MGM University

Vision

To create a dynamic centre of excellence where acquisition, dissemination, creation and application of knowledge in interdisciplinary scenario, character building and community involvement would contribute towards creating a better world.

Mission

- Establish a centre of excellence for modern education, research, innovation and all-round development of students.
- Inculcate scientific temperament, enquiring abilities and inquisitive attitude.
- Emphasize interdisciplinary education and programmes.
- Create unwavering sensitivity to ethics, morality and healthy practices in professional and personal life.
- Provide education in disciplines related to rich Indian art and heritage and thereby preserve our ancient knowledge and wisdom.
- Infuse a culture of interdisciplinary education for broader understanding and enrichment of life.
- Create an environment where empathy, service to society and societal concern become a second nature.
- Empower students to fit into the world of 'new economic order' and help India attain 'Pride of Place' at the global level.

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब दवज्ञान सब्ब भव, सब्ब

दिप भव हो

अत्तादह अत्त नो नाथो, अत्तादह

अत्त नो गदि

अत्त मागगपर अप्रमांसे है िुझे चलना

सब्ब का कल्याण हो,

वो कार्गकुशल करना

सब्ब का उत्तम मंगल, पथप्रिशगक हो

अत्त दिप भव भव प्रदिप भव, स्वरूप

रूप भव हो

ज्ञान सब्ब दवज्ञान सब्ब भव, सब्ब

दिप भव हो

बुद्धमं शरनं गच्छादम :

धम्मं शरनं गच्छादम :

संघं शरनं गच्छादम :

Dr. G. Y. Pathrikar College of Computer Science & Information Technology

MGM college of Computer Science and Information Technology was established in 2001 offering undergraduate and postgraduate degree program in Computer Science and Information Technology. College was renamed as Dr.G.Y.Pathrikar College of Computer Science and Information Technology in 2003 in memory of great educationalist, one of the founder member and Ex-Secretary MGM, Dr.G.Y.Pathrikar Sir.

It is first self-financed ISO certified institution offering program dedicated to Computer science and Information technology in Maharashtra and has achieved status of 2f/12b. Ours was the only and first college to be re-accredited as A+ grade with NAAC in the year 2017. Experienced and qualified faculty with Ph.D is strength of our college. Starting with 77 student's College has crossed total students strength of 10,000 passing out. Student are doing well in various MNCs like Infosys, Tech-Mahindra, Wipro, Capgemini, Cognizant etc. Many have their own Startups. Some of the students have completed their Masters and Ph.D. program from foreign countries like US, UK, Australia. Now we are constituent college of MGM University, Chhatrapati Sambhajnagar.

Vision

To be an academic institution in dynamic equilibrium in social, ecological and economical environment striving continuously for excellence in total quality education, research and technological service to the nation.

Mission

- To create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, and economical issues.
- To upgrade our students in all respect with the help of latest infrastructure in the area of Computer Science and Information Technology in order to build the National Capabilities.
- To understand the culture of Non-violence, truth, peace through Gandhian Philosophy.

Programs offered at Dr. G. Y. Pathrikar College of Computer Science & Information Technology

Undergraduate Programmes	Postgraduate Programmes	PhD Programmes	PG Diploma Programmes	Certificate Programmes
B.Sc(Computer Science) Honours / Honours with Research	M.Sc. (Computer Science)	Ph.D. in Computer Science and Information Technology	PG Diploma in Animation.	Robotics
B.Sc(Information Technology) Honours/ Honours with Research	M.Sc. (Information Technology)			
BCA(Science) Honours / Honours with Research	M.Sc. (Data Science)			
B.Sc(Animation) Honours / Honours with Research	M.Sc. (Animation)			
Integrated M.Sc. Data Science				
BCA(Digital Marketing) Honours				
B.Sc(Robotics) Honours				
B.Sc. (Artificial Intelligence & Machine Learning) Honours / Honours with Research				

Name of Program – B.Sc. (Computer Science) Honours / Honours with Research

Duration – Four Years

Eligibility -

- He / She Must have passed the Higher Secondary (Multipurpose) Examination conducted by H.S.C. Board Government of Maharashtra with Science / Technical Subjects or an Examination of any statutory University and Board recognized as equivalent thereto.

OR

- Candidates having offered prescribed vocational courses, (MCVC) with Computer Techniques / Information Technology / Electronics.

OR

- Three Years Course in Diploma Engineering conducted by the Board of Technical Education, Maharashtra State. He / She must have passed at qualifying examination.

Name of Faculty: Faculty of Basic and Applied Sciences

Name of the College: Dr.G.Y.Pathrikar College of Computer Science and Information Technology

Name of the Programme: B.Sc. (Computer Science) Honours / Honours with Research

Programme Type (UG/PG): UG

Duration: 04 Years (08 Semesters)

List of Options to select from Bucket of Courses provided in various categories:

Major	
Computer Science	
Core Major	Core Elective

Minor options for basic and applied science Faculty	GYP	IBT	UDBAS
	Cyber Security	Food Technology and Processing	Chemistry
	Robotics	Microbiology	Geo-Informatics
	Data Analytics	Biotechnology	Mathematics
	Block-Chain Technologies	Bioinformatics	Statistics
		Food Nutrition and Dietetics	Material Science

Minor options from Other Faculty	Faculty of Engineering and Technology	Faculty of Social Sciences & Humanities	Faculty of Design	Faculty of Management and Commerce	Interdisciplinary Faculty	Performing Arts
	Data Science	Filmmaking	Product Design	Financial Management	Cosmetic Technology	Theatre Arts
	IoT	Photography	Interior Design	E-Commerce	Education	Dance
	Geo-informatics and Applications	Mass Communication and Journalism	Contemporary Arts	International Business Management	Yog Sciences	Music
	EV Technology	Psychology	Visual Communication	Hospitality Mgmt	Physical Education	Folk Art
	Drone Technology	Economics	Fashion Technology	Travel and Tourism	Home Science	
	Robotics Technology	English		Art of Leadership		
	Chemical Technology	Social Work		Art of Business		
	AI&ML					
	Universal Human Values					
Energy management						

First Year - Semester I												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML101	Operating System	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML102	Data Structure	Lecture	2	2		30	20	50		08	20
MM	CSC41M MP101	Practical on Operating System	Practical	1		2	30	20	50		08	20
MM	CSC41M MP102	Practical on Data Structure	Practical	1		2	30	20	50		08	20
IKS	CSC41IK T101	Indian Psychology and yoga	Lecture	2	2	-	30	20	50		08	20
AEC		Basket of AEC From University	Lecture	2	2	-	30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2	-	30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2	-	30	20	50		08	20
VSC	CSC41V SP101	Programming in C	Practical	2		4	30	20	50		08	20
SEC	CSC 41SEL101	Computer System Architecture	Lecture	2	2	-	30	20	50		08	20
VEC	CSC41M ML101	Basket of VEC From University	Lecture	2	2	-	30	20	50		08	20
CC	CSC41M ML102	Basket of CC From University	Practical	2	-	4	50	-	50	20	-	20
Total				22	16	12	380	220	600			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation ,**Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

First Year- Semester II												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML103	Data Base Management System	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML104	Microprocessor	Lecture	2	2		30	20	50		08	20
MM	CSC41M MP103	Practical on Data Base Management System	Practical	1		2	30	20	50		08	20
MM	CSC41M MP104	Practical on Microprocessor	Practical	1		2	30	20	50		08	20
MI		Basket of MI From University	Lecture	2	2		30	20	50		08	20
AEC		Basket of AEC From University	Lecture	2	2		30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2		30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2		30	20	50		08	20
VSC	CSC41VS P102	Object Oriented Programming in C++	Practical	2		4	30	20	50		08	20
SEC	CSC41SE L102	Internet of Things	Lecture	2	2		30	20	50		08	20
VEC	CSC41M ML103	Basket of VEC From University	Lecture	2	2		30	20	50		08	20
CC	CSC41M ML104	Basket of CC From University	Practical	2	-	4	50	-	50	20	-	20
Total				22	16	12	380	220	600			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation ,Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Second Year- Semester III												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML201	Data Communication Network-I	Lecture	2	2	-	30	20	50		08	20
MM	CSC41M ML202	Computer Graphics	Lecture	2	2	-	30	20	50		08	20
MM	CSC41M ML203	Statistical Method	Lecture	2	2	-	30	20	50		08	20
MM	CSC41M MP201	Practical on Data Communication Network-I	Practical	1	-	2	30	20	50		08	20
MM	CSC41M MP202	Practical on Computer Graphics	Practical	1	-	2	30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2	-	30	20	50		08	20
MI		Basket of MI From University	Lecture	3	3	-	60	40	100		16	40
MI		Basket of MI From University	Practical	1	-	2	30	20	50		08	20
AEC		Basket of AEC From University	Lecture	2	2	-	30	20	50		08	20
VSC	CSC41V SP201	Programming in Java	Practical	2		4	30	20	50		08	20
FP	CSC41FP J201	Field Project	Project	2	-	4	50	-	50	20	-	20
CC		Basket of CC From University	Practical	2	-	4	50	-	50	20	-	20
Total				22	13	18	430	220	650			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, **Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Second Year- Semester IV												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML204	Software Engineering	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML205	Numerical Computational Technique	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML206	Data Communication Network II	Lecture	2	2		30	20	50		08	20
MM	CSC41M MP203	Practical on Software Engineering	Practical	1		2	30	20	50		08	20
MM	CSC41M MP204	Practical on Numerical Computational Technique	Practical	1		2	30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2		30	20	50		08	20
MI		Basket of MI From University	Lecture	3	3		60	40	100		16	40
MI		Basket of MI From University	Practical	1		2	30	20	50		08	20
AEC		Basket of AEC From University	Lecture	2	2		30	20	50		08	20
SEC	CSC41SE P201	Web Programming	Practical	2		4	30	20	50		08	20
CEP	CSC41CE P201	Community Engagement Program(As Per University Guidelines)	Practical	2	-	4	50	-	50	20	-	20
CC		Basket of CC From University	Practical	2	-	4	50	-	50	20	-	20
Total				22	13	18	430	220	650			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Third Year- Semester V												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML301	Cloud Computing	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML302	Machine Learning	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML303	Introduction to Robotics	Lecture	2	2		30	20	50		08	20
MM	CSC41M MP301	Practical Based on Cloud Computing	Practical	1		2	30	20	50		08	20
MM	CSC41M MP302	Practical Based on Machine Learning	Practical	1		2	30	20	50		08	20
ME	CSC41M EL301	Artificial Intelligence	Lecture	3	3		60	40	100		16	40
	CSC41M EL302	Blockchain Technology	Lecture	3	3		60	40	100		16	40
ME	CSC41M EP301	Practical Based on Artificial Intelligence	Practical	1		2	30	20	50		08	20
	CSC41M EP302	Practical Based on Blockchain Technology.	Practical	1		2	30	20	50		08	20
MI		Basket of MI From University	Lecture	3	2		60	40	100		16	40
MI		Basket of MI From University	Practical	1		2	30	20	50		08	20
VSC	CSC41V SP301	Python Programming	Practical	2		4	30	20	50		08	20
FP	CSC41FP J301	Field Project	Project	2	-	4	50	-	50	20	-	20
Total				20	14	16	410	240	650			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, Course Category: MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Third Year- Semester VI												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML304	Digital Image Processing	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML305	Deep Learning	Lecture	2	2		30	20	50		08	20
MM	CSC41M ML306	Theory of Computation	Lecture	2	2		30	20	50		08	20
MM	CSC41M MP303	Practical on Digital Image Processing	Practical	1		2	30		50		08	20
MM	CSC41M MP304	Practical on Deep Learning	Practical	1		2	30	20	50		08	20
ME	CSC41M EL303	Software cost estimation	Lecture	3	3		60	40	100		16	40
	CSC41M EL304	Data Analytics	Lecture	3	3						16	40
ME	CSC41M EP303	Practical Based on Software cost estimation	Practical	1		2	30	20	50		08	20
	CSC41M EP304	Practical Based on Data Analytics	Practical	1		2	30	20	50		08	20
MI		Basket of MI From University	Lecture	3	2		60	40	100		16	40
MI		Basket of MI From University	Practical	1		2	30	20	50		08	20
OJT	CSC41JT P301	On Job Training	Practical	4		8	60	40	100		16	40
Total				20	12	16	390	260	650			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, **Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Fourth Year- Semester VII												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML401	Neural Network	Lecture	3	3		60	40	100		16	40
MM	CSC41M ML402	Data Ware Housing and Data Mining	Lecture	3	3		60	40	100		16	40
MM	CSC41M ML403	Network Security	Lecture	3	3		60	40	100		16	40
MM	CSC41M MP401	Practical based on Neural Network	Practical	1		2	30	20	50		08	20
MM	CSC41M MP402	Practical on Data Ware Housing and Data Mining	Practical	1		2	30	20	50		08	20
MM	CSC41M MP403	Practical Based on Network Security	Practical	1		2	30	20	50		08	20
ME	CSC41M EL401	Geographical Information System	Lecture	3	3		60	40	100		16	40
	CSC41M EL402	Remote Sensing	Lecture	3	3		60	40	100		16	40
ME	CSC41M EP401	Practical Based on Geographical Information System	Practical	1		2	30	20	50		08	20
	CSC41M EP402	Practical Based on Remote Sensing	Practical	1		2	30	20	50		08	20
RM	CSC41R ML401	Research Methodology	Lecture	3	3		60	40	100		16	40
RM	CSC41R MP401	Practical based on Research Methodology	Practical	1		2	30	20	50		08	20
Total				20	15	10	450	300	750			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, **Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Fourth Year- Semester VIII												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML404	Biometric Technique	Lecture	3	3		60	40	100		16	40
MM	CSC41M ML405	Quantum Computing	Lecture	3	3		60	40	100		16	40
MM	CSC41M ML406	Software Testing	Lecture	3	3		60	40	100		16	40
MM	CSC41M MP404	Practical on Biometric Technique	Practical	1		2	30	20	50		08	20
MM	CSC41M MP405	Practical on Quantum Computing	Practical	1		2	30	20	50		08	20
MM	CSC41M MP406	Practical on Software Testing	Practical	1		2	30	20	50		08	20
ME	CSC41M EL403	Cyber Security	Lecture	3	3		60	40	100		16	40
	CSC41M EL404	Augmented Reality	Lecture	3	3		60	40	100		16	40
ME	CSC41M EP403	Practical Based on Cyber Security	Practical	1		2	30	20	50		08	20
	CSC41M EP404	Practical Based on Augmented Reality	Practical	1		2	30	20	50		08	20
OJT	CSC41JTP401	On job Training	Practical	4		8	60	40	100		16	40
Total				20	12	16	420	280	700			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, **Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Fourth Year- Semester VII (Honours with Research)												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML407	Medical Image Processing	Lecture	3	3		60	40	100		16	40
MM	CSC41M ML408	Pattern Recognition	Lecture	3	3		60	40	100		16	40
MM	CSC41M MP406	Practical on Medical Image Processing	Practical	1		2	30	20	50		08	20
MM	CSC41M MP407	Practical on Pattern Recognition	Practical	1		2	30	20	50		08	20
ME	CSC41M EL405	Human Computer Interaction	Lecture	3	3		60	40	100		16	40
	CSC41M EL406	Data Analytics	Lecture	3	3		60	40	100		16	40
ME	CSC41M EP405	Practical Based on Human Computer Interaction	Practical	1		2	30	20	50		08	20
	CSC41M EP406	Practical based on Data Analytics	Practical	1		2	30	20	50		08	20
RM	CSC41R ML401	Research Methodology	Lecture	3	3		60	40	100		16	40
RM	CSC41R MP401	Practical based on Research Methodology	Practical	1		2	30	20	50		08	20
RP	CSC41RP J401	Research Project	Practical	4		8	60	40	100		16	40
Total				20	12	16	420	280	700			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, **Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research project

Fourth Year- Semester VIII (Honours with Research)												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	CSC41M ML408	Biometric Technique	Lecture	3	3		60	40	100		16	40
MM	CSC41M ML409	Biomedical Image and Visualization	Lecture	3	3		60	40	100		16	40
MM	CSC41M MP408	Practical base on Biometric Technique	Practical	1		2	30	20	50		08	20
MM	CSC41M MP409	Practical based on Biomedical Image and Visualization	Practical	1		2	30	20	50		08	20
ME	CSC41M EL407	Natural Language Processing	Lecture	3	3		60	40	100		16	40
	CSC41M EL408	Fuzzy Logic	Lecture	3	3		60	40	100		16	40
ME	CSC41M EP407	Practical Based on Natural Language Processing	Practical	1		2	30	20	50		08	20
	CSC41M EP408	Practical Based on Fuzzy Logic	Practical	1		2	30	20	50		08	20
RP	CSC41RP J402	Research Project	Practical	8		16	120	80	200		32	80
Total				20	09	22	390	260	650			

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation, **Course Category:** MM-Major Mandatory, ME-Major Elective, MI-Minor, OE-Generic / Open electives, VSC-Vocational skill course, SEC-Skill Enhancement course, AEC-Ability Enhancement course, IKS-Indian Knowledge system, VEC-Value Education course, OJT-On Job Training / Internship / Apprenticeship, FP-Field project, CEP-Community engagement and service, CC-Co – curricular course, RM-Research methodology, RP-Research projec

Semester: FIRST

Syllabus Semester-I

Course code: CSC41MML101	Course name: Operating System
Course category: Major Mandatory	
Credits: 2	Teaching Scheme: L-2 P-0
Evaluation Scheme: CA-30 ESE-20	
Course Objectives:	
Student can understand the concept to process management and scheduling, and various is use in Inter Process Communication and the role of OS in interposes communication.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the process management policies and scheduling of processes by CPU	
CO2: Understand the need for process synchronization and coordination handled by operating system	
CO3: Describe and analyze the memory management and its allocation policies	
CO4: Understand the use and evaluate the storage management Policies with respect to different storage management Technologies	

Contents –

Unit	Content	Teaching hours
1	<p>Introduction: Concept of Operating System, History of Operating System, Operating System Structure, Types of Operating System ,Function of Operating System, Components of Operating system</p> <p>Process Management: Concept of Process, Process States, Process,Scheduling, operation on process Inter process communication</p> <p>Asynchronous Concurrent Process Parallel Processing ,Mutual Exclusion and Critical Section, threading Dekker’s Algorithm , Petersons algorithm, Hardware,Solution to Mutual Exclusion ,semaphores, implementation of semaphores P and V.</p>	10
2	<p>Concurrent Programming: Monitors,Deadlock concept, Four Necessary condition for deadlock Deadlock Presentation, Deadlock avoidance, deadlock detection, deadlock recovery</p> <p>Memory Management: Swapping, Contiguous Memory allocation, paging, Structure of the Page Table ,Segmentation, Example, the Intel Pentium,</p>	10
3	<p>Virtual Memory Management: Demand Paging, copy on write, Page replacement, allocation of Frames, thrashing, Memory Map Files, Allocating Kernel Memory</p> <p>Device Management: Techniques for device management, Device Characteristics, Device Allocation Considerations, Virtual Devices</p>	10

Text Books:

1. Operating System, Stuart E. Mandnick, JohnJ. Donovan Tata McGraw Hill Publication.
2. Operating System, H.M. Deitel ,Pearson Publication

Reference Books:

1. Operating System, Abraham Silberschatz, Peter B.Galvin, Wiley Publication.
2. Operating System, Andrew S.Tanenbaum, Pearson Publication.

Syllabus Semester-I

Course code: CSC41MML102	Course name: Data Structure
Course category: Major Mandatory	
Credits: 2	Teaching Scheme: L-2, P-0
Evaluation Scheme: CA-30, ESE-20	
Course Objectives:	
To introduce the concept of data structures and Algorithm, emphasize the importance of data structures in development and implementation of algorithms in Computer Programming.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Describe how arrays, records, linked structures, stacks, queues, trees, are represented in memory and used by algorithms.	
CO2: Describe common applications for arrays, records, linked structures, stacks, queues, trees.	
CO3: Demonstrate different methods for traversing trees.	
CO4: Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.	

Contents –

Unit	Content	Teaching hours
1	Introduction: Basic Terminology, Data Item, fields, Records, Files, Entity, Attributes, Data organization and Data Structure. Arrays: Representation of Linear Arrays, Traversing, Insertion and Deletions, sorting and Searching Algorithms, Multidimensional Arrays 2D and M-D concept, Record, Record Structure, Representation in Memory.	10
2	Linked List: Concept of linked List, Representation of linked list in Memory, Traversing a linked list, Searching a linked List: Sorted and Unsorted, Insertion and Deletion in Linked list, Header linked list and Two way list. Stacks and Queue: Operation, Array Representation of Stack Linked Reorientation of Stack, Queue, Representation of Queues, Types of queue	10
3	Binary Tree: Representing Binary trees in memory, Traversing Binary trees, Traversal Algorithm using Stack, Header node, Threads, Binary Search Tree Searching and Inserting in Binary search Trees, Deleting in Binary Search Trees.	10

Text Books:

1. Data Structure, Seymour Lipschutz , TataMcGraw-Hill Publication.

Reference Books:

1. Data Structure, Tannenbaum, PHI Publication.

2. An Introduction to Data Structure and Application, Jean Paul Tremblay, Tata McGraw-Hill Publication.

3. Introduction to Algorithms, Thomas H.Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford, PHI Publication.

Syllabus Semester-I

Course code: CSC41MMP101	Course name: Practical on Operating System
Course category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0, P-2
Evaluation Scheme: CA-30, ESE-20	
Course Objectives:	
To be familiar with various scheduling and Memory management techniques	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand function of operating system.	
CO2: Understand file system on operating system.	
CO3: Implementation of simulate paging Technique of memory management	

Contents –

Sr.no.	Description of Practical	Practical hours
1	Experiment No. 1 : Introduction to OS and Types of OS	1
2	Experiment No. 2 : System Calls	1
3	Experiment No. 3: Threads	1
4	Experiment No. 4 : Memory Mapped Files	1
5	Experiment No.5 :Semaphores using Shared Memory	1
6	Experiment No.6 : File System	1
7	Experiment No. 7: Structure of Page table, Segmentation. Example : the Intel Pentium	1
8	Experiment No.8: Write a C program to simulate producer- Consumer problem using semaphores.	1
9	Experiment No 9: Write a C program to simulate paging Technique of memory management.	1
10	Experiment No. 10 : Write a C program to simulate Bankers algorithm for the purpose of deadlock Avoidance	1

Text Books:

1. Operating System, Stuart E. Mandnick, JohnJ. Donovan Tata McGraw Hill Publication.

Reference Books:

1. Operating System, Andrew S.Tanenbaum, Pearson Publication.

Syllabus Semester-I

Course code: CSC41MMP102	Course name: Practical on Data Structure
Course category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0, P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of Computer Programming	
Course Objectives:	
To familiar with linear and non linear Data Structure.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand Linear and Non linear structure.	
CO2: Understand various operation perform on data structure.	

Contents –

Sr.no.	Description of Practical	Practical hours
1	To demonstrate the concept of one dimensional array finding the sum of array elements.	1
2	To insert an element in an array.	1
3	To delete an element from an array	1
4	To add two matrix A and B.	1
5	To multiply two matrix A and B	1
6	To Concatenate two string.	1
7	To copy a string into another string.	1
8	Implementation of linked list using array.	1
9	Implementation of stack using array.	1
10	Implementation of queue using array.	1

Text Books:

1.Data Structure , Seymour Lipschutz , TataMcGraw-Hill Publication

Reference Books:

1.Introduction to Algorithms, Thomas H.Cormen, Charles E. Leiserson,Ronald L.Rivest, Clifford, PHI Publication

Syllabus Semester-I

Course code: CSC41VSP101	Course name: Practical on Programming in C
Course category: Value Education course	
Credits: 2	Teaching Scheme: L-0, P-4
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of C Programming	
Course Objectives:	
To introduce the foundations of computing, programming and problem- solving Using computer Programming and its principles.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand various function in c programming	
CO2: Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task	

Contents –

Sr.no	Description of Practical	Practical hours
1	Program to find Simple Interest	1
2	Program to find smallest of two numbers using conditional operator.	1
3	Program to perform factorial of a given number.	1
4	Program to find the given number is palindrome or not.	1
5	Program to find the given number is Armstrong or not.	1
6	Program to reverse the given number.	1
7	Program to find Sum of digits.	1
8	Program to find day of the week.	1
9	Program to find the given character is vowel or not.	1
10	Write a macro that returns TRUE if its parameter is divisible by 10 and FALSE otherwise.	1

Text Books:

1. Let us C ,Y.P. Kanetkar, BPB publication

Reference Books:

1. Programming in C, E. Balaburuswamy ,Tata Macgraw Hill

Syllabus Semester-I

Course code: CSC41SEL101	Course name: Computer System Architecture	
Course category: Skill Enhancement course		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic knowledge of Digital Electronic		
Course Objectives:		
To convey basic introduction of computer system architecture, the structure of Computer, Working gates and its functionality.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Student will be able to learn basic concepts of digital logic.		
CO2: Student will be able to learn basic concepts of digital logic		

Contents –

Unit	Content	Teaching hours
1	Data Types: Number Systems, Octal and Hexadecimal Numbers, Decimal Representation, Alphanumeric Representation, 1's Complement, 2's Complement, Subtraction of Unsigned Numbers.	10
2	Introduction: Digital Computers, Logic Gates, Boolean Algebra, Complement of Function, Karnaugh's Map: Map Simplification, Product of Sums Simplification Don't Care Conditions. Combinational Circuits: Half Adder, Full Adder, 4-Bit Binary Adder, Half Subtractor and Full Subtractor	10
3	Flip Flops: SR- Flip Flop, D- Flip Flop, JK- Flip Flop, T- Flip Flop, Edge Triggered Flip Flops, Flip Flop Input Equations, State Table, State Diagram, Problems	10

Text Books:

1. Computer System Architecture, M. Morris Mano, Pearson Publication
2. Computer System, Digital Design, Fundamentals of Computer Architecture and Assembly Language, Ata Elahi, Springer

Reference Books:

1. Digital Electronics and Micro-Computers, R.K. Gaur, Dhanpatri.
2. Introduction to Digital Electronics, John Crowe and Barrie Hayes, Gill.

Semester: SECOND

Syllabus Semester-II

Course code: CSC41MML103	Course name: Database Management System
Course category: Major Mandatory	
Credits: 2	Teaching Scheme: L-2, P-0
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic Knowledge of Data Base Management System	
Course Objectives:	
To understand user requirements and frame it in data model	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Solve real world problems using appropriate set, function, and relational models	
CO2: Aware SQL environment.	
CO3: Design E-R Model for given requirements and convert the same into database tables	

Contents –

Unit	Content	Teaching hours
1	Introduction to Database Management System: Data Definition, DBMS definition, Types of Data, Record and File, File based System Vs DBMS, Database System Application, Purpose of Database System, Three levels Architecture for a DBMS. , Component of a DBMS: Users, query processor & storage Structure. , Advantageous & Disadvantageous of DBMS. Role of DBA.	10
2	Data Modeling and Design: Data physical schema, Data Model: Importance of Data Model, Types of Data Model: Relational, ER, Semi-structured, Object-Oriented, Network & Hierarchical Data Model. , Entity-Relationship Data Mode :Entity , Entity Set, Types of Entities, Strong & Weak Entity, ER diagram, mapping cardinalities, data association, Attribute, Types of Attributes , ,Relational Data Model: Basic Structure of Relational Data Model, keys, tuples, Database Schema , Constraints : Integrity Rule 1 & 2(entity integrity ,referential integrity) , Data flow diagram, Functional Dependency, Dependency Diagram, , Normalization: First Normal Form, Second Normal Form, Third Normal Form, Conversion.	10
3	Relational Algebra & Oracle: Basic Operation –Union, Intersection, Difference and Cartesian Product, Advance Operation- Projection, Selection, Join (Inner and Outer) & Division, Examples based on above Operation, Relation Algebraic Queries. , Introduction to Oracle: Versions of Oracles, Products of Oracle, Tools of Oracle , SQL: Logging to SQL/ I SQL, SQL plus Worksheet.	10

Text Books:

- 1.Database System Concepts, Silberschatz A., Korth H., Sudarshan S., McGraw Hill Publishers
2. Database Systems: S.K.Singh ,Pearson, 2013

Reference Books:

1. Pearson Education, Connally T, Pearson Education, 2002

Syllabus Semester-II

Course code: CSC41MML104	Course name: Microprocessor	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic Knowledge of Digital Electronics.		
Course Objectives:		
On completion of this course the student will be able to: Understand and classify the instruction set of 8086 microprocessor and distinguish the use of different instructions and apply it In assembly language programming.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Describe the architecture & organization of 8086 Microprocessor.		
CO2: Relate the addressing modes used in the instructions.		
CO3: Realize the Interfacing of memory & various I/O devices with 8086 microprocessor		

Contents –

Unit	Content	Teaching hours
1	Introduction to Microprocessor an Microcomputer: Historical background Microprocessor based personal computer system, Computer data formats. 8086 Hardware specification, Microcomputer structure and operation 8086 internal architecture, Real Mode & Protected Mode Memory Addressing, Memory Paging. Introduction to programming 8086 : Prog lang.	10
2	Addressing Modes Data addressing modes Program memory addressing modes Stack memory addressing modes Data Movement Instructions (Inst related with 8086 only) MOV revisited: Machine language, theop-code, MOD field, resister assignment, R/M memory Addressing, special addr. Mode.	10
3	Data Movement Instructions: PUSH/POP, initializing stack. Miscellaneous data transfer instructions: XCHG, LAHF & SAHF, Arithmetic instructions, Addition, subtraction and comparison Multiplication and division BCD and ASCII arithmetic.	10

Text Books:

1. The Intel Microprocessors: Architecture, programming and interfacing, Barry B. Brey.
2. Microprocessors and Interfacing, Douglas Hall.

Syllabus Semester-II

Course code: CSC41MMP103	Course name: Practical on Data base management System	
category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Course Objectives:		
The main objective is students gain knowledge about databases for storing the data and to share the data among different kinds of users for their business operations.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand concept of Database Management system		
CO2: Understand application of SQL environment		

Contents –

Sr.no.	Description of Practical	Practical hours
1	Draw E-R diagram and convert entities and relationships to relation table for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)	1
2	Write relational algebra queries for a given set of relations	1
3	Perform the following: a. Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)	1
4	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.	1
5	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions , Math Functions Join Queries- Inner Join, Outer Join Sub queries- With IN clause, With EXISTS clause	1
6	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from a view	1
7	Write a PL/SQL program using FOR loop to insert ten rows into a database table.	1
8	Given the table EMPLOYEE (Emp No, Name, Salary, Designation, Dep tID) write a cursor to select the five highest paid employees from the table.	1
9	Illustrate how you can embed PL/SQL in a high-level host language such as C And demonstrates how a banking debit transaction might be done.	1
10	Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.	1

Text Books:

1. Database System Concepts, Silberschatz A., Korth H., Sudarshan S., McGraw Hill Publishers.

Reference Books:

1. Pearson Education, Connally T, Pearson Education, 2002.

Syllabus Semester-II

Course code: CSC41MMP104	Course name: Practical on Microprocessor
category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0, P-2
Evaluation Scheme: CA-30, ESE-20	
Course Objectives:	
On completion of this course the student will be able to: Understand and classify The instruction set of 8086 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand Assembly Language programming concept.	
CO2: To develop and execute assembly language program.	

Contents –

Sr.no.	Description of Practical	Practical hours
1	Addition and subtraction of two 8-bit numbers with programs based on different Addressing modes of 8086.	1
2	Addition and subtraction of two 16-bit numbers. (Using 2's Complement method, also programs which access numbers from specified memory location)	1
3	Multiplication of two 8-bit numbers using the method of successive Addition and Shift & add.	1
4	Division of two 8 bit numbers using the method of Successive subtraction and shifts & subtract.	1
5	Block transfer and block exchange of data bytes.	1
6	Design and develop an Assembly language program using 8086 Microprocessor and to show the following aspects. a. Programming b. Execution c. Debugging.	1
7	Write an ALP program to perform 8 Bit arithmetic operations using MASM software and 8086.	1
8	Write an ALP program to perform 16 Bit arithmetic operations using MASM software and 8086.	1
9	Write an ALP program to perform 3*3 matrix multiplication and addition	1
10	Write an ALP program to perform ascending order using 8086	1

Text Books:

1. The Intel Microprocessors: Architecture, programming and interfacing, Barry B. Brey.

Reference Books:

1. Microprocessors and Interfacing, Douglas Hall.

Syllabus Semester-II

Course code: CSC41VSP102 Course name: Practical on Object oriented Programming in C++
Course category: Vocational skill course
Credits: 2 Teaching Scheme: L-0, P-4 Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic knowledge of programming language.
Course Objectives: To understand object oriented programming concept.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Classify inheritance with the understanding of early and late binding, Usage of exception handling, generic programming
CO2: Demonstrate the use of various OOPs concepts with the help of programs.

Contents –

Sr.no.	Description of Practical	Practical hours
1	Write a C++ program to find the sum of individual digits of a positive integer	1
2	Write a C++ program to generate the first n terms of the sequence	1
3	Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.	1
4	Write a C++ program to sort a list of numbers in ascending order.	1
5	Write a program Illustrating Class Declarations, Definition, and Accessing Class Members	1
6	Program to illustrate default constructor, parameterized constructor and copy constructors	1
7	Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.	1
8	Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.	1
9	Write a Program to Generate Fibonacci Series use Constructor to Initialize the Data Members.	1
10	Write a Program to Generate Fibonacci Series use Constructor to Initialize the Data Members.	1

Text Books:

1.Object Oriented Programming with C++ ,E Balagurusamy , Tata McGraw-Hill Education

Reference Books:

1.A Tour of C++, Bjarne Stroustrup ,Addison-Wesley Professional

Syllabus Semester-II

Course code: CSC41SEL102	Course name: Internet of Things	
Course category: Skill Enhancement course		
Credits: 2	Teaching Scheme: L-2, P-0	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic Knowledge of Internet and Digital Electronic		
Course Objectives: In this course, student will explore various components of Internet of things such As Sensors, Internet working.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the vision of IoT from a global context.		
CO2: Understand the application of IoT		
CO3: Building state of the art architecture in IoT		

Contents –

Unit	Content	Teaching hours
1	Introduction of Internet of Things : IoT Definition, Characteristics, IoT Functional Blocks, Physical design of IoT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels & Deployment Templates Domain Specific IOT: Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, industry, Health & lifestyle.	10
2	IOT and M2M: Introduction, M2M, Difference Between IoT and M2M, SDN and NFV for IoT. IOT System Management With NETCONF-YANG: Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Limitation of SNMP, Network operator requirements, NETCONF, YANG, IoT Systems Management with Net conf-yang.	10
3	IOT Platform Design: Introduction, IoT Design Methodology, case Study on IoT System for Weather Monitoring, Motivation for using Python. IOT System –Logic Design Using Python: Introduction, Installing Python, python Data types & Data Structures, Control Flow, Functions, Modules, Packages, file handling data/time operation, classes, Python Packages of interest for IoT.	10

Reference Books:

1. Internet of Things (A Hands-on-Approach), Vijay Madiseti , Arshdeep Bahga, VPT
2. Internet of Things (IoT) Technologies, Application, Challenges, and Solution, B.K. Tripathy & J. Anuradha, CRC Press.
3. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler, Vlasios Tsiatsis , A press Publications

Semester: THIRD

Syllabus Semester-III

Course code: CSC41MML201	Course name: Data Communication Network-I	
Course Category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA- 30 ESE-20
Pre-requisites: Basic Knowledge of Computer Network		
Course Objectives:		
The course objectives include learning about computer network organization and, obtaining a theoretical understanding of data communication and computer networks.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Become familiar with communication system and protocols and standards		
CO2: Understand the types of networks and LAN topologies, basic concept of networking.		
CO3: Learn OSI model, Types of Signals Encoding and Modulating		
CO4: Understand modem classification		

Contents

Unit	Content	Teaching hours
1	Data Communication and its Characteristics: Components of data communication Transmitter, Receiver, Medium, Message, Protocol. Standards, Standard organizations. Basic block diagram of data communication system Data Transmission: Serial, Parallel Synchronous, Asynchronous, Isochronous Transmission.	6
2	Transmission Characteristics: Signaling rate, data rate, bit rate, baud rate Need of computer networks, Network criteria, advantages of networking Network topologies: Mesh, Star, Bus, Tree, Ring and Hybrid topologies -Schematic diagram, working, Point to-point, Multipoint, Broadcast Based on physical size(scale):PAN, BAN, LAN, MAN, WAN,VPN Based on Architecture: Peer to Peer, Client Server, advantages of Client Sever over Peer-to-Peer Model.	8
3	TCP/IP protocol suite with define protocols in respective Layers: Physical layer, Data Link Layer, Network Layer, Transport Layer, Application Layer Addressing in TCP/IP: Physical, logical, Port and specific The ISO-OSI model: Physical layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer.	8
4	Multiplexing: Basic concept, Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time- Division Multiplexing Transmission medium: classification based on electromagnetic wave spectrum Guided Media -Twisted pair(UTP,STP) cable -connector, Coaxial cable -connector, Fiber-optic cable -connector, performance and applications Unguided Media -Radio waves, microwaves, Infrared and their applications Modems classifications: Broadband modem, DSL —ADSL, HDSL, VDSL Switching: Circuit-switched networks, Packet switched networks Datagram Approach, virtual circuit approach.	8

Text Books:

1. Data Communications and Networking, Behrouz A. Forouzan Forouzan ,Tata McGraw Hill Education Private Limited 4th edition 2017

2. Computer Networks , Tenenbaum , PHI Publication

Reference Books:

1. Data Communications and Computer Networks, Brijendra Singh ,PHI Publication

Syllabus Semester-III

Course code: CSC41MML202	Course name: Computer Graphics
Course category: Major Mandatory	
Credits: 2	Teaching scheme: L-2 P-0
Evaluation scheme: CA: 30 ESE-20	
Pre-requisites: Knowledge of Application of Computer graphics.	
Course Objectives:	
To Introduce various Graphics Applications in real world scenario and learn more about 2D and 3D Transformation Technique.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1. To understand fundamentals of graphics used in various applications	
CO2. To Understand various 2D and 3D transformation Technique in Computer Graphics.	
CO3. Understand Curves and Fractals generation technique	
CO4. Understand color use in computer graphics.	

Contents

Unit	Content	Teaching hours
1	Fundamental of Computer Graphics: Application of Computer Graphics, Classification of Computer Graphics, Types of Graphics Devices, Video Display Devices, Input Devices, Display File and its Structure Graphics file Format.	6
2	2D Transformation: Translation, Rotation, Scaling, Homogenous Coordinates for Translation, Homogenous Coordinates for Rotation, and Homogenous Coordinates for Scaling. Composition of 2D Transformation, Other transformations Reflection, Shear.	8
3	3D Transformation: Translation, Scaling Rotation, Shearing, Reflection, Multiple Transformation Projection, Perspective Projection, Parallel Projection, Types of Parallel & Perspective Projection, Vanishing Points. Diffuse Illumination, Specular Reflection.	8
4	Curves and Fractals: Curve Generation, Representation of Parametric & Non-Parametric Curves, Spline Representation, Bezier curves, B-Spline curves Fractals, classification of fractals, Topological Dimension, fractal Dimension, Hilbert's curves, Koch curve. Colour Models and Animation: RGB, CMY and HSV. Introduction of Animation, Animation Using Colour Table, Animation of Wireframe Models.	8

Text Books:

1. Computer Graphics, A.P.Godse, Technical Publication
2. Mathematical Elements for Computer Graphics, D.F.Rogers, Tata McGraw-Hill Publication

Reference Books:

1. Computer Graphics, M. Pauline Baker, Donald Hearn ,PHI Publication
2. Introduction to Computer Graphics 3 rd Edition Using OpenGL and Java, Karsten Lehn; Merijam Gotzes; Frank Klawonn, Springer ,2023

Syllabus Semester-III

Course code: CSC41MML203	Course name: Statistical Method
Course category: Major Mandatory	
Credits: 2	Teaching scheme: L-2 P-0
Evaluation scheme: CA- 30 ESE-20	
Pre-requisites: Basic understanding of statistical data processing	
Course Objectives:	
To emphasis descriptive statistics, understand various statistical methods: measures of central tendency, measure of dispersion	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the elementary statistical methods.	
CO2: Analyze the data to represent it graphically	
CO3: Understand tabulate and interpret data it to generate information in descriptive form.	
CO4: Understand Measures of Dispersions	

Contents -

Unit	Content	Teaching hours
1	Statistical Methods: Definition, scope and importance of Statistics, concepts of statistical population and sample. Data & Types of data: Primary and Secondary data, qualitative & quantitative data Classification, Tabulation and Graphical Representation: Preparation of Tables, Presentation of Data: Variable, Random Variable, Frequency, And Frequency Distribution. Diagrammatic representation of Measures of Skewness and Kurtosis: Data: Line and Bar Diagram, Histogram, Component Bar diagram, Pie Chart, Line Graph, Frequency polygon.	6
2	Measures of Central Tendency: Characteristics of Good measure of Central Tendency. Concept of central tendency- for Group and Ungroup data. Mean, Arithmetic mean (A.M.): simple and weighted Merits and demerits. Geometric mean (G.M.): computation for G M, Merits demerits and applications of G.M.	8
3	Harmonic Mean (H.M.): computation for frequency, non-frequency data, merits and demerits of H.M. Median: Definition, Median for grouped and ungrouped data, Properties and Merits & demerits. Mode: Definition, Mode for grouped & ungrouped data, Graphical Method for finding mode, Merits and demerits.	8
4	Measures of Dispersions: Purposes of Measure of Dispersion, Properties of Good measures of Dispersion, Range, Quartile Deviation & Mean Deviation, Variance, Standard Deviation Coefficient of Variation.	8

Text Books:

1. Fundamental of Mathematical Statistics, S. C. Gupta & V. K. Kapoor, Sultan Chand & Sons publication
2. Fundamental of Statistical Methods , Dr.S.P. Gupta, Sultan Chand & Sons, 2021

Reference Books:

1. Basic Statistics, B.L.Agarwal, New Age (P) Limited.Publication

Syllabus

Semester-III

Course code: CSC41MMP201 Course name: Practical on Data Communication Network-I		
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA- 30 ESE-20
Course Objectives:		
Basic knowledge of networking connectivity and configuration		
Course Outcomes: At the end of the course, the students will be able to		
CO1: Understand various component if computer network		
CO2: Understand Network topology and installation		

Contents -

Sr.no.	Description of Practical	Practical Hours
1	Analyze the type of network topology used in your lab and Prepare technical specifications for it.	2
2	Connect computers in bus topology and transfer the data.	2
3	Install/configure/Test Peer to Peer LAN and sharing of resources.	2
4	Configure Point to Point network in laboratory.	2
5	Prepare patch cord and cross connection cables, use to connect the Devices on the LAN.	2
6	Using a Switch Install a LAN network consisting of 6 computers	2
7	Use route command to test the performance of the given network	2
8	Install and test Router, Repeater and Bridge	2
9	Configure/Test Internet connectivity.	2
10	Assign IP address to the PC connected to the internet	2
11	Project	10

Text Books:

1. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw Hill Education Private Limited 4th edition 2017.
2. Computer Networks , Tenenbaum , PHI Publication

Reference Books:

1. Data Communications and Computer Networks, Brijendra Singh , PHI Publication

Syllabus

Semester-III

Course code: CSC41MMP202	Course name: Practical on Computer Graphics
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA- 30 ESE-20	
Course Objectives:	
To be familiar with various 2D and 3D Transformation techniques.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand and implementation of transformation technique	
CO2: Understand various color model use in computer graphics system.	

Contents -

Sr.no.	Description of Practical	Practical Hours
1	Execute a program for 2D Translation using C or C++	2
2	Implementation for 2D Scaling using C or C++	2
3	Write and Execute a program for 2D Rotation using C or C++	2
4	Implementation a program for Line Drawing using C or C++	2
5	Write and Execute a program for Circle Drawing using C or C++	2
6	Write and Execute a program for 2D Translation using C or C++	2
7	Implementation a program for Rectangle using C or C++	2
8	Write and Execute a program for Ellipse using C or C++	2
9	Write and Execute a program for Pixel at specified position using C or C++	2
10	Implementation a program for stylish line drawing C or C++	2
11	Project	10

Text Books:

1. Graphics Under C, Yashvant Kanetkar , BPB Publication.
2. Mathematical Elements for Computer Graphics, D.F.Rogers, Tata McGraw-Hill Publication

Reference Books:

1. Computer Graphics, M. Pauline Baker, Donald Hearn ,PHI Publication

Syllabus Semester-III

Course code: CSC41VSP201	Course name: Programming in Java
Course category: Vocational skill course	
Credits: 2	Teaching scheme: L-0 P-2
Evaluation scheme: CA-30 ESE-20	
Pre-requisites: Programming skill.	
Course Objectives:	
Implement object oriented programming concept in java using basic syntaxes of control Structures, strings and function for developing skills of logic building activity.	
Course Outcomes: At the end of the course, the students will be able to –	
CO1: Understand basic concept of implementation of java programming.	
CO2: Understand demonstration of how to achieve reusability using inheritance,	
CO3: Understand interfaces and packages and describes faster application development.	
CO4: Understand in Java Database connectivity Using SQL	

Contents -

Sr.no.	Description of Practical	Practical Hours
1	Implement Java Program to find the size of primitive data type.	2
2	Write a Java Program to print the table from 1 to 100 using loops.	2
3	Implement a Java Program to use all the operators.	2
4	Write a Java Program to show single level inheritance.	2
5	Java Program for Multilevel Inheritance.	2
6	Implement a Java Program to demonstration of Creation of own Package	4
7	Write a Java Program to Demonstration of Exception Handling	4
8	Implement a Java Program to Create the Dictionary	4
9	Write a Java Program for the use of various Controls	4
10	Implement a Java Program to demonstrate the use of Layout	4
11	Write a Java Program to demonstrate the use of Menus	4
12	Implement a java program to demonstration of Inet Address Class	4
13	Write a java program to demonstrate Database connectivity Using SQL	4
14	Develop a java program that implements a simple client server application. (The client sends data to server. The server receives the data uses it to produce a result and then sends the result back to the client then The client displays the result on the console.)	4
15	Project	14

Text Books:

1. Programming with Java a Primer, E. Balagurusamy , McGraw Hill Education, Fourth edition, ISBN-10: 9383286377
2. Java: The Complete Reference ,Herbert Schildt McGraw-Hill, 2018,

Reference Books:

1. Java: A Beginner's Guide,Herbert Schildt ,McGraw-Hill Education, 7th edition

Semester: FOURTH

Syllabus Semester-IV

Course code: CSC41MML204	Course name: Software Engineering	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA- 30 ESE-20
Pre-requisites: Basic concept of program and software.		
Course Objectives:		
Acquire knowledge of software design process.		
Course Outcomes: At the end of the course, the students will be able to		
CO1: Understand software design process.		
CO2: Learn coding, testing and quality management phase.		
CO3: Develop appropriate experimentation, analyses and interpret data.		
CO4. Understand Software Project Management.		

Contents -

Unit	Content	Teaching hours
1	Software Life Cycle: Classic waterfall model and its extensions, Incremental Model, Rapid Application Development, Agile Development Model, Spiral Model, Comparison of different Life cycle model.	6
2	Requirement Analysis and Specification: Requirement Gathering and Analysis, Software Requirement Specification, Characteristics of SRS Document, Functional Requirement, Formal System Specification, Axiomatic Specification, Algebraic Specification.	8
3	Software Design Design Process, Outcome of the Design Processes, Classification of Design Activities, Classification of Design Methodology, Characteristics of Good Design, Cohesion and Coupling, Function-Oriented Design, Object-Oriented Design, User Interface Design. Coding, Testing and Quality Management: Coding Standards and Guidelines, Software Documentation, Basic Concepts and Technologies of Testing, Test Cases, Tests as Bugs Filter, Unit Testing, Black-Box Testing, White- Box Testing	8
4	Software Project Management: Software Project Management Complexity, Responsibilities of Software Project Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, COCOMO, Risk Management.	8

Text Books:

1. Fundamentals of Software Engineering, Mall, Rajib, PHI Learning Private Limited
2. The software Engineer Guidebook Gergely Orosz
2. Fundamentals of Software Engineering, Mall, Rajib, PHI Learning Private Limited
2. The software Engineer Guidebook Gergely Orosz

Reference Books:

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman , McGraw Hill Education

Syllabus Semester-IV

Course code: CSC41MML205	Course name: Numerical Computational Technique	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA- 30 ESE-20
Pre-requisites: Basic knowledge of mathematics.		
Course Objectives: To develop logical understanding of numerical computational technique.		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Apply Numerical analysis which has enormous application in the field of computer science		
CO2: Familiar with numerical solutions of nonlinear equations in a single variable		
CO3: Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.		
CO4: Understand least square curve Fitting and Numerical Integration		

Contents-

Unit	Content	Teaching hours
1	Introduction: Introduction to Numerical Computing, Numeric Data, Analog Computing, digital computing, characteristics of numerical computing, computational environment, new trends in numerical computing.	6
2	Approximation and Errors in computing : Introduction, Significant digit, Inherent errors Numerical error modeling error, blunders, absolute and Relative error Numerical solution of Transcendental Equation : Introduction, Definition Root of a function, Concept of iterative method, Search method for initial guess, bisection method, False position method, Newton Raphson method	8
3	Interpolation I : Definition, polynomial interpolation, Forward Differences, Backward differences Interpolation II : Newton-Gregory Forward Difference Interpolation Formula, Newton-Gregory Backward Difference Interpolation Formula, Newton's divided Difference Interpolation, Lagrange's Interpolation.	8
4	Least square curve Fitting : Concept of best fit, criteria for best fit least square fit, fitting a straight line Numerical Integration: Introduction, Trapezoidal Rule, simpson's 1/3 Rule, Simpson's 3/8 Rule, Romberg Integration.	8

Text Books:

1. Numerical Methods, E.Balguruswamy, McGraw Hill Publication
2. Numerical Computational Methods, Dr. P.B.Patil, Narosa Publication Hous

Reference Books:

1. Introductory Methods of Numerical Analysis, S.S Sastry, PHI Publication
2. Fundamental of Numerical Computation, Tobin and Richard J. Braun, 2017

Syllabus Semester-IV

Course code: CSC41MML206	Course name: Data Communication Network II	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30 ESE-20
Pre-requisites: Fundamental knowledge of computer network and components.		
Course Objectives:		
Theoretical and practical understanding of data communication and computer networks concepts.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Design Computer Network considering particular topology.		
CO2: Understand the relationship of layer with addresses in TCP/IP.		
CO3: Understand and Compare characteristics of protocol.		
CO4: Understand Controlled access		

Contents -

Unit	Content	Teaching hours
1	Error Detection and Correction : Types of Errors, Redundancy, Detection versus Correction, Forward Error Correction versus Retransmission, Coding, Modular Arithmetic. BLOCK CODING, Error Detection, Error Correction, Hamming Distance, Minimum Hamming Distance. LINEAR BLOCK CODES, Minimum Distance for Linear Block Codes, Some Linear Block Codes.	6
2	Data Link Control: FRAMING , Fixed-Size Framing , Variable-Size Framing FLOW AND ERROR CONTROL , Flow Control , Error Control. NOISELESS CHANNELS , Simplest Protocol , Stop-and-Wait Protocol, NOISY CHANNELS , Stop-and-Wait Automatic Repeat Request , Go-Back-N Automatic Repeat Request, Selective Repeat Automatic Repeat Request Piggybacking .HDLC Configurations and Transfer Modes, Frames, Control Field.	8
3	Multiple Access : RANDOMACCESS, ALOHA , Carrier Sense Multiple Access (CSMA) , Carrier Sense Multiple Access with Collision Detection (CSMA/CD) , Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)	8
4	CONTROLLED ACCESS ,Reservation , Polling , Token Passing CHANNELIZATION, Frequency-Division Multiple Access (FDMA) , Time-Division Multiple Access (TDMA) , Code-Division Multiple Access (CDMA).	8

Text Books:

1. Data Communications and Networking, Behrouz A. Forouzan Tata McGraw Hill Education Private Limited 4th edition.2017

Reference Books:

1. Data Communications and Computer Networks , Tenenbaum ,Pearson Publication

Syllabus Semester-IV

Course code: CSC41MMP203 Course name: Practical on Software Engineering			
Course category: Major Mandatory			
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA: 30	ESE-20
Course Objectives:			
Basic knowledge of Software design process			
Course Outcomes: At the end of the course, the students will be able to –			
CO1: Understand software testing process.			
CO2: Understand various step of software development			

Contents -

Sr.no.	Description of Practical	Practical Hours
1	Implementation of Testing Tools : QTP, WinRar	2
2	Manual Writing for Software	2
3	COCOMO Model Estimation for ATM Machine	2
4	Preparation of Risk Management	2
5	Preparation of SRS Document	2
6	Preparation of Axiomatic Specification	2
7	Design architecture for Educational WebApp	2
8	Estimation of Software for Household Robot	2
9	Coding of Software Modeling	2
10	Preparation of ISO Certifications for Software's	2
11	Project	10

Text Books:

1. Fundamentals of Software Engineering, Mall, Rajib, PHI Learning Private Limited

Reference Books:

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, McGraw Hill Education

Syllabus Semester-IV

Course code: CSC41MMP204 Course name: Practical on Numerical Computational Technique
Course category: Major Mandatory
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA- 30 ESE-20
Course Objectives:
To understand Practical Implementation of Numerical Computational Technique
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand implementation of Numerical Technique in Programming.
CO2: Understand Interpolation Technique.

Contents

Sr.no.	Description of Practical	Practical Hours
1	Analysis of different Numerical Computational Technique.	2
2	Implementation of Program in C++ for representation of, Bisection Method	2
3	To develop program in C ++ for representation of, False Position Method	2
4	To develop Program in C ++ for representation of, Newton-Raphson Method	2
5	Implementation of Program in C++ for representation of, addition of two Matrices	2
6	To develop Program in C ++ for representation of, Matrix Inverse Method	2
7	Implementation of Program in C++ for representation of, Newton-Gregory Forward Difference Interpolation Formula.	2
8	To develop Program in C++ for representation of, Newton-Gregory Backward Difference Interpolation Formula.	2
9	To develop Program in C++ for representation of Newton's Divided Difference Interpolation	2
10	Implementation of Program in C for representation of Lagrange's Interpolation	2
11	Project	10

Text Books:

1. Numerical Methods, E.Balguruswamy, McGraw Hill Publication
2. Numerical Computational Methods, Dr. P.B.Patil, Narosa Publication Hous.

Reference Books:

1. Introductory Methods of Numerical Analysis, S.S Sastry, PHI Publication

Syllabus Semester-IV

Course code: CSC41SEP201	Course name: Web Programming	
Course category: Skill Enhancement course		
Credits: 2	Teaching scheme: L-0 P-4	Evaluation scheme: CA: 30 ESE-20
Pre-requisites : Knowledge of Internet		
Course Objectives:		
Design interactive website by using web Programming language		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic concept of Web Programming.		
CO2: Understand design structure website using Web Programming.		
CO3: Understand Protocol and HTTP.		
CO4: Understand registration from using forms tag		

Contents-

Sr.no.	Description of Practical	Practical Hours
1	What is internet & explain the history of Internet	2
2	Explain the world wide web	2
3	What is web page & its types	2
4	Introduction to Protocol & explain HTTP ,IP,SMTP,UDP,FDP,HTTPS	2
5	Introduction is HTML	2
6	Explain basic structure of HTML	4
7	Write a program hello word using HTML	4
8	Implement a program using heading tag & Paragraph tag	4
9	Implement the tag & its type	4
10	Explain list tag with example	4
11	Analysize a Working with hyperlink	4
12	To insert the image in web page using img tag	4
13	Explain table tag with example	4
14	Design registration from using forms tag	4
15	Project	14

Text Books:

1. The Complete Reference HTML and CCS , Thomas A Powell , McGraw Hill Education, Fifth Edition.

Reference Books:

1. HTML:A Beginner's Guide, Wendy Willard, Todd Meister McGraw Hill Education Fourth Edition



Semester: V

Syllabus Semester-V

Course code: CSC41MML301	Course name: Cloud Computing
Course category: Major Mandatory	
Credits: 2	Teaching scheme: L-2 P-0
Evaluation scheme: CA: 30 ESE-20	
Pre-requisites: Basics knowledge of Network Security and Privacy.	
Course Objectives:	
Understanding basics of cloud computing and Key concepts of different cloud computing services.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand Computing Technologies	
CO2: Learn the Concept of Cloud Infrastructure, Web Services and Platforms	
CO3: Understand Business application of Cloud Computing.	
CO4: Understand Cloud Disaster Management.	

Contents -

Unit	Content	Teaching hours
1	Introduction to Cloud computing:- Evolution of computing paradigms, Concept of cloud, Introduction to virtualization and virtual machine, Virtualization in fabric/cluster/grid context, Virtual network, Information model & data model for virtual machine, Service Oriented Architecture, On Demand Computing, Web services: SOAP versus REST.	6
2	Cloud Computing Technologies: Introduction to Cloud Computing, Cloud Architecture and Cloud Storage, Characteristics of cloud computing, Components and Organizational scenarios of clouds, Administering and Monitoring cloud services, Benefits and Limitations of cloud computing, Deploy application over cloud: Cloud computing technology, Accessing the cloud, Cloud Applications, Migrating to the Cloud, Software Licenses, Cloud Cost Model, Service Levels for Cloud Applications..	8
3	Web Services and Platforms: Service Models, Software-as-a-Service, Platform-as-a-Service, Infrastructure -as-a-Service, Process-as-a-Service, Application-as-a-Service, Storage-as-a-Service, Information-as-a-Service, Integration-as-a-Service, Security-as-a-Service, Management/Governance-as-a-Service, Testing-as-a-Service, Comparison among IAAS, PAAS, SAAS Cloud computing platforms.	8
4	Cloud Disaster Management:- Cloud Disaster Management, Disaster Recovery, Disaster Recovery Planning, Benefits of a cloud Disaster Recovery service, Disaster Recovery as a Cloud Service, Cloud data Centers, Comparing approaches.	8

Text Books:

1. Cloud Computing Dr.Pandey U.S. & Dr. Chaudhary KavitaS. Chand Publishing.
2. Cloud Computing Miller Pearson Education India

Reference Books:

1. Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud Mark Wilkins-First Edition.
- 2."Handbook of cloud computing" by Borko Furht, Armando Escalante published by springer (2010).

Syllabus Semester-V

Course code: CSC41MML302	Course name: Machine Learning	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluationscheme: CA-30 ESE-20
Pre-requisites: Basic knowledge of Stastics , Computer Programming, Data Mining		
Course Objectives: To introduce students to the basic concepts and techniques of Machine Learning		
Course Outcomes: At the end of the course, the students will be able to–		
CO1: To become familiar with data representation techniques.		
CO2: Identify machine learning techniques suitable for a given problem		
CO3: Understand of the Data Clustering techniques.		
CO4: Identify machine learning techniques suitable for a given problem		

Contents-

Unit	Content	Teaching hours
1	Introduction to Machine Learning What is Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning, Why Machine Learning?, Framework for Developing Machine Learning Models, State-of-the-Art Languages / Tools In Machine Learning. Descriptive Analytics- Working with Data Frames in Python, Handling Missing Values, and Exploration of Data using Visualization: Drawing Plots, Bar Chart, Histogram, Distribution or Density Plot, Box Plot, Comparing Distributions, Scatter Plot, Pair Plot, Correlation and Heat map.	6
2	Linear Regression- Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model, Model Diagnostics, Multiple Linear Regression.	8
3	Classification Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Classification Tree (Decision Tree Learning) Clustering Overview, Clustering Working, K-Means Clustering, Creating Product Segments Using Clustering, Hierarchical Clustering.	8
4	Advances in Machine Learning- Gradient Descent Algorithm, Scikit-Learn Library for Machine Learning, K-Nearest Neighbors (KNN) Algorithm, Random Forest	8

Text Books:

1. Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley
2. Machine Learning, Author: Saikat Dutt, S. Chandramouli, Amit K.Das, Pearson Pub.

Reference Books:

1. Machine Learning with Python, By Abhishek Vijayvargia, BPB Publications
2. Machine Learning, By Mitchell Tom, McGraw Hill Pub.
3. Applied Machine Learning ,McGrawHill Publication

Syllabus Semester-V

Course code: CSC41MML303	Course name: Introduction to Robotics	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30 ESE-20
Pre-requisites: Basic knowledge of Automation and Control		
Course Objectives:		
The objective of this course is to impart knowledge about robots and their control and design.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic components of robotics, classification of robots and their applications		
CO2: Summarize the history of robotics, technological advances and types of End Effectors		
CO3: Integrate mechanical and electrical hardware for a real prototype of robotic device.		
CO4: Perform kinematic and dynamic analyses with simulation.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Robotics: Introduction to Robotics, history and evolution of robotics, types and components of a robot, Classification of robots, closed-loop and open- loop control systems. Kinematics systems; Definition of mechanisms and manipulators, Social issues and safety.	6
2	Robot Kinematics and Dynamics: Kinematic Modeling, Homogeneous coordinates, translation and rotation Representation, Coordinate transformation, Introduction to Robot Kinematics-forward solution, DH parameters, Jacobian, Singularity, and Statics. Dynamic Modeling: Equations of motion, Euler-Lagrange formulation.	8
3	Sensors and Vision System: Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. Introduction to Cameras, Camera calibration, Geometry of Euclidean/Similarity/Affine/Projective transformations Vision applications in robotics.	8
4	Robot Control: Basics of control, Transfer functions, Control laws: P, PD, PID, Non-linear and advanced controls. Robot Actuation Systems: Actuators, Electric, Hydraulic and Pneumatic; Transmission. Gears, Timing Belts and Bearings, Parameters for selection of actuators. Control Hardware and Interfacing: Embedded systems, Architecture and integration with sensors, actuators, components, Programming for Robot Applications	8

Text Books:

1. Introduction to Robotics: Analysis, Systems, Applications, Robotics and Control Mittal R.K.and Nagrath I. Tata McGraw Hill.

Reference Books:

1. Introduction to Robotics, Saha, S.K McGraw-Hill Higher Education, New Delhi, 2014.Embedded System Design Steve Heath, 2nd Edition, Newnes, Burlington,2003.

Syllabus Semester-V

Course code: CSC41M MP301	Course name: Practical on Cloud Computing
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA-30 ESE-20	
Pre-requisites: Basic knowledge of Computer Network and operating system	
Course Objectives: To understand Practical Implementation of Cloud computing	
Course Outcomes: At the end of the course, the students will be able to-	
CO1: Understand Cloud Computing Basics	
CO2: Understand Concept of Cloud Infrastructure.	
CO3: Cloud computing Security Components	

Contents -

Sr.No.	List of Practical	Practical Hours
1	Install Virtual box/VMware Workstation with different flavors of Linux or windows Operating System	2
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs	2
3	Install Google App Engine. Create hello world app and other simple web applications using python/java.	2
4	Use Google App Engine launcher to launch the web applications.	2
5	Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim	2
6	Find a procedure to transfer the Text files from one virtual machine to another virtual machine	2
7	Find a procedure to transfer the Image files from one virtual machine to another virtual machine	2
8	Find a procedure to transfer the Video files from one virtual machine to another virtual machine	2
9	Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)	2
10	Install Hadoop single node cluster and run simple applications like word count.	2
11	Project	10

Text Books:

1. Cloud Computing Dr.Pandey U.S. & Dr. Chaudhary Kavita S. Chand Publishing.
2. Cloud Computing Miller Pearson Education India.

Reference Books:

1. Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud Mark Wilkins-First Edition.

Syllabus Semester-V

Course code: CSC41M MP302 Course name: Practical Based on Machine Learning
Course category: Major Mandatory
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA:30 ESE-20
Pre-requisites: Basic knowledge of Statistics, Computer Programming, Data Mining.
Course Objectives: To introduce students to the basic concepts and techniques of Machine Learning.
Course Outcomes: At the end of the course ,the students will be able to–
CO1: Understand the ethical implications and considerations in machine learning applications.
CO2: Develop skills to select appropriate algorithms for problems

Contents -

Sr.No.	Description of Practical	Practical Hours
1	Working with Data Frames in Python using libraries such as Pandas.	2
2	Exploring data using visualization techniques: creating various plots such as bar charts, histograms, scatter plots, etc., using libraries like Matplotlib and Seaborn.	2
3	Reading Data Form CSV File.	2
4	Implement simple linear regression from scratch or using libraries like scikit-learn	2
5	Extend to multiple linear regression and compare the results.	2
6	Implement binary logistic regression for a classification task.	2
7	Implement K-Means clustering algorithm from scratch or using libraries like scikit-learn.	2
8	Use clustering to create product segments or customer segments from a given dataset.	2
9	Implement the K-Nearest Neighbors (KNN) algorithm for classification or Regression tasks.	2
10	Explore various analytics and machine learning use cases across different industries.	2
11	Project	10

Text Books:

1. Applied Machine Learning, M. Gopal, McGraw-Hill Education

Reference Books:

1. Machine Learning for Text, Charu C. Aggarwal, Springer

Syllabus Semester-V

Course code: CSC41MEL301	Course name: - Artificial Intelligence
Course category: - Elective	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA- 60 ESE-40	
Pre-requisites: Programming Knowledge, knowledge of Mathematics concepts like probability, statistics, Algebra, Matrix, Calculus	
Course Objectives:	
To understand the concept of Artificial Intelligence strength and weakness of problem solving and search algorithms, reasoning.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Able to evaluate Artificial Intelligence methods.	
CO2: Analyze and illustrate how search algorithms play vital role in problem solving, inference, perception, knowledge representation and learning.	
CO3: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems	

Contents -

Unit	Content	Teaching hours
1	Introduction to AI: Basic Definitions, History of AI, Overview of AI, Evolution of AI, Applications of AI, Classification of AI. Artificial Intelligence vs Machine learning.	9
2	Search algorithm in AI: Introduction Search Algorithm Terminologies, Importance of Search Algorithms Properties of Search Algorithms: Types of search algorithms: uninformed (Blind search) search and informed search (Heuristic search) algorithms.	9
3	Uninformed Blind Search Algorithm: Introduction. types of uninformed search algorithms Breadth-first Search, Depth-first Search Depth-limited Search, Iterative deepening depth-first search, Uniform cost search, Bidirectional Search Advantage ,Disadvantage, Example	9
4	Informed Search Algorithm: Introduction, Key Characteristics of Informed Search Algorithms, types of Informed Search algorithm, Greedy Best First Search, A* Algorithm Advantage & limitation.	9
5	Concepts of knowledge and reasoning: Introduction, types of Knowledge in AI, Declarative , Procedural, Meta Heuristic Structural Knowledge, Applications of Knowledge Representation in AI, Reasoning in AI, types of Reasoning in AI, Applications of Reasoning in AI	9

Text Books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
2. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016

Reference Books:

1. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2. Nilsson Nils J, "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4
3. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Syllabus Semester-V

Course code: CSC41M EL302	Course name: -Blockchain Technology
Course category: -Elective	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA-60 ESE-40	
Pre-requisites: Basic knowledge of programming languages, data structure algorithms, DBMS concepts.	
Course Objectives :	
To gain the awareness about the concepts of various implementations of blockchain technology	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Student will be able to understand the fundamentals of blockchain technology	
CO2: Apply knowledge of implementations of Bitcoin, Ethereum and Hyperledger to develop solutions in the appropriate domains.	

Contents -

Unit	Content	Teaching hours
1	Introduction to Block chain Technology: Distributed systems ,The history of blockchain, Benefits and limitations of blockchain, Features of a blockchain decentralization, immutability, transparency, and security, Types of blockchain: public, private, and consortium.	9
2	Structure of Blockchain: Blocks, transactions, and hashes, Components of a blockchain: chain of blocks, distributed ledger, and consensus mechanisms, How blockchain works:transaction flow, validation, and mining.	9
3	Cryptography in Blockchain: Introduction – cryptographic primitives – Symmetric cryptography- private keys, stream ciphers and block ciphers, Asymmetric cryptography- public key, Digital Signatures, Hash functions, Merkle trees.	9
4	BitCoin Introduction : Definition, Bitcoin structure and operation, Elliptic Curve Cryptography (ECC), Private keys in Bitcoin, Public keys in Bitcoin, Addresses in Bitcoin, The transaction life cycle of bitcoin, Transaction verification.	9
5	Ethereum: Introduction, Ethereum block chain architecture- The Ethereum network- Mainnet, testnet, private net, Components of the Ethereum ecosystem- keys and addresses, accounts, Transactions and messages, Ethereum Development Environment.	9

Text Books:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018.

Reference Books:

1. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends, in 2017 IEEE International Congress on Big Data (BigData Congress), 2017

Syllabus Semester-V

Course code: CSC41M EP301 Course name: Practical Based on Artificial Intelligence
Course category: Elective
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA-30 ESE- 20
Pre-requisites : Basic Knowledge of, C++,Python programming , probability, statistics, Algebra, Matrix, Calculus
Course Objectives:
To understand implementation of various problem , search algorithms use in Artificial Intelligence
Course Outcomes: At the end of the course, the students will be able to -
CO1: Able to evaluate Artificial Intelligence (AI) methods.
CO2: Describe their foundations.
CO3: Analyze and illustrate how search algorithms play vital role in problem solving, inference, perception, knowledge representation and learning.
CO4: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems

Contents-

Sr.No.	Description of Practical	Practical Hours
1	Write a program to implement depth first search Algorithm	2
2	Write a program to implement breadth first search Algorithm	2
3	Write a program to solve tower of Hanoi problem	2
4	Write a program for Hill climbing problem	2
5	Write a program to implement A* algorithm	2
6	Write a program to solve Water jug problem.	2
7	Design the simulation of tic-tac-toe game using min-max algorithm	2
8	Write a program to shuffle Deck of cards	2
9	Write a program to derive the predicate.	2
10	Write a program which contains three predicates: male, female, parent. Make rules for following family relations: father, mother, grandfather, Grandmother, brother, sister, uncle, aunt, nephew, and niece, cousin. And answer the questions.	2
11	Project	10

Text Books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall
2. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016

Reference Books:

1. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2. Nilsson Nils J, "Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco,CA, ISBN: 978-1-55-860467-4
3. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

Syllabus **Semester-V**

Course code: CSC41M EP302 Course name: Practical Based on Blockchain Technology
Course category: Elective
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA-30 ESE-20
Pre-requisites: Basic knowledge of Matlab Software
Course Objectives: Understanding Block chain Fundamentals, creating basic blocks.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Knowledge of Blockchain Concepts and creating basic blocks.
CO2: Proficiency in Blockchain Development.
CO3: Ability to Design and Implement Blockchain Applications.
CO4: Evaluation and Analysis of Blockchain Systems.

Contents-

Sr. No.	Content	Practical Hours
1	Generate SHA-256 hashes for input data using Matlab	2
2	Create a genesis block for the blockchain.	2
3	Append a block to the blockchain.	2
4	Implement a simple proof-of-work mechanism.	2
5	Verify the integrity of a blockchain.	2
6	Display the blockchain as a table.	2
7	Simulate multiple nodes maintaining a blockchain.	2
8	Ensure blocks have consistent timestamps.	2
9	Add transaction data to the blockchain.	2
10	Handle blockchain forks and select the longest chain.	2
11	Project	10

Text Books:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition. Birmingham: Packt Publishing, 2018.

Reference Books:

1. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends, in 2017 IEEE International Congress on Big Data (BigData Congress), 2017.

Syllabus Semester-V

Course code : CSC41VSP301	Course name : Python Programming
Course category: Vocational Skill Course	
Credits: 2	Teaching scheme: L-0 P-4
Evaluation scheme : CA:30 ESE-20	
Pre-requisites: Basic knowledge of Computer Programming	
Course Objectives:	
Describe the core syntax and semantics of Python programming language.	
Course Outcomes: At the end of the course, the students will be able to:	
CO1: To learn basics of Python.	
CO2: Develop console application.	
CO3: To Learn Python Data Types.	
CO4: To illustrate the process of structuring the data using lists, dictionaries, tuples and sets.	

Contents-

Sr. No.	Description of Practical	Practical Hours
1	Installing Python and Shell or Notebook, Launching the IPython Shell, Launching the Jupyter Notebook	2
2	Passing Values to and from the Shell, Shell-Related Magic Command, Errors and Debugging, Controlling Exceptions	2
3	Aggregations: Min, Max, and Everything in Between, Summing the Values in an Array, Minimum and Maximum, Example: What Is the Average Height of US Presidents?	2
4	Sorting Arrays, Fast Sorting in NumPy: np.sort and np.argsort, Partial Sorts: Partitioning, Example: k-Nearest Neighbors	2
5	Data Indexing and Selection, Data Selection in Series, Data Selection in DataFrame, Operating on Data in Pandas, Ufuncs: Index Preservation, UFuncs: Index Alignment	2
6	Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values	4
7	Vectorized String Operations , Introducing Pandas String Operations, Tables of Pandas String Methods, Example: Recipe Database	4
8	General Matplotlib Tips, Importing matplotlib, Setting Styles, show() or No show()? How to Display Your Plots, Saving Figures to File	4
9	Text and Annotation, Example: Effect of Holidays on US Births, Transforms and Text Position, Arrows and Annotation, Customizing Ticks, Major and Minor Ticks, Hiding Ticks or Labels, Reducing or Increasing the Number of Ticks	4
10	Three-Dimensional Plotting in Matplotlib, Three-Dimensional Points and Lines, Three-Dimensional Contour Plots	4
11	Installing Python and Shell or Notebook, Launching the IPython Shell, Launching the Jupyter Notebook	4
12	Passing Values to and from the Shell, Shell-Related Magic Command, Errors and Debugging, Controlling Exceptions	4
13	Aggregations: Min, Max, and Everything in Between, Summing the Values in an Array, Minimum and Maximum, Example: What Is the Average Height of US Presidents?	4
14	Sorting Arrays, Fast Sorting in NumPy: np.sort and np.argsort, Partial Sorts: Partitioning, Example: k-Nearest Neighbors	4
15	Project	14

Text Books:

1. Introduction to Python Programming Gowrishankar S, Veena A, CRC Press/Taylor 1st Edition
2. Core Python Programming Chun, J Wesley Pearson 2nd Edition

Reference Books:

1. Learning Python Lutz, Mark O Rielly 4th Edition
2. Head First Python Barry, Paul O Rielly 2nd Edition



Semester: VI

Syllabus Semester-VI

Course code: CSC41MML304	Course name: Digital Image Processing		
Course category: Major Mandatory			
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA- 30	ESE-20
Pre-requisites: Basics knowledge of Computer Programming			
Course Objectives: Processing of Image data for extracting pictorial information.			
Course Outcomes: At the end of the course, the students will be able to -			
CO1: Understand basic Digital Image processing.			
CO2: Understand the different Image acquisition and processing techniques.			
CO3: Get familiar with the techniques used for Image enhancement and Segmentation.			
CO4: Design GUI using digital image processing techniques			

Contents -

Unit	Content	Teaching hours
1	Introduction of Digital Image Processing: Applications of Image Processing, Fundamental Steps of Digital Image Processing, Components of an Image Processing System. Image Sensing and Acquisition: Image Acquisition using a Single Sensor, Sensor Strips and Sensors Array, Image Sampling and Quantization.	6
2	Image Enhancement and Filtering Techniques: Intensity Transformation Function, Histogram Processing, Spatial Filtering, Spatial Correlation and Convolution, Generating Spatial Filter Mask, Smoothing Spatial Filters, Sharpening Spatial Filter. The Fourier Transform of Sampled Functions, Discrete Fourier Transform.	8
3	A Model of Image Degradation/Restoration Process: Noise Models, Mean Filter, Order-Statistics Filter, Adaptive Filter, Band pass Filter and Notch Filter. Wavelet Function, Wavelet Transform, Fast Wavelet Transform	8
4	Image Compression and Morphological Operations Image Compression: Coding Redundancy, Spatial and Temporal Redundancy Morphological Operations: Erosion, Dilation, Duality, Opening and Closing, The Hit-or- Miss Transformation. Image Segmentation Point, Line Edge Detection: Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection.	8

Text Books:

1. Rafael C Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, India 3rd Edition
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall

Reference Books:

1. Kenneth R. Castleman, Digital Image Processing, Pearson Education, India
2. Rafael C Gonzalez, Richard E. Woods, Steven L. Eddins, Image Processing Using MATLAB, McGraw Hill, 2nd Edition

Syllabus Semester-VI

Course code: CSC41MML305	Course name: Deep Learning
Course category: Major Mandatory	
Credits: 2	Teaching scheme: L-2 P-0
Evaluation scheme: CA-30 ESE-20	
Pre-requisites: Basic Understanding of Mathematics, Statistics, Python programming languages.	
Course Objectives:	
The objective of this course is to introduce students to deep learning algorithms and their applications in order to solve real problems.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Describe the feed-forward and deep networks.	
CO2: Design single and multi-layer feed-forward deep networks and tune various hyper-parameters.	
CO3: Implement deep neural networks to solve a problem	
CO4: Analyze performance of deep networks.	

Contents -

Unit	Content	Teaching Hours
1	Introduction to Deep Learning: Basic building blocks of Deep Learning, Principles of Deep Learning , Venn diagram, Differences between Artificial Intelligence, Machine Learning and Deep Learning , Deep Learning workflow diagram, Applications of Deep Learning,	6
2	Neural Networks: Understanding key components of Neural Networks in Deep Learning: Neurons, Connections, Weights and Biases, Propagation Functions, Learning Rule. Image illustration of the analogy between a biological neuron and an artificial neuron, Adaptive learning environment: Three-stage process (Input Computation, Output Generation, Iterative Refinement), Layers in Neural Network Architecture: Input Layer, Hidden Layers, Output Layer, Advantages and Disadvantages of Neural Networks.	8
3	Working of Neural Networks: Forward Propagation, Linear Transformation, Activation, Back propagation (Loss Calculation, Gradient Calculation, Weight Update), Iteration. Types of Neural Networks and Deep Learning Algorithms, feed-forward neural network, Multilayer Perceptron (MLP), Convolution Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Artificial Neural Networks (ANN)	8
4	Deep Network: Long Short Term Memory Networks (LSTMs), Generative Adversarial Networks (GANs), Supervised and Unsupervised Learning with Deep Network	8

Text Books:

1. Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm”, O’Reilly, 2017.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016

Reference Books:

1. Bunduma, N. (2017). Fundamentals of Deep Learning
2. Heaton, J. (2015). Deep Learning and Neural Networks, Heaton Research Inc.

Syllabus Semester-VI

Course code: CSC41MML306	Course name: Theory of Computation		
Course category: Major Mandatory			
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30	ESE-20
Pre-requisites: Basic Knowledge of Programming Languages, Data Structures and Algorithms			
Course Objectives:			
To understand the foundational concepts of computation, analyze formal languages and automata, explore computability and complexity, apply mathematical proof techniques, and develop problem-solving skills for designing computational models.			
Course Outcomes: At the end of the course, the students will be able to-			
CO1: Design automata, grammars, and expressions for modeling computational problems.			
CO2: Analyze Turing machines and distinguish between decidable and un-decidable problems.			
CO3: Classify problems into complexity classes and evaluate computational efficiency.			
CO4: Apply computation theory to real-world problems like pattern matching and compiler design.			

Contents -

Unit	Content	Teaching hours
1	Review of Mathematical Theory: Sets, Functions, Logical statements, Proofs, relations, languages, Mathematical induction, strong principle, Recursive definitions.	6
2	Regular Languages and Finite Automata: Regular expressions, regular, languages, applications, Automata with output-Moore machine, Mealy, machine, Finite automata, memory requirement in a recognizer, definition, union, intersection and complement of regular languages. Non Determinism Finite Automata, Conversion from NFA to FA, Non Determinism Finite Automata Conversion of NFA Minimization of Finite automata Regular And Non Regular Languages, pumping lemma.	8
3	Context free grammar (CFG): Definition, Unions Concatenations And Kleen's of Context free language Regular grammar, Derivations and Languages, Relationship between derivation and derivation trees, Ambiguity Unambiguous CFG and Algebraic Expressions BacosNaur Form (BNF), Normal Form CNF.	8
4	Pushdown Automata: Definition and working of PDA, Types of PDA: Deterministic (DPDA) and Non-Deterministic PDA (NPDA), CFL And NCFL: Definition, deterministic PDA, Equivalence of CFG and PDA, Equivalence of CFG and PDA: Conversion of CFG to PDA, Conversion of PDA to CFG, Pumping lemma for CFL, Proof and applications for proving non-CFLs, Closure properties of CFL, Intersections and Complements of CFL, Non-CFL, Membership problem, emptiness problem, and equivalence problem.	8

Text Books:

1. An introduction to automata theory and formal languages By Adesh K. Pandey, Publisher: S. K. Kataria & Sons.

Reference Books:

1. Introduction to Computer Theory by Deniel I. Cohen, Joh Wiley & Sons, Inc.

Syllabus

Semester-VI

Course code: CSC41MMP303	Course name: Practical on Digital Image Processing		
Course category: Major Mandatory			
Credits: 1	Teaching scheme: T-0 P-2	Evaluation scheme: CA-30	ESE-20
Pre-requisites : Basic Knowledge of Matlab software ,Digital Image processing			
Course Objectives:			
Perform the different operations of different steps included in Digital Image Processing on an image.			
Course Outcomes: At the end of the course, the students will be able to -			
CO1: Understand the Image processing Techniques			
CO2: Apply different Filters on an image.			
CO3: Compress and restore an image			
CO4: Segment an Image			

Contents-

Sr.No.	Description of Practical	Practical Hours
1	Write program for Histogram Equalization and Histogram Matching	2
2	Write program for Discrete Fourier Transform	2
3	Write program for Smoothing Sharpening Spatial Filter	2
4	Write a program for Adaptive Filter	2
5	Write a program for Bandpass Filter and Notch Filter.	2
6	Write program for Wavelet Transform	2
7	Write program for Image Compression	2
8	Write program on Morphological operations on an image	2
9	write program for edge detection	2
10	Write program for Line Detection	2
11	Project	10

Text Books:

1 .Rafael C Gonzalez, Richard E. Woods, Steven L. Eddins, Image Processing Using MATLAB, McGraw Hill, 2nd Edition

Reference Books:

1. Kenneth R. Castleman, Digital Image Processing, Pearson Education, India

Syllabus Semester-VI

Course code: CSC41M MP304	Course name: Practical on Deep Learning
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-2 P-0
Evaluation scheme: CA:30 ESE-20	
Pre-requisites: Basic knowledge statics, Python programming languages	
Course Objectives:	
The objective of this course is to introduce students to deep learning algorithms and their applications in order to solve real problems.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Describe the feed-forward and deep networks.	
CO2: Design single and multi-layer feed-forward deep networks and tune various hyper-parameters.	
CO3: Implement deep neural networks to solve a problem	
CO4: Analyze performance of deep networks.	

Contents-

Sr.No.	Description of Practical	Practical Hours
1	Introduction of Deep Learning , Workflow Venn diagram	2
2	Introduction of Neural Network Architecture & diagram	2
3	Implement a feed-forward neural network	2
4	Train and test a feed-forward neural network	2
5	Implement a Multilayer Perceptron (MLP) neural network	2
6	Train and test a Multilayer Perceptron (MLP) neural network	2
7	Implementation of Convolutional Neural Networks (CNNs)	2
8	Train and test a Convolutional Neural Networks (CNNs)	2
9	Implementation of Recurrent Neural Networks (RNNs)	2
10	Train and test a Recurrent Neural Networks (RNNs)	2
11	Project	10

Text Books:

1. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017.
2. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2016

Reference Books:

1. Bunduma, N. (2017). Fundamentals of Deep Learning
2. Heaton, J.(2015). Deep Learning and Neural Networks, Heaton Research Inc.

Syllabus Semester-VI

Course code: CSC41M EL303	Course name: Software Cost Estimation
Course category: Elective	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA-60 ESE-40	
Pre-requisites: Basic Knowledge of Software Engineering	
Course Objectives: To get well familiar with software effort estimation as one of the basic elements of planning and managing software development which mostly predict the success of failure of software	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand software development and the application of quantitative approaches for managing software development projects	
CO2: Terminological and methodological principles of software effort estimation	
CO3: Common factors influencing software project effort.	
CO4: Basic types of uncertainty and common sources of uncertainty	

Contents -

Unit	Content	Teaching hours
1	Principles of effort and cost estimation: Basic Concepts of Effort Estimation, Effort Estimation Stakeholders, Project Equilibrium Triangles, Objectives of Effort Estimation, Estimation Life Cycle, Basic Components of Project Effort, Productivity	9
2	Common Factors Influencing Software Project Effort : Difference Between Context Factors and Effort Drivers, Scale Factors, Economies of Scale in Parametric Effort Models, Factors Influencing Effect of Scale, Effort Drivers, Process Characteristics, Product Characteristics, Project Characteristics, Selecting Relevant Factors Influencing Effort, Reducing the Negative Impact of Scale and Effort Drivers	9
3	Estimation Under Uncertainty : Nature of Estimation Uncertainty, Sources of Uncertainty, Representing Uncertainty, Handling Uncertainty, Prediction Intervals Based on Estimation Accuracy, Prediction Intervals Based on Bootstrapping, Evaluating Actual Uncertainty of Prediction Intervals, Reducing Uncertainty,	9
4	Basic Estimation Strategies : Top-Down Estimation Approach, Bottom-Up Estimation Approach, Method of Proportions, Aggregating Component “Bottom” Estimates, Selecting Appropriate Estimation Strategy, Using Multiple Alternative Estimation Methods, Combining Alternative Estimates,	9
5	Selecting an Appropriate Estimation Method: Classification of Effort Estimation Methods, Proprietary vs. Nonproprietary Methods, Data-Driven Methods, Parametric vs. Nonparametric Estimation, Expert-Based Methods, Hybrid Methods, Comparison of Estimation Paradigms.	9

Text Books:

1. Software Project Effort Estimation Foundations and Best Practice Guidelines for Success, Adam Trendowicz Ross Jeffery, ISBN 978-3-319-03628-1, Springer Cham Heidelberg New York Dordrecht London

Reference Books:

1. Practical Software Project Estimation: A Toolkit for Estimating Software Development Effort & Duration: A Toolkit for Estimating Software Development Effort, Peter Hill (Author), McGraw-Hill Education
2. Software Estimation without Guessing: Effective Planning in Imperfect, by George Dinwiddie, Publisher O'Reilly

Syllabus Semester-VI

Course code: CSC41MEL304	Course name: Data Analytics	
Course category: Elective		
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA-60, ESE-40
Pre-requisites: Basics Knowledge of R Programming		
Course Objectives: The objective of this course is to provide comprehensive knowledge of Data Analytics and R programming paradigms		
Course Outcomes: At the end of the course, the students will be able to -		
CO 1: Understand the Basics of Data Analytics		
CO 2: Handle the Data Matrices, Arrays and Lists in R Programming.		
CO 3: Creating Data Frames for data manipulations		
CO 4: Apply Object Oriented Programming Concepts in R		
CO 5: Develop Interfacing using R Programming		

Contents –

Unit	Content	Teaching hours
1	Introduction: Introducing to R , R Data Structures ,Help functions in R , Vectors , Scalars ,Declarations, recycling , Common Vector operations , Using all and any, Vectorized operations ,NA and NULL values , Filtering Vectorised if-then else , Vector Equality, Vector Element names	9
2	Matrices, Arrays And Lists: Creating matrices, Matrix operations, Applying Functions to Matrix Rows and Columns, Adding and deleting rows and columns, Vector/Matrix Distinction, Avoiding Dimension Reduction, Higher Dimensional arrays , lists , Creating lists, General list operations , Accessing list components and values , applying functions to lists , recursive lists	9
3	Data Frames: Creating Data Frames, Matrix-like operations in frames, Merging Data Frames, Applying functions to Data frames, Factors and Tables, factors and levels, Common functions used with factors, Working with tables, Other factors and table related functions , Control statements , Arithmetic and Boolean operators and values, Default values for arguments, Returning Boolean values, functions are objects, Environment and Scope issues , Writing Upstairs ,Recursion, Replacement functions , Tools for composing function code , Math and Simulations in R	9
4	Object Oriented Programming: S3 Classes , S4 Classes, Managing your objects ,Input Output ,Accessing keyboard and monitor ,Reading and writing files, Accessing the internet ,String Manipulation Graphics, Creating Graphs ,Customizing Graphs, Saving graphs to files , Creating three-dimensional plots	9
5	Interfacing: Interfacing R to other languages, Parallel R, Basic Statistics, Linear Model, Generalized Linear models, Non-linear models , Time Series and Auto-correlation Clustering.	9

Text Books:

1. The Art of R Programming: A Tour of Statistical Software Design by Norman Matloff No Starch Press
2. R for Everyone: Advanced Analytics and Graphics by Jared P. Lander Addison-Wesley Data & Analytics Series

Reference Books:

1. Beginning R – The Statistical Programming Language by Mark Gardener Wiley
2. Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R Robert I. Kabacoff Amazon Digital South Asia Services Inc.

Syllabus Semester-VI

Course code: CSC41M EP303 Course name: Practical Based on Software Cost Estimation
Course category: Elective
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA-30 ESE-20
Pre-requisites : Basic Knowledge of Software Engineering
Course Objectives: Understand the different threats and challenges in software effort estimation and managing software development, and different measures related with software effort and cost estimation.
Course Outcomes: At the end of the course, the students will be able to
CO1: Understand with threats and challenges of software development projects
CO2: Understand different approaches with software development.
CO3: Get knowledge of various evaluation and review techniques of software effort estimation
CO4: Apply the knowledge to real software cost and effort projects

Contents-

Sr.No.	Description of Practical	Practical Hours
1	Study of effort estimation threats and challenges of software development projects	2
2	Effort Estimation Stakeholders and their role and impact are software estimation.	2
3	Study of Probabilistic vs. Possibilistic vs. Granulation uncertainty	2
4	Measurement Error of Function Point Analysis	2
5	Study of actual loss in accuracy due to artificially increased precision.	2
6	Study of Computing Prediction Interval Based on Historical Data	2
7	Study of Top-Down and Bottom-Up Deliverable-Oriented WBS	2
8	Study of Bottom-Up Estimation Using the Method of Proportions	2
9	Program Evaluation and Review Technique (PERT)	2
10	Case study on software cost estimation	2
11	Project	10

Text Books:

1. Software Project Effort Estimation Foundations and Best Practice Guidelines for Success, Adam Trendowicz Ross Jeffery, ISBN 978-3-319-03628-1, Springer Cham Heidelberg New York Dordrecht London.

Reference Books: :

1. Practical Software Project Estimation: A Toolkit for Estimating Software Development Effort & Duration: A Toolkit for Estimating Software Development Effort, Peter Hill (Author), McGraw-Hill Education
2. Software Estimation without Guessing: Effective Planning in Imperfect, by George Dinwiddie, Publisher O'Reilly

Syllabus Semester-VI

Course code: CSC41MEP304	Course name: Practical Based on Data Analytics
Course category: Elective	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA-30, ESE-20	
Pre-requisites: Basics Knowledge of R Programming	
Course Objectives: The objective of this course is to provide comprehensive knowledge of R programming paradigms and Data Analytics.	
Course Outcomes: At the end of the course, the students will be able to -	
CO 1: Understand the Basics of R Programming	
CO 2: Handle the Data Matrices, Arrays and Lists	
CO 3: Creating Data Frames for data manipulations	
CO 4: Apply Object Oriented Programming Concepts in R	
CO 5: Develop Interfacing using R Programming	

Contents -

Sr.No.	Description of Practical	Practical hours
1	Installing R and R Studio IDE	2
2	Using R execute the basic commands, array, list and frames.	2
3	Create a Matrix using R and Perform the operations addition, subtraction, multiplication, transpose, inverse etc.	2
4	Using R Execute the statistical functions: mean, median, mode, quartiles, range, inter quartile range, histogram.	2
5	Using R import the data from Excel/.CSV file and find mean, median, mode, quartiles, range, inter quartile range, histogram.	2
6	Using R import the data from Excel/.CSV file and find standard deviation, variance and co-variance.	2
7	Using R import the data from Excel/.CSV file and find skewness and kurtosis.	2
8	Perform hypothesis testing using R	2
9	Plot the scatter diagram and find the correlation coefficient using R.	2
10	Perform the linear regression using R.	2
11	Project	10

Text Books:

1. The Art of R Programming: A Tour of Statistical Software Design by Norman Matloff No Starch Press
2. R for Everyone: Advanced Analytics and Graphics by Jared P. Lander Addison-Wesley Data & Analytics Series

Reference Books:

1. Beginning R – The Statistical Programming Language by Mark Gardener Wiley
2. Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R Robert I. I. Knell Amazon Digital South Asia Services Inc.

Semester: VII

Syllabus Semester-VII

Course Code: CSC41MML401	Course Name: Neural Networks	Course Category: Major Mandatory
Credits: 3	Teaching Scheme:L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic knowledge of Mathematics, Understanding of Probability and Statistics, Fundamentals of Programming, Basic concepts of Data Structures and Algorithms.		
Course Objectives: To understand different neural network architectures and training algorithms		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Explain the fundamental concepts of artificial neural networks.		
CO2: Distinguish between different neural network architectures and learning paradigms.		
CO3: Design and develop single-layer and multi-layer neural network models for data science problems.		
CO4: Apply appropriate learning algorithms and evaluate neural network performance using suitable metrics.		
CO5: Analyze and apply neural network techniques to solve real-world classification and prediction problems.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Neural Networks: Biological neurons and brain-inspired computing, Structure and functioning of biological neuron, Artificial neuron model, Components of artificial neuron, Types of neural networks, Feedforward and feedback networks, Activation functions: step, sigmoid, tanh, ReLU, Learning paradigms: supervised, unsupervised, reinforcement, Historical development of neural networks, Applications of neural networks	9
2	Single Layer Neural Networks: Perceptron model, Mathematical formulation of perceptron, Perceptron learning algorithm, Convergence of perceptron algorithm, Adaline model, Madaline model, Delta learning rule, Linear separability, Limitations of single-layer networks, Applications of single-layer neural networks	9
3	Multilayer Neural Networks: Multilayer perceptron (MLP) architecture, Forward propagation, Backpropagation algorithm, Gradient descent learning, Error surfaces, Convergence issues, Overfitting and underfitting, Regularization techniques, Performance evaluation metrics.	9
4	Advanced Neural Network Models: Radial Basis Function (RBF) networks, Structure and training of RBF networks, Self-Organizing Maps (SOM), Competitive learning, Hopfield networks, Energy function, Boltzmann machines, Stochastic learning, Recurrent Neural Networks (RNN), Feedback connections	9
5	Deep Learning and Applications: Introduction to deep learning, Deep neural network architectures, Convolutional Neural Networks (CNN), Convolution and pooling operations, Long Short-Term Memory (LSTM) networks, Gated mechanisms, Autoencoders, Dimensionality reduction, Applications in data science.	9

Text Books: 1. Simon Haykin, Neural Networks and Learning Machines, Pearson
B. Yegnanarayana, Artificial Neural Networks, PHI

Reference Books: 1. Marting T. Hagan et al., Neural Network Design, 2nd edition.
2. Ian Goodfellow et al., Deep Learning, MIT Press
3. S. Rajasekaran, G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI

Syllabus Semester-VII

Course code: CSC41MML402	Course name: - Data Warehousing and Data Mining	
Course category: Major Mandatory		
Credits: 03	Teaching scheme: L-3 P-0	Evaluation scheme: CA:60 ESE-40
Pre-requisites: Students should have prior knowledge of the following subjects and concepts: Database Management Systems (DBMS) Basic Programming Concepts ,Analytical and Problem-Solving Skills		
Course Objectives: To understand the concepts and architecture of data warehousing		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the fundamentals, architecture, and components of data warehousing systems.		
CO2: Design data warehouse schemas and understand ETL processes for data integration.		
CO3: Describe the concepts and processes involved in data mining and knowledge discovery.		
CO4: Apply classification and association rule mining techniques to analyze datasets.		
CO5: Analyze clustering techniques and identify suitable data mining methods for real-world problems.		

Contents

Unit	Content	Teaching hours
1	Introduction to Data Warehousing: Introduction to Data Warehousing, Need for Data Warehousing, Characteristics of Data Warehouse, Data Warehouse Architecture, Components of Data Warehouse	9
2	Data Warehouse Design: Data Warehouse Design Process, ETL (Extract, Transform, Load) Process, Data Cleaning, Data Integration Data Reduction and Transformation	9
3	Data Mining: Introduction to Data Mining, Data Mining vs Data Warehousing, Knowledge Discovery in Databases (KDD) Process, Data Mining Functionalities, Issues and Challenges in Data Mining, Applications of Data Mining	9
4	Data Mining Techniques: Classification Techniques, Decision Tree Induction, Bayesian Classification ,Rule-Based Classification, Association Rule Mining, Market Basket Analysis ,Apriori Algorithm, FP-Growth Algorithm	9
5	Clustering & Advanced Topics : Clustering Concepts, Types of Clustering Methods, Partitioning Methods: K-Means, Hierarchical Clustering Density-Based Clustering (DBSCAN – overview),Outlier Detection, Introduction to Web Mining, Introduction to Text Mining	9

Text Books: 1. Data Mining: Concepts and Techniques- Jiawei Han, Micheline Kamber & Jian Pei
2. Data Warehousing Fundamentals-Paulraj Ponnaiah

Reference Books: 1. Data Warehousing in the Real World *Sam Anahory & Dennis Murray* guide.
2. Principles of Data Mining — *David Hand, Heikki Mannila & Padhraic Smyth* — Good for theoretical insights.
3. Data Warehousing, Data Mining & OLAP — *Alex Bezon & Stephen J. Smith* — Combined topic coverage.

**Syllabus
Semester-VII**

Course code: CSC41MML403	Course name: - Network Security
Course category: Major Mandatory	
Credits: 03	Teaching scheme: L-3 P-0
Evaluation scheme: CA: 60 ESE-40	
Pre-requisites: Computer Networks, Operating Systems	
Course Objectives: Identify common network threats, attacks, and vulnerabilities.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Define and distinguish security goals and related concepts.	
CO2: Describe defensive strategies against common attacks.	
CO3: Understand secure protocol operations in network environments	
CO4: Suggest appropriate network monitoring practices.	
CO5: Analyze wireless, cloud, mobile/BYOD, virtual, and IoT network security issues.	

Contents

Unit	Content	Teaching hours
1	Fundamentals of Network Security : Need for network security, Security goals: Confidentiality, Integrity, Availability (CIA), Threats, vulnerabilities, risks, Security policies and models, Basics of cryptography, Symmetric and asymmetric encryption, Hash functions, Digital signatures, Public Key Infrastructure (PKI)	9
2	Network Attacks and Vulnerabilities: Passive vs active attacks, Network reconnaissance and scanning, IP spoofing, ARP poisoning, DNS attacks, Session hijacking, Man-in-the-Middle attacks, Denial of Service (DoS) and Distributed DoS attacks, Malware and botnets (network perspective)	9
3	Secure Network Protocol: Secure socket layer (SSL) and Transport Layer Security (TLS), Secure Shell (SSH), HTTPS and secure email concepts, IPSec architecture: AH and ESP, Transport and tunnel modes, Virtual Private Networks (VPNs)	9
4	Network Security Devices and Monitoring: Firewalls, Packet filtering, Stateful inspection, Application-level gateways Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS), Network Address Translation (NAT) and security, Network monitoring, logging, and SIEM basics, Honeypots and honeynets.	9
5	Wireless, Cloud, and Emerging Network Security Issues : Wireless network security: WLAN threats, WEP, WPA, WPA2, WPA3 Mobile and BYOD security challenges, Cloud network security basics, Virtual networks, Security groups and network isolation IoT security challenges Legal, ethical, and compliance issues in network security	9

Text Books: 1. William Stallings – Network Security Essentials
2. Behrouz A. Forouzan – Cryptography and Network Security

Reference Books: 1. Charlie Kaufman, Radia Perlman – Network Security: Private Communication in a Public World

Syllabus Semester-VII

Course Code: CSC41MMP401	Course Name: Practical Based on Neural Networks	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0,P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Knowledge of programming in Python, basic data handling and visualization		
Course Objectives: To design and train neural network models using programming tools.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Students will be able to implement neural network components and activation functions in software.		
CO2: Students will be able to code and train single-layer neural networks for classification tasks.		
CO3: Students will be able to apply and analyze regularization and model evaluation metrics.		
CO4: Students will be able to implement advanced neural network models for clustering and sequence data.		
CO5: Students will be able to select and justify neural network methods based on dataset and problem type.		

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Implementation of an artificial neuron model and study of different activation functions.	2
2	Implementation of the Perceptron learning algorithm for binary classification.	2
3	Implementation of Adaline network using the delta learning rule.	2
4	Demonstration of linear separability and limitations of single-layer neural networks.	2
5	Implementation of Multilayer Perceptron (MLP) using backpropagation for classification.	2
6	Study of overfitting and underfitting in MLP using regularization techniques.	2
7	Implementation of Radial Basis Function (RBF) network for function approximation.	2
8	Implementation of Self-Organizing Map (SOM) for clustering and visualization.	2
9	Implementation of Recurrent Neural Network (RNN) for sequence prediction.	2
10	Implementation of deep learning models such as CNN or LSTM for real-world datasets.	2
11	Project	10

Text Book 1. Neural Networks and Deep Learning: A Textbook by Charu C. Aggarwal

Reference Book: 1. Deep Learning with Python by François Chollet — practical implementation using Keras/Tensor Flow

2. Neural Networks for Pattern Recognition by Christopher M. Bishop

Syllabus Semester-VII

Course code: CSC41MMP402	Course name: Practical based on Data Ware Housing and Data Mining
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA:30 ESE-20	
Pre-requisites: Basic knowledge of DBMS, programming concepts, data structures, and elementary statistics is required to understand data warehousing and data mining techniques.	
Course Objectives: Provide hands-on experience with data warehousing concepts.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Design and implement data warehouse schemas.	
CO2: Perform ETL and OLAP operations.	
CO3: Preprocess real-world datasets.	
CO4: Implement data mining techniques such as classification, clustering, and association	

Contents-

Sr.No.	Content	Practical Hours
1	Study of Data Warehouse Architecture: Understand components: Source systems, ETL, staging area, data warehouse, data marts, OLAP. Draw and explain three-tier architecture.	2
2	Design of Star Schema: Create a star schema for an application (Sales / Hospital / Library). Identify fact table and dimension tables.	2
3	Design of Snowflake Schema: Convert star schema into snowflake schema. Explain normalization of dimension tables.	2
4	ETL Process Implementation: Perform Extract, Transform, Load (ETL) operations: Extract data from CSV/Excel Clean and transform data Load into database (MySQL / Oracle)	2
5	OLAP Operations: Perform OLAP operations on warehouse data: Roll-up, Drill-down, Slice, Dice, Pivot	2
6	Data Preprocessing: Perform: Data cleaning, Handling missing values, Data normalization, Data transformation	2
7	Association Rule Mining: Implement Apriori algorithm, Generate frequent item sets and association rules, Calculate support and confidence.	2
8	Classification: Implement classification using: Decision Tree, Naïve Bayes, Evaluate accuracy of the model.	2
9	Clustering: Perform K-Means clustering, Analyze cluster formation and distance metrics.	2
10	Data Mining Case Study / Visualization Perform mining on a real dataset, Apply one or more techniques: Classification, Clustering, Association Visualize results using graphs/charts.	2
11	Project	10

Text Books: 1. Data Mining: Concepts and Techniques- Jiawei Han, Micheline Kamber & Jian Pei
2. Data Warehousing Fundamentals-Paulraj Ponnaiah

Reference Books: 1. Data Warehousing in the Real World Sam Anahory & Dennis Murray guide.
2. Principles of Data Mining — David Hand, Heikki Mannila & Padhraic Smyth — *Good for theoretical insights.*
3. Data Warehousing, Data Mining & OLAP — Alex Bezon & Stephen J. Smith — Combined topic coverage.

Syllabus
Semester-VII

Course code CSC41MMP403:	Course name Practical Based on Network Security
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA: 30 ESE- 20	
Pre-requisites : Computer Networks, Basic Linux/Windows commands	
Course Objectives: Provide hands-on exposure to network security tools and techniques	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Use network security tools to analyze traffic and detect threats	
CO2: Configure firewalls, VPNs, and secure services	
CO3: Demonstrate common network attacks in a controlled environment	
CO4: Apply security policies and best practices	

Contents-

Sr.No.	Content	Practical Hours
1	Introduction to Network Security Tools •Familiarization with Linux security environment •Basic networking commands (ifconfig/ip, netstat, ss, ping, traceroute)•Introduction to Kali Linux / Security lab setup	2
2	Network Scanning and Enumeration, Port scanning using Nmap, OS and service detection,Vulnerability scanning overview	2
3	Packet Capture and Traffic Analysis •Capturing live traffic using Wireshark •Analysis of TCP, UDP, ARP, ICMP packets Identifying suspicious traffic patterns	2
4	Password Cracking and Authentication Attacks (Demo-based)Dictionary and brute-force attacks using Hydra (controlled environment),Understanding authentication weaknesses ,Countermeasures	2
5	Firewall Configuration •Configure firewall rules using iptables / ufw •Allow/deny traffic based on IP, port, and protocol Testing firewall effectiveness	2
6	Intrusion Detection System (IDS) Installation and configuration of Snort Writing basic detection rules Analyzing alert logs	2
7	Secure Communication Using SSH and TLS •SSH configuration and secure remote login •Key-based authentication Understanding TLS through HTTPS traffic analysis	2
8	Virtual Private Network (VPN) Setup •Configuration of IPsec or SSL VPN (OpenVPN/WireGuard) •Testing encrypted tunnels VPN traffic analysis	2
9	Wireless Network Security •WLAN security configuration (WPA2/WPA3) •Monitoring wireless traffic (demo) Understanding common wireless attacks and defenses	2

10	Log Analysis and Security Monitoring <ul style="list-style-type: none"> •System and network log analysis •Introduction to SIEM concepts (ELK stack / Splunk demo) Detecting anomalies from logs	2
11	Project	10

Text Books: 1. William Stallings – Network Security Essentials
2. Behrouz A. Forouzan – Cryptography and Network Security

Reference Books: 1. Charlie Kaufman, Radia Perlman – Network Security: Private Communication in a Public World

**Syllabus
Semester-VII**

Course code: CSC41MEL401	Course name: Geographical Information System
Course category: Major Elective	
Credits: 03	Teaching scheme: L-3 P-0
Evaluation scheme: CA: 60 ESE-40	
Pre-requisites: Basic Knowledge of Remote Sensing and Geographical Information System application	
Course Objectives: To explore GIS software, applications, and emerging trends.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain basic concepts and components of GIS	
CO2: Identify and differentiate spatial data models	
CO3: Perform basic spatial data management and analysis	
CO4: Understand coordinate systems and map projections	
CO5: Use GIS software and relate GIS to real-world applications	

Contents

Unit	Content	Teaching hours
1	Introduction to Geographical Information System: Definition and concept of GIS, History and evolution of GIS, Components of GIS: Hardware, Software, Data, People, Methods, GIS vs CAD vs MIS, Applications of GIS in various fields: Urban planning, Agriculture, Disaster management, Environment studies, Transportation, Advantages and limitations of GIS	9
2	Spatial Data and Data Models: Types of spatial data: Raster data model, Vector data model, Comparison between raster and vector data, Attribute data and non-spatial data, Data sources: Maps, Satellite imagery, GPS data, Aerial photographs. Data input methods: Digitization, Scanning, GPS data collection.	9
3	GIS Data Input & Data Management: Methods of Data Input: Digitizing, Scanning, Direct Entry: Data Editing and Quality Control, Data Storage and Retrieval techniques, Attribute Data Management, GIS Software Packages and Tools	9
4	Coordinate Systems and Map Projections: Earth as a sphere and geoid, Geographic coordinate system, projected coordinate system, Map projections: Types, advantages, limitations, Scale and resolution, Errors and distortions in projections	9
5	GIS Software, Applications and Future Trends: GIS software overview: ArcGIS, QGIS, Basic GIS workflow, Web GIS and Mobile GIS, Integration of GIS with GPS and Remote Sensing, Case studies: Disaster management, smart cities, environmental monitoring, Future trends in GIS.	9

Text Books: 1. Kang-tsung Chang, Introduction to Geographic Information Systems, McGraw-Hill Education.
2. Burrough, P.A. and McDonnell, R.A., Principles of Geographical Information Systems, Oxford University Press.

Reference Books: 1. Longley, P.A., Goodchild, M.F., Maguire, D.J., Rhind, D.W., Geographic Information Systems and Science, Wiley.
2. DeMers, M.N., Fundamentals of Geographic Information Systems, Wiley.
3. Heywood, I., Cornelius, S., Carver, S., An Introduction to Geographical Information Systems, Pearson Education

**Syllabus
Semester-VII**

Course code: CSC41MEL402	Course name: Remote Sensing	Course category: Major Elective
Credits: 03	Teaching scheme: L-3 P-0	Evaluation scheme: CA: 60 ESE-40
Pre-requisites: Basic Knowledge of Remote Sensing application		
Course Objectives: To study remote sensing platforms, sensors, and data products.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain basic concepts and principles of remote sensing		
CO2: Describe electromagnetic spectrum and atmospheric interactions		
CO3: Identify remote sensing platforms and sensor systems		
CO4: Interpret and analyze remote sensing images		
CO5: Apply remote sensing techniques to real-world problems		

Contents

Unit	Content	Teaching hours
1	Introduction to Remote Sensing: Definition & scope of Remote Sensing, History and development of remote sensing technologies, Principles of aerial photography and photogrammetry, Electromagnetic Spectrum & energy interaction with Earth's surface. Geometric characteristics of aerial photographs.	9
2	Remote Sensing Platforms and Sensors: Types of remote sensing platforms (terrestrial, airborne, space borne), Types of sensors (optical, thermal, microwave), Satellite systems overview, Sensor characteristics and image acquisition.	9
3	Image Interpretation and Data Products: Fundamentals of image interpretation, Types of image products, Interpretation keys and techniques, Digital vs visual image interpretation Digital image characteristics and pixel concepts, Image resolution (spatial, spectral, radiometric, temporal), Types of digital data products, Elements of digital image interpretation.	9
4	Image Processing Techniques: Concepts of digital image processing, Image preprocessing (filtering, enhancements), Image transformation, Classification fundamentals.	9
5	Applications of Remote Sensing: Environmental monitoring, Agriculture and forestry, Water resources, Urban planning, Disaster management applications	9

Text Books: 1. Remote Sensing and Image Interpretation — T. M. Lilles and, R. W. Kiefer & J. W. Chipman (Wiley) — Key foundational text covering principles and interpretation.
2. Fundamentals of Remote Sensing — George Joseph & C. Jeganathan (Universities Press) — Good intermediate-level book focusing on remote sensing fundamentals

Reference Books 1. Remote Sensing of the Environment: An Earth Resource Perspective — J. R. Jensen (Pearson)
2. Textbook of Remote Sensing and GIS — M. Anji Reddy (BS Publications)
3. Digital Image Processing — R. C. Gonzalez & R. E. Woods

Syllabus Semester-VII

Course Code: CSC41MEP401	Course Name: Practical Based on Geographical Information System
Course Category: Major Elective	
Credits: 1	Teaching Scheme : L-0, P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of QGIS and ArcGIS	
Course Objectives: Provide hands-on experience with GIS software tools such as QGIS and ArcGIS	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Use GIS software efficiently	
CO2: Create and edit spatial and attribute data	
CO3: Perform basic spatial analysis	
CO4: Apply GIS concepts to real-world problems	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Introduction to GIS software interface (QGIS/ArcGIS): layers, toolbars, project settings	2
2	Digitization of spatial features (points, lines, polygons)	2
3	Creation and editing of attribute tables	2
4	Importing spatial data (Shapefile, GeoJSON, raster data)	2
5	Working with raster data and basic raster analysis	2
6	Vector data analysis: selection, clipping, merging	2
7	Buffer analysis on spatial features	2
8	Overlay analysis (intersection, union)	2
9	Basic use of GPS data in GIS	2
10	Develop System using real-world spatial data for any application	2
11	Project	10

Text Book: 1.Kang-tsung Chang, Introduction to Geographic Information Systems, McGraw-Hill Education.
2.Burrough, P.A. and McDonnell, R.A., Principles of Geographical Information Systems, Oxford University Press.

Reference Book:1.Burrough, P.A. and McDonnell, R.A., Principles of Geographical Information Systems, Oxford University Press.
2.DeMers, M.N., Fundamentals of Geographic Information Systems, Wiley.
3.Heywood, I., Cornelius, S., Carver, S., An Introduction to Geographical Information Systems, Pearson Education

Syllabus Semester-VII

Course Code: CSC41MEP402	Course Name: Practical Based on Remote Sensing
Course Category: Major Elective	
Credits: 1	Teaching Scheme : L-0, P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of QGIS,ENVI,ERDAS , ArcGIS	
Course Objectives: To Understand Working on real satellite data	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Familiarize with Remote Sensing software and tools.	
CO2: Perform basic image enhancement and pre-processing.	
CO3: Integrate raster data with spatial (vector) layers for analysis.	
CO4: Apply Remote Sensing concepts to real-world problems	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Introduction to Remote Sensing Software: Installation & setup: QGIS (free/open-source) or Arc GIS /ENVI/ERDAS, Interface overview, Loading spatial and raster datasets	2
2	Loading & Visualizing Satellite Imagery: Importing satellite images (e.g., Landsat, Sentinel),Displaying multispectral bands, Band combinations (RGB, false color), Adjusting histogram and contrast	2
3	Image Enhancement: Contrast stretching, Filtering (low/high pass), Edge enhancement	2
4	Georeferencing datasets, Raster-vector integration	2
5	Image enhancement and classification using QGIS/ENVI/ERDAS	2
6	Georeferencing datasets, Thematic map creation	2
7	Visual interpretation of satellite images	2
8	Image Classification – Unsupervised: K-means / ISODATA clustering, Creating class groups, Mapping land-cover classes	2
9	Image Classification – Supervised: Selecting training samples, Applying classification algorithm (e.g., Parallelepiped, Maximum Likelihood)	2
10	Develop System for Urban growth mapping, Forest cover change, Water body dynamics, Disaster assessment (flood, drought)	2
11	Project	10

Text Book: 1. Remote Sensing and Image Interpretation — Lilles and, Kiefer & Chipman ,Best for basic to advanced RS theory and lab foundations.
2. Fundamentals of Remote Sensing — George Joseph & C. Jeganathan,Focuses on satellite sensors and data interpretation.

Reference Book: 1.Remote Sensing Digital Image Analysis — Jensen Excellent for classification & processing techniques.
2.Remote Sensing and GIS Integration — Anji Reddy Good for GIS linkage and case studies

Syllabus Semester VII

Course code: CSC41RML401	Course Name: Research Methodology	
Course Category: Research Methodology		
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA-60, ESE-40
Pre-requisites: Basic understanding of subject fundamentals, elementary statistics, and academic reading and writing skills.		
To develop an understanding of research methodology principles and techniques applicable to problem identification, analysis..		
Course Outcome: After completion of the course the student will be able:		
CO1: To develops the ability to identify research problems and formulate objectives and hypotheses.		
CO2: To familiarizes students with research design, data collection, and analysis techniques relevant to robotics.		
CO3: To enhances skills in technical writing, documentation, and research ethics.		
CO4: Analyze and apply statistical techniques such as data processing, descriptive statistics, correlation, regression, and hypothesis testing to interpret and validate research data.		
CO5: Evaluate research findings and create a structured research report or mini proposal using appropriate referencing styles, ethical practices, and computer-based research tools.		

Unit	Contents	Teaching Hours.
1	Introduction to Research & Research Process : Meaning of Research, objectives, motivation, and significance of research, Types of research (basic/applied, qualitative/quantitative, conceptual/empirical) Research methods vs. research methodology, Research Approaches, Significance of Research, Scientific method and research ethics, Steps in the research process, Criteria of Good Research, Problems Encountered by Researchers in India	09
2	Research Problem Formulation & Research Design: Identification and definition of research problems in engineering/robotics (Meaning and sources of research problems, Criteria for selecting a research problem, Defining and formulating research problems), Review of literature and research gap identification, Formulation of objectives and hypotheses, Research design: exploratory, descriptive, experimental, Features of a good research design	09
3	Sampling Design & Data Collection Methods: Sampling concepts, population, sample, sampling errors , Probability and non-probability sampling techniques (Sample size (basic concept)Types of sampling errors (Sampling error, Non-sampling error, Bias and sources of bias), Methods of data collection: observation, interview, questionnaire, experiments, Selection of appropriate sampling and data collection methods (Nature of research problem, Objectives of the study, Time, cost, and resource constraints, Accuracy and reliability requirements, Relevance to robotics and engineering research)	09
4	Data Processing, Analysis & Hypothesis Testing: Data processing (Editing, coding, classification, tabulation), Descriptive statistics) Measures of central tendency, Measures of dispersion, Correlation and regression, Hypothesis testing (Concepts and Procedure, parametric and non-parametric tests), Interpretation of Statistical results.	09
5	Research Reporting: Interpretation of research results, Research report writing (Structure of research report technical paper, and project report), Referencing styles and bibliography, Plagiarism and ethical issues in research, Role of computers in research (Data analysis tools, Documentation and presentation tools), Preparation of a mini research proposal / report.	09

Text Books : 1.C.R. Kothari — Research Methodology: Methods & Techniques 2.Ranjit Kumar — Research Methodology: A Step-by-Step Guide for Beginners
Reference Books: 1.Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. — An Introduction to Research Methodology 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design
Online Resources: 1.Alison – Essentials of Research Methodology

Syllabus Semester VII

Course Code: CSC41R MP401 Course Name: Practical Based on Research Methodology
Course Category: Research Methodology
Credits: 1 Teaching Scheme: L-0, P-2 Evaluation Scheme: CA-30,ESE-20
Pre-requisites: Research Methodology practical is a basic understanding of research design, data collection methods, and fundamental statistical and analytical tools.
Course Objectives: The Research Methodology course is to equip students with the skills to design, conduct, analyze, and interpret research systematically and ethically.
Course Outcomes: At the end of the course, the students will be able to -
CO1: To develop the ability to formulate research problems and design appropriate research methodologies.
CO2: To design data collection and analysis procedures using suitable statistical and analytical techniques.
CO3: To understand the principles of ethical research and effectively interpret and present research findings.

Sr.No.	Title of the Experiment
1	Identify research papers from journals/conferences and prepare a structured literature review.
2	Select a domain in computer fraternity and define a clear research problem with objectives.
3	Write research objectives and formulate null and alternative hypotheses.
4	Develop a suitable research design for a selected problem (exploratory/descriptive/experimental).
5	Identify population, sample size, sampling technique, and justify the choice.
6	Design a questionnaire for data collection related to a computer fraternity problem.
7	Collect sample data using questionnaire/observation and enter data in spreadsheet/software.
8	Perform basic statistical analysis (mean, median, standard deviation, graphs).
9	Apply an appropriate statistical test (t-test / chi-square) and interpret results.
10	Prepare and present a mini research report standard research paper format.

Text Books : 1.C.R. Kothari Research Methodology: Methods & Techniques 2.Ranjit Kumar Research Methodology: A Step-by-Step Guide for Beginners
Reference Books: 1.Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. An Introduction to Research Methodology 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design
Online Resources: 1.Alison – Essentials of Research Methodology

Semester: VIII

B.Sc. (Hons) Computer Science

Syllabus Semester-VIII

Course code: CSC41M ML404	Course name:- Biometric Technique	Course category:- Major Mandatory
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA-60 ESE-40
Pre-requisites: Basic knowledge of image processing techniques and programming concepts		
Course Objectives: To introduce the principles, traits, standards, algorithms, multimodal fusion techniques, and security aspects of biometric systems, with in-depth study of fingerprint, face, iris, and emerging biometric modalities.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the fundamentals of biometric systems including goals, scope, biometric traits, standards, and applications.		
CO2: Describe and apply the principles of fingerprint, face, and iris recognition systems including acquisition, feature extraction, and matching.		
CO3: Analyze additional biometric traits such as ear, gait, hand geometry, periocular, face marks, and tattoos along with their challenges.		
CO4: Compare and evaluate multi-biometric systems, fusion levels, and acquisition/processing sequences for performance improvement.		
CO5: Assess security threats and adversary attacks on biometric systems and propose suitable countermeasures for system protection.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Biometric: what is biometrics? goals, scope, biometric characteristics, different biometric traits in biometric systems, Biometric Standards, Multi Biometric Systems, Application of biometric systems. Fingerprint, Face and Iris Recognition: Friction Ridge Pattern, Fingerprint Acquisition: Sensing Techniques Image Quality, Feature Extraction: Ridge Orientation and Frequency Estimation, Singularity, Ridge and Minutiae Extraction	9
2	Face Recognition: Psychology of Face Recognition, Facial Features, Image Psychology of Face Recognition, Facial Features, Image Acquisition, Face Detection, Feature Extraction and Matching Iris Recognition: Image Acquisition, Iris Segmentation, Iris Encoding and Matching, Iris Quality	9
3	Additional Biometric Traits: Ear Detection, Challenges of Ear Detection, Gait Recognition, Challenges of Gait recognition Hand Geometry: Image Capture, Hand Segmentation, Feature Extraction, Feature Matching and Challenges of Hand Geometric Recognition. Periocular, Face Marks, Tattoo.	9
4	Multi-Biometrics: Multi-Sensor System, Multi-Algorithm System, Multi-Instance System, Multi-Sample System, , Acquisition and Processing Sequence Fusion Levels: Sensor-Level Fusion, Feature-Level Fusion, Score- Level Fusion, Rank-Level Fusion and Decision-Level Fusion	9
5	Security of Biometric System : Adversary Attacks: : Insider Infrastructure attacks, Attacks at the interface: Impersonation, Obfuscation Spoofing attacks on biometric processing: Attacks on the system module, attacks at the interconnection	9
Text Books: 1.Essentials of Bioinformatics, Jin Xiong,CAMBRIDGE UNIVERSITY PRESS 2.Handbook of Multibiometrics , Anil K. Jain, Arun A. Ross, KarthikNandakumar, Springer Science & Business Media		
Reference Books: 1.Biometrics: Theory, Methods and Applications, N. V. Boulgouris, Konstantinos, N. Plataniotis, Evangelia, Micheli-Tzanakou, John Wiley & Sons		

Syllabus Semester-VIII

Course code: CSC41MML405	Course name: Quantum Computing
Course category: - Major Mandatory	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA:60 ESE-40	
Pre-requisites: Basic Knowledge of quantum computing and programming concept.	
Course Objectives: To provide a strong foundation in quantum computing applications.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Able to explain the fundamental concepts of quantum computing.	
CO2: Able to represent quantum states and operations mathematically using Dirac notation and matrix representations.	
CO3: Build quantum circuits using standard gates and simulate results.	
CO4: Implement simple quantum algorithms (Deutsch-Jozsa, Grover, QFT basics).	
CO5: Understand noise, NISQ limitations, and basic error correction concepts.	

Contents

Unit	Content	Teaching hours
I	Introduction to Quantum Computing: History of quantum computation and quantum information, Future directions, Introduction to Quantum bits(Qubits), Single qubits gates, Multiple qubits gates, Measurements in bases other than the computational basis, Quantum circuits, Qubit copying circuit, Example: Bell states, quantum teleportation. Quantum algorithms :Classical computations on a quantum computer, Quantum parallelism, Deutsch's algorithm, The Deutsch-Jozsa algorithm, Quantum algorithms summarized, Experimental quantum information processing, Quantum information theory: example problems.	9
2	Introduction to Quantum Mechanics: Linear Algebra, Bases and linear independence, Linear operators and Matrix, Inner products, The Pauli matrices, Eigenvectors and eigenvalues. Ad-joints and Hermitian operators, Tensor products, Operator functions, the commutator and anti-commutator, The polar and singular value decomposition, Postulate Quantum mechanics, State space, Evolution, Quantum measurement, Distinguishing quantum states, Projective measurements, POVM measurements, Quantum Phase, Composite systems, Quantum mechanics: a global view, Application super-dense coding, Ensembles of quantum states, General properties of the density operator, The reduced density operator, The Schmidt decomposition and purification, EPR and the Bell inequality.	9
3	Quantum computation: Quantum circuits, Quantum algorithms, Single qubit operations, Controlled operations, Measurement, Universal quantum gates, Two-level unitary gates are universal, Single qubit and CNOT gates are universal, A discrete set of universal operations, Approximating arbitrary unitary gates is generically hard, Quantum computational complexity, Summary of the quantum circuit model of computation, Simulation of quantum systems, Simulation in action, The quantum simulation algorithm, An illustrative example, Perspectives on quantum simulation.	9
4	The Quantum Fourier transform and its applications: The quantum Fourier transform, Phase estimation, Performance and requirements, Applications: order-finding and factoring, Application: order-finding, Application: factoring, General applications of the quantum Fourier transform, Period-finding, Discrete logarithms, The hidden subgroup problem, Other quantum algorithms?	9
5	Quantum Algorithms: The quantum search algorithm, The oracle, The procedure, Geometric visualization, Performance, Quantum search as a quantum simulation, Quantum counting, Speeding up the solution of NP-complete problems, Quantum search of an unstructured database, Optimality of the search algorithm, Black box algorithm limits.	9

Text Books:

1. David McMahon, “Quantum Computing Explained”, Wiley-IEEE Computer Society Press, 2007.
2. Venkateswaran Kasirajan, “Fundamentals of Quantum Computing -Theory and Practice”, Springer, 2021.

Reference Books:

1. Nielsen, M. A., & Chuang, I. L., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Nidhi Ismail Keshta, Dr. Abhishek Agarwal, Dr. Vandana Rathore “QUANTUM COMPUTING FOR BEGINNERS” Exoofencr Intenatonal Publication.
3. Tyler Soloway “Quantum Computing Explained For Everyone”.

Syllabus Semester-VIII

Course code: CSC41MMP406	Course name: Software Testing
Course category: Major Mandatory	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA: 60 ESE-40	
Pre-requisites: Basic knowledge of programming concepts, software engineering fundamentals, software development life cycle (SDLC), and understanding of software requirements.	
Course Objectives: To introduce fundamental concepts, principles, and processes of software testing	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand basic concepts, principles, and life cycle of software testing.	
CO2: Apply suitable testing strategies and levels to identify software defects.	
CO3: Design test cases using black-box and white-box testing techniques.	
CO4: To Plan and manage testing activities using testing metrics and automation tools.	
CO5: Analyze, evaluate, and apply test automation concepts by selecting appropriate testing tools	

Contents

Unit	Content	Teaching hours
1	Software Testing Strategies: Verification and validation, strategic issue, strategies for conventional Software and Web Apps, level Of Testing, Unit testing, Integration testing (Top down integration, Bottom up integration), Function Testing, System Testing, Acceptance Testing (Alpha/Beta), regression Testing, Load/Stress testing, Security testing.	9
2	Testing Techniques: Testing Fundamentals, Testing Characteristics, Internal and External View, Functional Testing, Non-Functional Testing, Black Box testing: boundary value analysis, equivalence class testing, state table based testing, cause-effect graphing based testing, error guessing. White box Testing Techniques: need, logic coverage criteria, basis path testing, Flow graph matrices, loop testing, data flow testing, mutation testing. Static Testing, Differences between BBT & WBT, Testing Client- Server Architecture.	9
3	Managing the Test Process: Test Management: test organization, structure and of testing group, test planning, detailed test design and test specification.	9
4	Software Metrics: need, definition and classification of software matrices. Testing Metrics for Monitoring and Controlling the Testing Process: attributes and corresponding matrices, estimation model for testing effort, architectural design, information flow matrix used for testing, function point and test point, analysis. Efficient Test Suite Management: minimizing the test suite and its benefits, test suite minimization problem, test suite prioritization its type , techniques and measuring effectiveness.	
5	Test Automation: Automation and Testing Tools: need, categorization, selection and cost in testing tool, guidelines for testing tools. Study of testing tools: Win Runner, QTP, Load Runner, Test Director and IBM Rational Functional Tester, Selenium etc.	9

Text Books: 1. Software Testing Principles and Practices Naresh Chauhan Oxford Higher Education
2. Effective Methods for Software Testing, third edition by William E. Perry, Wiley Publication

Reference Books: 1. Software Engineering a practitioner's Approach By Roger S. Pressman (Seventh edition) Mc Graw Hill

Syllabus Semester-VIII

Course code: CSC41MMP404	Course name: Practical Based on Biometric Technique
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA-30, ESE-20	
Pre-requisites: Basics of mathematics, Image Processing Technique	
Course Objectives: Acquire knowledge about various biometric technologies.	
Course Outcomes: At the end of the course, the students will be able to -	
CO 1: Learn the process of designing and implementing biometric systems, including system architecture, database management, integration with existing systems, and security considerations.	
CO 2: Gain hands-on experience in biometric data acquisition techniques, including sensor technologies, image processing, feature extraction, and template matching algorithms	
CO 3: Learn about the practical applications of biometric systems in different domains such as security, access control, identity verification, surveillance, and forensic science.	

Contents -

Sr.No.	Description of Practical	Practical hours
1	Read the image of the fingerprint and use different techniques of noise reduction	2
2	Preprocess fingerprint images, including tasks such as ridge detection.	2
3	Enhance the image by using Linear Filter.	2
4	Perform the segmentation on fingerprint.	2
5	Extract key features such as finger length, width, and hand shape from the captured images.	2
6	Evaluate the performance of the system in terms of accuracy, speed, and robustness.	2
7	Investigate vulnerabilities like spoofing attacks and assess the system's resilience.	2
8	Design Graphical User Interface for Face Recognition..	2
9	Design Graphical User Interface for Fingerprint Recognition.	2
10	Design Graphical User Interface for Iris Recognition.	2
11	Project	10

Text Books: 1.Essentials of Bioinformatics, Jin Xiong,CAMBRIDGE UNIVERSITY PRESS

2..Handbook of Multibiometrics , Anil K. Jain, Arun A. Ross, KarthikNandakumar, Springer Science & Business Media

Reference Books: 1.Biometrics: Theory, Methods and Applications, N. V. Boulgouris, Konstantinos, N. Plataniotis, Evangelia, Micheli-Tzanakou, John Wiley & Sons

Syllabus Semester-VIII

Course code: CSC41MMP405	Course name: Practical based on Quantum Computing
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA:30 ESE-20	
Pre-requisites: Basic Knowledge of Linear Algebra, Python programming concept.	
Course Objectives: Acquire Knowledge about quantum Computing and linear algebra to design, program, and analyze quantum algorithms and secure communication protocols using the Qiskit framework, while addressing the challenges of quantum error correction.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Able to do Program real quantum circuits using the Qiskit framework.	
CO2: Visualize qubit states on the Bloch Sphere.	
CO3: Mitigate errors using bit-flip and phase-flip correction codes.	
CO4: Simulate secure communication through Quantum Key Distribution.	

Contents-

Sr.No.	Content	Practical Hours
1	Visualization of Single-Qubit States and Rotations on the Bloch Sphere using Qiskit.	2
2	Implementation and Verification of Basic Quantum Logic Gates (Pauli, Hadamard, and Toffoli) and Multi-Qubit Systems.	2
3	Generation and Measurement of Maximum Entanglement (Bell States) and Verification of Quantum Correlations.	2
4	Implementation of the Deutsch-Jozsa Algorithm to Distinguish Constant and Balanced Functions.	2
5	Practical Implementation of the Bernstein-Vazirani Algorithm for Single-Query String Identification.	2
6	Simulation of Grover's Search Algorithm for Unstructured Database Searching using Amplitude Amplification.	2
7	Construction of the Quantum Fourier Transform (QFT) Circuit and Verification of Phase States.	2
8	Implementation of the Three-Qubit Bit-Flip Error Correction Code for Fault-Tolerant Simulation.	2
9	Simulation of the BB84 Quantum Key Distribution (QKD) Protocol for Secure Communication.	2
10	Analysis of Security in Quantum Cryptography: Simulating an Intercept-Resend (Eavesdropping) Attack.	2
11	Project	10

Text Books: 1. Learn Quantum Computing with Python and IBM Quantum by Robert Loreda
2. Quantum Computing: An Applied Approach" by Jack D. Hidary.

Reference Books: 1. Eric Johnston Programming Quantum Computers: Essential Algorithms and Code" (O'Reilly)
2. Learn Quantum Computing with Python and IBM Quantum by Robert Loreda (Packt Publishing)
3. Dancing with Qubits by Robert S. Sutor

**Syllabus
Semester-VIII**

Course code: CSC41MMP406	Course name: Practical on Software Testing
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-1
Evaluation scheme: CA: 30 ESE-20	
Pre-requisites: Basic knowledge of programming concepts, software engineering fundamentals, software development life cycle (SDLC), and understanding of software requirements.	
Course Objectives: To introduce concepts, principles, and processes of software testing	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Prepare test plans and test cases for a sample application.	
CO2: Design and execute black box test cases using standard techniques.	
CO3: Perform white box, unit, and integration testing on program modules.	
CO4: Apply system, automation, and tool-based testing for quality assurance.	

Contents-

Sr.No.	Content	Practical Hours
1	Design of test cases using Equivalence Class Partitioning (Black Box)	2
2	Design of test cases using Boundary Value Analysis (Black Box)	2
3	Test case design using Decision Table / State Transition Testing (Black Box)	2
4	Unit Testing of a program module	2
5	Integration Testing (Top-Down / Bottom-Up) of modules	2
6	System Testing and Regression Testing for an application	2
7	White Box Testing: Basis Path Testing and Cyclomatic Complexity	2
8	White Box Testing: Loop Testing and Data Flow Testing	2
9	Test Plan Preparation and Test Case Documentation	2
10	Test Metrics and Effort Estimation for a module .	2
11	Project	10

Text Books: 1. Software Testing Principles and Practices Naresh Chauhan Oxford Higher Education 2. Effective Methods for Software Testing, third edition by William E. Perry, Wiley Publication
Reference Books: 1. Software Engineering a practitioner's Approach By Roger S. Pressman (Seventh edition) Mc Graw Hill

Syllabus

Semester-VIII

Coursecode: CSC41M EL403	Course name: Cyber Security	Course category: Major Elective
Credits: 3	Teaching scheme: L- 3 P-0	Evaluation scheme: CA: 60 ESE- 40
Pre-requisites: Students should possess foundational knowledge of discrete mathematics and elementary number theory, basic programming skills in at least one language, and an understanding of fundamental data structures and algorithms. Introductory computer networking concepts is expected, along with basic awareness of information security principles such as confidentiality, integrity, and availability.		
Course Objectives: To understand the mathematics behind Cryptography		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To learn the importance of number theory in designing crypto systems		
CO2: To design public and private key cryptosystems.		
CO3: To do cryptanalysis of various cryptosystems.		
CO4: To implement cryptographic algorithms & structure Privacy issues and able to resolve them.		
CO5: Analyze, apply, and evaluate digital signature schemes.		

Contents

Unit	Content	Teaching hours
1	Introduction to Security:-Security Goals : Security Services(Confidentiality, Integrity, Authentication, Non-repudiation ,Access control) – Security Mechanisms (Encipherment, Data Integrity, Digital Signature, Authentication Exchange, Traffic Padding, Routing Control, Notarization, Access control) -Security Principles. Introduction to Cryptography:-Kerckh off's Principle -Classification of Cryptosystems-Cryptanalytic attacks- Cipher Properties (Confusion, Diffusion).	9
2	Traditional Secret Key Ciphers: - Substitution Ciphers (mono alphabetic ciphers, poly alphabetic ciphers)-Transposition Ciphers-Stream and Block Ciphers. Modern Secret Key Ciphers:- Substitution Box-Permutation Box-Product Ciphers	9
3	Data Encryption Standard (DES) (Fiestel and Non-Fiestel Ciphers, Structure of DES, DES Attacks,2-DES, 3-DES) - Advanced Encryption Standard (AES) (Structure, Analysis)- Cryptographic Hash Functions– Properties - Secure Hash Algorithm-Message Authentication Code (MAC).	9
4	Public Key Cryptosystems (PKC): Types of PKC –Trapdoor -one way functions -RSA Cryptosystem (Integer Factorization Trapdoor, Key Generation, Encryption, Decryption) Elgamal Crypto system (Discrete Logarithm Trapdoor, Key Generation, Encryption, Decryption) - Diffie-Hellman Key Exchange Protocol, Man in the Middle attack on Diffie-Hellman Protocol.	9
5	Digital Signature:- Signing – Verification - Digital signature forgery (Existential forgery, Selective forgery, Universal forgery) - RSA Digital Signature Scheme - Elgamal Signature Scheme – IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload-Intruders, Intrusion Detection, Distributed Denial of Service attacks.	9

Text Books: 1.Behrouz A. Forouzan and Debdeep Mukhopadhyay, Cryptography & Network Security, Second Edition, Tata McGraw Hill, New Delhi, 2010

2. Douglas R. Stinson, “Cryptography: Theory and Practice”, Third Edition, CRC Press.

Reference Books :1. AtulKahate, “Cryptography and Network Security”, 2nd Edition, Tata McGraw Hill, 2003.

2. Bernard Menezes, Network Security and Cryptography-Cengage Learning India, 2011

Syllabus

Semester-VIII

Course code: CSC41MEL404	Course name: - Augmented Reality	Course category: - Major Elective
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA:60 ESE:40
Pre-requisites: Basic Knowledge of Simulation.		
Course Objectives: Students will learn basics of tracking, displays and sensors.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understanding different type's displays and tracking. Basics of Visualization.		
CO2: Basics of Camera simulation.		
CO3: Learn AR Software architecture and workspace.		
CO4: Apply collaboration system		
CO5: Apply, analyze, and design augmented reality systems by modeling and annotating geometry		

Contents

Unit	Content	Teaching hours
1	Introduction to Augmented Reality Brief history, applications, mixed reality continuum, virtual reality, biquitous Computing. Displays - Multimodal displays, audio display, haptic, tactile and tangible Displays Gustatory displays, visual perception, characteristics.	9
2	Computer Vision for Augmented reality Marker tracking, Multiple camera infrared tracking, Natural feature tracking by detection, Incremental tracking, simultaneous localization and mapping Calibration and Registration - Camera calibration, calibration, Registration, Latency. Visual Coherence - Photometric registration, Common illumination, Diminished reality, Camera simulation.	9
3	Situated visualization - Challenges, visualization registration, Annotation and labeling, X-ray visualization, spatial manipulation, Information filtering Interaction - Output modalities, Input modalities, Tangible interfaces, Virtual User interfaces on real surfaces, Multi-view interfaces.	9
4	Modeling and annotation - Specifying geometry, Specifying appearance, Semi-automatic reconstruction, free form modeling. Authoring – Requirement of AR authoring, elements of authoring, standalone authoring solutions, Navigation - Foundation of Human navigation, exploration and recovery, Route visualization, view point guidance, Multiple perspective	9
5	Collaboration - Properties of collaboration system, co-located collaboration System, Remote collaboration. Software architecture - AR Application requirements, Software engineering requirement, data flow, scene graphs, Developer support	9

<p>Text Books: 1. Augmented Reality by Dieter Schmalstieg, Tobias Hollerer , Pearson publication. 2. Augmented Reality with Unity AR Foundation, Jonathan Linowes Packt Publishing Limited. 3. Kaliraj P, Devi T, (2021). Innovating with Augmented Reality: Applications in Education and Industry</p> <p>Reference Books: 1. Virtual and Augmented Reality (VR/AR), Bernhard Jung, Paul Grimm, Ralf Doerner, Wolfgang Broll 2022.</p>

Syllabus Semester-VIII

Coursecode: CSC41M EP403	Course name: Practical Based on Cyber Security
Course category: Major Elective	
Credits: 1	Teachingscheme: L-0 P-2
Evaluation scheme: CA: 30 ESE- 20	
Pre-requisites: Basic Knowledge of Programming Python Languages.	
Course Objectives: To learn different commands for implementing encryption and decryption	
Course Outcomes: At the end of the course, the students will be able to	
CO1: Understand & Explain classical and modern cryptographic techniques including substitution ciphers, transposition ciphers, DES, and AES.	
CO2: Apply symmetric and asymmetric encryption algorithms such as stream ciphers, block ciphers.	
CO3: Analyze the security properties of cryptographic algorithms by comparing DES Feistel structure.	
CO4: Evaluate authentication and integrity mechanisms using MACs, SHA-256, digital signatures.	
CO5: Design & Implement secure communication systems integrating encryption, key exchange, hashing, and digital signatures in Python.	

Contents-

Sr.No.	Content	Practical Hours
1	Implement monoalphabetic and polyalphabetic substitution ciphers in Python.	2
2	Development transposition cipher encryption and decryption using Python.	2
3	Demonstrate stream cipher and block cipher operations using Python.	2
4	Implement DES encryption and decryption and analyze its Feistel structure in Python.	2
5	Implement AES encryption and decryption using Python Crypto library.	2
6	To Develop cryptographic hash functions (SHA-256) and verify data integrity using Python.	2
7	Implement Message Authentication Code (MAC) generation and verification in Python.	2
8	Implement RSA key generation, encryption, and decryption in Python.	2
9	Demonstrate Diffie-Hellman key exchange and demonstrate Man-in-the-Middle attack in Python.	2
10	Implement RSA digital signature schemes with signing and verification in Python	2
11	Project	10

Text Books: 1. Cryptography and Network Security by William Stallings; Introduction to Modern Cryptography by Jonathan Katz & Yehuda Lindell; Applied Cryptography by Bruce Schneier.

Reference Books: 1. AtulKahate, "Cryptography and Network Security", 2nd Edition, Tata McGraw Hill, 2003.
2. Bernard Menezes, Network Security and Cryptography-Cengage Learning India, 2011

Syllabus
Semester-VIII

Course code: CSC41MEP404 Course name: Practical Based on Augmented Reality
Course category: Major Elective
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA: 30 ESE- 20
Pre-requisites : Basic Knowledge of Simulation
Course Objectives:
Students will learn basics of tracking, displays and sensors.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand fundamentals of AR, VR, MR and Ubiquitous Computing
CO2: Implement AR tracking and computer vision techniques
CO3: Analyze calibration, registration and visual coherence
CO4: Design AR interaction, visualization, collaboration and navigation

Contents-

Sr.No.	Content	Practical Hours
1	Study the brief history of Augmented Reality	2
2	Demonstrate a simple AR vs VR application	2
3	Case study on Ubiquitous Computing applications	2
4	Study and demonstration of Multimodal Displays	2
5	Analyze Visual Perception characteristics (depth, color, motion)	2
6	To Implement Marker-based AR tracking	2
7	Implement Natural Feature Tracking (NFT)	2
8	To Implement Photometric Registration	2
9	Design a Situated Visualization system	2
10	Perform Visualization Registration	2
11	Project	10

Text Books: 1. Complete Virtual Reality and Augmented Reality Development with Unity
2. Kaliraj P, Devi T, (2021). Innovating with Augmented Reality: Applications in Education and Industry
3. Augmented Reality by Dieter Schmalstieg, Tobias Hollerer , Pearson publication.

Reference Books: 1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Virtual and Augmented Reality (VR/AR), Bernhard Jung, Paul Grimm, Ralf Doerner, Wolfgang Broll 2022.

Semester: VII

B.Sc. (Hons with Research) Computer Science

Syllabus

Semester-VII

Course code: CSC41M ML407	Course name: - Medical Image Processing
Course category: - Major Mandatory	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA:60 ESE-40	
Pre-requisites: Knowledge Digital Image Processing	
Course Objectives : Provide knowledge of segmentation and feature extraction methods for identifying regions of clinical interest	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain the principles of medical imaging modalities, image formation, and medical image data formats.	
CO2: Apply image enhancement and noise reduction techniques to improve the quality of medical images.	
CO3: Apply image enhancement and noise reduction techniques to improve the quality of medical images.	
CO4: Analyze medical images using registration and visualization techniques for multi-modal and longitudinal studies.	
CO5: Use modern tools and basic machine learning approaches to solve real-world medical image processing problems.	

Contents

Unit	Content	Teaching hours
1	Introduction & Medical Imaging Modalities: Overview of medical imaging systems X-ray, CT, MRI, Ultrasound, PET/SPECT, Image formation and acquisition basics, Image file formats (DICOM, NIFTI) and metadata, Human visual perception and quality metrics	9
2	Pre-Processing & Enhancement: Image sampling and quantization, Noise models and filtering (spatial and frequency domain), Contrast & histogram enhancement, Restoration and de-artifacting techniques.	9
3	Segmentation & Feature Extraction: Thresholding, region growing, edge-based and clustering segmentation, Model-based segmentation techniques, Feature extraction shape, texture, intensity. Evaluation metrics for segmentation.	9
4	Registration & Visualization : Image alignment — rigid, affine and nonlinear registration, Similarity measures and optimization techniques, Multi-modal registration, Visualization of medical images (2D and 3D volume rendering)	9
5	Advances in medical Image Processing : Machine learning & deep learning for image classification/segmentation, Introduction to radiomics and quantitative imaging, Hands-on lab exercises (e.g., MATLAB/Python), Reading and displaying DICOM images, Enhancement and segmentation tasks, Registration pipeline implementation, Case Studies (e.g., MRI tumor segmentation, CT lung analysis)	9

Text Books: 1.Applied Medical Image Processing: A Basic Course — Wolfgang Birkfellner-CRC Press 2.Fundamentals of Medical Image Processing Using MATLAB,Dwijesh Kumar Dutta Majumder & Dipankar Ray-PHI Learning Pvt. Ltd.
Reference Books: 1.Handbook of Medical Image Processing and Analysis — Edited by Isaac N. Bankman-Academic press 2.Medical Image Processing, Reconstruction and Analysis: Concepts and Methods — Jiri Jan-CRC Press

Syllabus Semester-VII

Course code: CSC41M ML408	Course name: - Pattern Recognition	Course category: - Major Mandatory
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA:60 ESE-40
Pre-requisites: Knowledge Digital Image Processing		
Course Objectives : To provide the general mechanism and design of Automatic system recognition		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To understands basic structure of pattern recognition systems.		
CO2: To understands relationship between pattern and feature.		
CO3: To understands supervised and unsupervised pattern recognition approaches.		
CO4: Evaluate supervised and non-parametric classification methods including KNN, PNN, SVM, HMMs, neural networks, and decision tree models.		
CO5: Design pattern recognition and clustering solutions using unsupervised learning, mixture models, hierarchical clustering, and graph-based methods.		

Contents

Unit	Content	Teaching hours
1	Introduction to Pattern Recognition, Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features	9
2	Maximum Likelihood and Bayesian Estimation: Parameter estimation methods, Maximum- Likelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, Computational Complexity and Overfitting, Component Analysis and Discriminants, Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning.	9
3	Non-parametric : Density estimation, Parzen-window method, Probabilistic Neural Networks (PNNs), K-Nearest Neighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification. Linear Discriminant function based classifiers: Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)	9
4	Multilayer Neural Network: Feed Forward Classification, Back Propagation Algorithm, Error Surface Stochastic Data: Stochastic search, Boltzmann Learning, Evolutionary method and Genetic Programming.	9
5	Non-metric methods for pattern classification: Decision trees, Classification and Regression Trees (CART) and other tree methods, String recognition and Rule Based method. Unsupervised learning and clustering : Mixture Densities and Identifiability, Maximum Likelihood estimation, Application Normal Mixture, Unsupervised Bayesian Learning, Data Description and Clustering, Hierarchical Clustering, Graph theory method, Problem of validity, Component analysis	9

Text Books: 1 R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification" John Wiley, 2007 2nd Edition

Reference Books: 1. Christopher M. Bishop, "Neural Network for Pattern Recognition" Oxford Ohio Press

Syllabus Semester-VII

Course code: CSC41M MP406	Course name: Practical on Medical Image Processing
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA: 30 ESE- 20	
Pre-requisites : Basic Knowledge Medical Image processing Matlab, Python	
Course Objectives: Provide hands-on experience with medical image datasets and file formats..	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Read, display and analyze medical images using appropriate tools.	
CO2: Apply preprocessing and enhancement techniques to medical images.	
CO3: Implement segmentation and feature extraction algorithms.	
CO4: Perform basic image registration and visualization tasks.	
CO5: Analyze medical image data for real-world diagnostic applications.	

Contents-

Sr.No.	Content	Practical Hours
1	Introduction to Medical Images • Reading and displaying medical images (DICOM/NIFTI) • Exploring metadata and image properties	2
2	Image Sampling, Quantization and Histogram Analysis • Sampling and quantization effects • Histogram plotting and interpretation • Contrast enhancement using histogram equalization	2
3	Noise Modeling and Filtering • Adding noise (Gaussian, Salt & Pepper) to medical images • Spatial filtering: mean, median, Gaussian filters • Performance comparison using PSNR / MSE	2
4	Image Enhancement Techniques • Contrast stretching • Edge enhancement using spatial operators • Frequency-domain filtering (optional)	2
5	Image Segmentation – Basic Techniques • Thresholding (global and adaptive) • Edge-based segmentation • Region-based segmentation	2
6	Advanced Segmentation Techniques • Clustering-based segmentation (K-means) • Morphological operations • Segmentation performance evaluation	2
7	Feature Extraction from Medical Images • Shape features (area, perimeter) • Texture features (GLCM) • Intensity-based features	2
8	Image Registration, Rigid and affine transformation, Similarity measures (SSD, NCC), Registration of multimodal images • Report submission with methodology and results	2
9	Medical Image Visualization , 2D visualization ,3D volume visualization ,Slice navigation and ROI selection	2
10	To develop system for Tumor segmentation in MRI or Lung analysis in CT images	2
11	Project	10

Text Books: 1.Fundamentals of Medical Image Processing Using MATLAB Authors: Dwijesh Kumar Dutta Majumder, Dipankar Ray-PHI Learning Pvt. Ltd.

Reference Books: 2.Medical Image Processing, Reconstruction and Analysis: Concepts and Methods — Jiri Jan-CRC Press

Syllabus
Semester-VII

Course code: CSC41MMP407	Course name: Practical on Pattern Recognition
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA: 30 ESE- 20	
Pre-requisites : Strong knowledge of linear algebra, probability, calculus and High Programming skill in computer Languages specifically python and basic understanding of machine learning principles	
Course Objectives: Understanding the pattern Recognition, preprocessing, feature extraction, and classification	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Able to apply the knowledge of mathematics for obtaining solutions in pattern recognition domain	
CO2: Able to apply various algorithms for pattern recognition	
CO3: Able to map the pattern recognition concepts for solving real life problems	
CO4: Able to carry out implementation of algorithms using different simulation tools	

Contents-

Sr.No.	Content	Practical Hours
1	Illustrate and discuss the use of various method of pattern recognition.	2
2	Assuming a set of images that need to be classified read the image and calculates basic statics such as mean, mode and standard deviation.	2
3	Write a program for image enhancement for medical dataset.	2
4	Write a program to implement the naiv Bayesian classifier for sample training data set as a .csv file. Compute the accuracy of classifier considering few test data sets.	2
5	Write a program to construct a Bayesian network considering medical data and use this model to diagnosis heart patient.	2
6	Write a program to implement Bayes Theorem and its formula.	2
7	Write a program to perform Data Analysis on given data sets.	2
8	Write a program to implement KNN on Image data Sets.	2
9	Write a program to implement K-Means Clustering.	2
10	Write a program to implement PCA.	2
11	Project	10

Text Books: 1 R.O.Duda,P.E.HartandD.G.Stork, "PatternClassification" JohnWiley,2007 2nd Edition

Reference Books: 1. ChristopherM.Bishop, "NeuralNetworkforPatternRecognition" OxfordOhioPress

Syllabus

Semester-VII

Course code: CSC41MEL405	Course name: - Human Computer Interaction
Course category: - Major Elective	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA: 60 ESE-40	
Pre-requisites: Basic knowledge of computer science, psychology, mathematics and statistics	
Course Objectives: To enable students to design, implement, and evaluate user-friendly interactive systems by applying HCI principles, usability guidelines, and Java-based GUI/CLI development techniques.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Able to Explain basic concepts, history, and importance of Human-Computer Interaction.	
CO2: Apply user-centered design principles to analyze user needs and design interfaces.	
CO3: Create simple interaction designs using navigation, screen layout, and GUI guidelines/heuristics.	
CO4: Analyze interfaces using models and theories .	
CO5: Evaluate interface usability using expert review and user-based evaluation methods.	

Contents

Unit	Content	Teaching hours
1	<p>Introduction: What is Human Computer Interaction(HCI),History evolution of the field, Interactive System design , Discipline involved in HCI, HCI important, The psychology of every d ay things, Principals of HCI, User-Centered Designe areas of knowledge that relate with HCI.</p> <p>Applications: HCI in the context of mobile devices, consumer devices, business applications, scientific applications, web-based applications, collaboration systems, games.</p>	9
2	<p>Basics of Interaction Design: Design, Design process, Navigation design, Screen design and layout. Design rationale. Rules for designing GUIs: Principles, Standards, Guidelines, Golden rules and heuristics, HCI patterns.</p> <p>Implementation details: Perception, gestalt perception, typography, Graphic design- color, display, paper, and other output devices, designing forms and information visualization, events, action object and object action. Overview of the elements of windowing systems, Programming the application, using toolkit and User interface management systems. Software process involved in HCI, Usability engineering, Iteration and prototyping, virtual reality.</p>	9
3	<p>Evaluation, Universal Design and User Support: Evaluation techniques: evaluation, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing an evaluation method. Heuristic evaluation and cognitive walkthroughs.</p> <p>Universal design: principles, Multi-modal interaction, designing for diversity.</p> <p>User support: Requirements of user support, Approaches to user support, Adaptive help systems, designing user support systems.</p>	9
4	<p>Models and Theories: Cognitive models: Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures. Socio-organizational issues and stakeholder requirements: Organizational issues, Capturing requirements.</p> <p>Communication and collaboration models: Face-to-face communication, Conversation, Text-based communication, Group working. Task analysis: Differences between task analysis and other techniques, Task decomposition, Knowledge-based analysis, Entity- relationship-based techniques, Sources of information and data collection, Uses of task analysis. Dialog notations and design,</p> <p>Models of the system: Standard formalisms, Interaction models, Continuous behavior. Modeling rich interaction.</p>	9
5	<p>Groupware, Ubiquitous computing and WWW: Groupware: Groupware systems, Computer-mediated communication, Meeting and decision support systems, Shared applications and artifacts, Frameworks for groupware, implementing synchronous groupware. Ubiquitous computing and augmented realities: Ubiquitous computing applications research, Virtual and augmented reality, Information and data visualization. Hypertext, multimedia and the World Wide Web: Understanding hypertext, Finding things, Web technology and issues, Static web content, Dynamic web content. Case Studies.</p>	9

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale — Human–Computer Interaction (Pearson, 3rd ed.)
2. Jenny Preece, Yvonne Rogers, Helen Sharp — Interaction Design: Beyond Human–Computer Interaction (Wiley, latest/6th ed.)
3. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs — Designing the User Interface: Strategies for Effective HCI (Pearson, 6th ed.)

Reference Books:

1. Human computer Interaction ,Alan Dix, Janet Finlay, Gregory d. Abowd, Russell Beale Third Edition
2. Don Norman The Design of Everyday Things (Revised & Expanded).

Syllabus
Semester-VII

Course Code: CSC41MML406 Course Name: Data Analytics Course Category: Major Mandatory
Credits: 3 Teaching Scheme: L-3 P-0 Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Students must have to basic knowledge about programming and data understanding
Course Objectives: To equip students with the technical skills required to collect, clean, analyze, and visualize data using the Python ecosystem for evidence-based decision-making.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand and explain the comprehensive data analysis process, distinguishing between quantitative and qualitative data
CO2: Apply Python syntax and the NumPy library to perform high-performance numerical computations
CO3: Utilize Pandas data structures to ingest, organize, and manage data from diverse sources such as CSVs, Excel files, JSON
CO4: Analyze and Transform raw datasets by applying advanced techniques
CO5: Create professional-grade visualizations using Matplotlib and Seaborn to interpret data trends and present findings visually

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Data Analysis: Data Analysis, Knowledge Domains of the Data Analyst, Computer Science, Mathematics and statistics, Machine Learning and Artificial Intelligence, Professional fields of Application, Understanding the Nature of the Data, The Data Analysis Process, Quantitative and Qualitative Data Analysis, Open Data, Python and Data Analysis	9
2	Introduction to the Python: Python the Programming Language, The Interpreter and the execution phases of the code, Installing Python, Python Distributions, Ipython, PyPI the Python Package Index, SciPy, NumPy, Pandas, Matplotlib, NumPy Library: NumPy Installation, ndarray, Basic Operations, Indexing, Slicing and Iterating, Conditions and Boolean Arrays, Shape Manipulations, Array Manipulations, General Concepts, Structured Arrays, Reading and Writing Array Data on Files	9
3	The Pandas Library: Installations of Pandas, Introduction to Pandas Data Structure, Operations between Data Structures, Function application and Mapping, Sorting and Ranking, Correlation and Covariance, Hierarchical Indexing and leveling Pandas: Reading and Writing Data, I/O API Tools, CSV and textual Files, Reading Data in CSV or text files, Reading and writing HTML Files, Reading Data from XML, Reading and writing data on Microsoft excel files , JSON Data Interacting with Databases, Reading and writing data with NoSQL Databases: MangoDB.	9
4	Pandas in Depth: Data Manipulation: Data Preparation, Concatenating, Data Transformation, Discretization and Binning, Permutation, String Manipulations, Data Aggregation, Group Iteration, Advanced Data Aggregation	9
5	Data Visualization with matplotlib and seaborn: The matplotlib Library, The matplot Architecture, pyplot, Data Visualization with Jupyter Notebook, Using kwargs, Adding Elements to the chart, Handling Data Values, Chart typology: Line Charts, Bar Charts, Pie Charts, Advanced Charts, The mplot3d Toolkit, Multipanel Plots, The Seaborn	9

Text Books: 1.Python Data Analytics by Fabio Nelli ISBN 9798868800993 Third Edition

Reference Books:1.Data Analytics by Anil Maheshwari ISBN-9352604180 2nd Edition

Online Resources: 1.NPTEL / SWAYAM lectures.

**Syllabus
Semester-VII**

Course code: CSC41M EP405	Course name: Practical Based on Human Computer Interaction
Course category: Major Elective	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA: 30 ESE-20	
Pre-requisites: Basics knowledge of Java programming.	
Course Objectives: To enable students to design, implement, and evaluate user-friendly interactive systems by applying HCI principles, usability guidelines, and Java-based GUI/CLI development techniques.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Develop basic CLI-based Java programs using String args and apply input handling/output formatting.	
CO2: Create simple GUI applications using Java AWT, including components, layouts, and basic window handling.	
CO3: Implement GUI navigation and event-driven interaction (menus, screen switching, button actions) using proper event handling models.	
CO4: Apply HCI concepts in implementation: error handling & recovery	
CO5: Build and demonstrate an interface using the prototyping paradigm	

Contents-

Sr.No.	Content	Practical Hours
1	Designing command line interface (CLI)-based programs using String args in Java.	2
2	Hands on experience with the Java AWT to create simple GUIs	2
3	Simple Login Form with Validation (Forms + Feedback)	2
4	Registration Form with Good Form Design (Forms + Typography + Constraints)	2
5	Create a GUI Navigation Menu with a left-side menu (Home, Profile, Settings, Help).	2
6	Write a program for Error Handling & Recovery	2
7	Create a UI with 3 themes: Light, Dark, High-Contrast.	2
8	Design a window showing grouping by: Proximity (related buttons close), Similarity (same color/shape), Alignment (grid layout).	2
9	Write Event Handling Practical (Events, Action-Object / Object-Action)	2
10	Building an interface using prototyping paradigm	2
11	Project	10

Text Books: 1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human-Computer Interaction (Pearson) 2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs
2. Designing the User Interface: Strategies for Effective Human-Computer Interaction (Pearson) 3. Cay S. Horstmann & Gary Cornell Core Java (Vol I: Fundamentals) (Prentice Hall).

Reference Books: 1. Herbert Schildt – Java: The Complete Reference.
2. James Gosling, Ken Arnold, David Holmes – The Java Programming Language.
3. Ben Shneiderman et al. – Designing the User Interface: Strategies for Effective Human-Computer Interaction.

Syllabus
Semester-VII

Course Code: CSC41MMP406	Course Name: Practical Based on Data Analytics
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0 P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Students must have to basic knowledge about programming and data understanding	
Course Objectives: To equip students with the technical skills required to collect, clean, analyze, and visualize data using the Python ecosystem for evidence-based decision-making.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand and explain the comprehensive data analysis process, distinguishing between quantitative and qualitative data	
CO2: Apply Python syntax and the NumPy library to perform high-performance numerical computations	
CO3: Utilize Pandas data structures to ingest, organize, and manage data from diverse sources such as CSVs, Excel files, JSON	
CO4: Analyze and Transform raw datasets by applying advanced techniques	
CO5: Create professional-grade visualizations using Matplotlib and Seaborn to interpret data trends and present findings visually	

List of Practicals:

Sr.No	Title of the Experiment	Practical Hours
1	Create a list of student names and a list of their marks. Store them in a dictionary. Calculate the average marks using a simple loop.	2
2	Create a 1D array of numbers from 1 to 20. Reshape it into a 4x5 matrix (2D array) and print the shape and data type.	2
3	Create an array of 5 product prices and perform mathematical operations on entire datasets at once.	2
4	Create a Pandas DataFrame from a dictionary of 5 employees (ID, Name, Salary). Display the first 3 rows (head) and check column types (info).	2
5	Generate a dummy CSV file using Python, then read it back into a Pandas DataFrame.	2
6	Create a DataFrame with missing values (NaN). Fill numerical missing values with the Mean and categorical missing values with "Unknown".	2
7	Using the Employee DataFrame (from Practical 4), filter and display only those employees who earn more than 70,000.	2
8	Given a dataset of sales with "Region" (North, South), calculate the Total Sales per region.	2
9	Plot a Line Chart showing the temperature changes over a week. Add labels for "Days" and "Temperature".	2
10	Generate 100 random numbers using NumPy (representing ages of a population) and plot a Histogram using Seaborn to see the age distribution.	2
11	Project	10

Text Books: 1.Python Data Analytics by Fabio Nelli ISBN 9798868800993 Third Edition

Reference Books: 1.Data Analytics by Anil Maheshwari ISBN-9352604180 2nd Edition

Syllabus
Semester VII

Course code: CSC41RML401	Course Name: Research Methodology
Course Category: Research Methodology	
Credits: 3	Teaching scheme: L-3 P-0
Evaluation scheme: CA-60, ESE-40	
Pre-requisites: Basic understanding of subject fundamentals, elementary statistics, and academic reading and writing skills.	
Objective: To develop an understanding of research methodology principles and techniques applicable to problem identification, analysis.	
Course Outcome: After completion of the course the student will be able:	
CO1: To develops the ability to identify research problems and formulate objectives and hypotheses.	
CO2: To familiarizes students with research design, data collection, and analysis techniques relevant to robotics.	
CO3: To enhances skills in technical writing, documentation, and research ethics.	
CO4: Analyze and apply statistical techniques such as data processing, descriptive statistics, correlation, regression, and hypothesis testing to interpret and validate research data.	
CO5: Evaluate research findings and create a structured research report or mini proposal using appropriate referencing styles, ethical practices, and computer-based research tools.	

Unit	Contents	Teaching Hours.
1	Introduction to Research & Research Process : Meaning of Research, objectives, motivation, and significance of research, Types of research (basic/applied, qualitative/quantitative, conceptual/empirical) Research methods vs. research methodology, Research Approaches, Significance of Research, Scientific method and research ethics, Steps in the research process, Criteria of Good Research, Problems Encountered by Researchers in India	09
2	Research Problem Formulation & Research Design: Identification and definition of research problems in engineering/robotics (Meaning and sources of research problems, Criteria for selecting a research problem, Defining and formulating research problems), Review of literature and research gap identification, Formulation of objectives and hypotheses, Research design: exploratory, descriptive, experimental, Features of a good research design	09
3	Sampling Design & Data Collection Methods: Sampling concepts, population, sample, sampling errors , Probability and non-probability sampling techniques (Sample size (basic concept)Types of sampling errors (Sampling error, Non-sampling error, Bias and sources of bias), Methods of data collection: observation, interview, questionnaire, experiments, Selection of appropriate sampling and data collection methods (Nature of research problem, Objectives of the study, Time, cost, and resource constraints, Accuracy and reliability requirements, Relevance to robotics and engineering research)	09
4	Data Processing, Analysis & Hypothesis Testing: Data processing (Editing, coding, classification, tabulation), Descriptive statistics) Measures of central tendency, Measures of dispersion, Correlation and regression, Hypothesis testing (Concepts and Procedure, parametric and non-parametric tests), Interpretation of Statistical results.	09
5	Research Reporting: Interpretation of research results, Research report writing (Structure of research report technical paper, and project report), Referencing styles and bibliography, Plagiarism and ethical issues in research, Role of computers in research (Data analysis tools, Documentation and presentation tools), Preparation of a mini research proposal / report	09

Text Books : 1.C.R. Kothari — Research Methodology: Methods & Techniques 2.Ranjit Kumar — Research Methodology: A Step-by-Step Guide for Beginners
Reference Books: 1.Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. — An Introduction to Research Methodology 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design
Online Resources: 1.Alison – Essentials of Research Methodology

Syllabus Semester-VII

Course Code: CSC41RMP401	Course Name: Practical Based on Research Methodology
Course Category: Research Methodology	
Credits: 1	Teaching Scheme: L-0, P-2
Evaluation Scheme: CA-30,ESE-20	
Pre-requisites: Research Methodology practical is a basic understanding of research design, data collection methods, and fundamental statistical and analytical tools.	
Course Objectives: The Research Methodology course is to equip students with the skills to design, conduct, analyze, and interpret research systematically and ethically.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: To develop the ability to formulate research problems and design appropriate research methodologies.	
CO2: To design data collection and analysis procedures using suitable statistical and analytical techniques.	
CO3: To understand the principles of ethical research and effectively interpret and present research findings.	

List of Practicals:

Sr.No.	Title of the Experiment
1	Identify research papers from journals/conferences and prepare a structured literature review.
2	Select a domain in computer fraternity and define a clear research problem with objectives.
3	Write research objectives and formulate null and alternative hypotheses.
4	Develop a suitable research design for a selected problem (exploratory/descriptive/experimental).
5	Identify population, sample size, sampling technique, and justify the choice.
6	Design a questionnaire for data collection related to computer fraternity problem.
7	Collect sample data using questionnaire/observation and enter data in spreadsheet/software.
8	Perform basic statistical analysis (mean, median, standard deviation, graphs).
9	Apply an appropriate statistical test (t-test / chi-square) and interpret results.
10	Prepare and present a mini research report standard research paper format.

Text Book: 1. Practical Research: Planning and Design – Paul D. Leedy & Jeanne Ellis Ormrod

Reference Book: 1. Research Methodology: Methods and Techniques – C.R. Kothari

Semester: VIII

B.Sc. (Hons with Research) Computer Science

Syllabus Semester-VIII

Course code: CSC41M ML408	Course name:- Biometric Technique	Course category:- Major Mandatory
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA-60 ESE-40
Pre-requisites: Basic knowledge of image processing techniques and programming concepts		
Course Objectives: To introduce the principles, traits, standards, algorithms, multimodal fusion techniques, and security aspects of biometric systems, with in-depth study of fingerprint, face, iris, and emerging biometric modalities.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the fundamentals of biometric systems including goals, scope, biometric traits, standards, and applications.		
CO2: Describe and apply the principles of fingerprint, face, and iris recognition systems including acquisition, feature extraction, and matching.		
CO3: Analyze additional biometric traits such as ear, gait, hand geometry, periocular, face marks, and tattoos along with their challenges.		
CO4: Compare and evaluate multi-biometric systems, fusion levels, and acquisition/processing sequences for performance improvement.		
CO5: Assess security threats and adversary attacks on biometric systems and propose suitable countermeasures for system protection.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Biometric: what is biometrics? goals, scope, biometric characteristics, different biometric traits in biometric systems, Biometric Standards, Multi Biometric Systems, Application of biometric systems. Fingerprint, Face and Iris Recognition: Friction Ridge Pattern, Fingerprint Acquisition: Sensing Techniques Image Quality, Feature Extraction: Ridge Orientation and Frequency Estimation, Singularity, Ridge and Minutiae Extraction	9
2	Face Recognition: Psychology of Face Recognition, Facial Features, Image Psychology of Face Recognition, Facial Features, Image Acquisition, Face Detection, Feature Extraction and Matching Iris Recognition: Image Acquisition, Iris Segmentation, Iris Encoding and Matching, Iris Quality	9
3	Additional Biometric Traits: Ear Detection, Challenges of Ear Detection, Gait Recognition, Challenges of Gait recognition Hand Geometry: Image Capture, Hand Segmentation, Feature Extraction, Feature Matching and Challenges of Hand Geometric Recognition. Periocular, Face Marks, Tattoo.	9
4	Multi-Biometrics: Multi-Sensor System, Multi-Algorithm System, Multi- Instance System, Multi-Sample System, , Acquisition and Processing Sequence Fusion Levels: Sensor-Level Fusion, Feature-Level Fusion, Score- Level Fusion, Rank-Level Fusion and Decision-Level Fusion	9
5	Security of Biometric System :Adversary Attacks: : Insider Infrastructure attacks, Attacks at the interface: Impersonation, Obfuscation Spoofing attacks on biometric processing: Attacks on the system module, attacks at the interconnection	9

Text Books: 1.Essentials of Bioinformatics, Jin Xiong,CAMBRIDGE UNIVERSITY PRESS

2.Handbook of Multibiometrics , Anil K. Jain, Arun A. Ross, KarthikNandakumar, Springer Science & Business Media

Reference Books: 1.Biometrics: Theory, Methods and Applications, N. V. Boulgouris, Konstantinos, N. Plataniotis, Evangelia, Micheli-Tzanakou, John Wiley & Sons

Syllabus
Semester-VIII

Course code: CSC41MML409	Course name: - Biomedical Image and Visualization
Course category: - Major Mandatory	
Credits: 3	Teaching scheme: L-2 P-0
Evaluation scheme: CA:60 ESE-40	
Pre-requisites: Basic knowledge of digital images, programming (Python/MATLAB), physics of imaging, linear algebra, and image processing fundamentals.	
Course Objectives : Apply techniques in real-world clinical imaging scenarios and decision-making	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the fundamentals and purposes of various imaging systems.	
CO2: Explain physical principles behind image acquisition.	
CO3: Apply preprocessing and enhancement to medical images.	
CO4: Extract and analyze meaningful features.	
CO5: Create effective visualizations for 2D/3D images.	

Contents

Unit	Content	Teaching hours
1	Introduction of Biomedical Imaging: Overview to biomedical imaging and visualization, Types of medical imaging modalities: X-Ray (Radiography), Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound, Nuclear imaging (PET/SPECT), Digital representation of medical images (DICOM format)	9
2	Physics of Medical Image Acquisition: Basics of X-ray and CT physics, MRI signal generation & k-space, Ultrasound principles, Factors affecting image quality (noise, artifacts)	9
3	Biomedical Image Processing: Digital image representation (pixels, sampling, quantization), Image enhancement: filtering, histogram equalization, Segmentation methods: thresholding, region growing, Edge detection and morphological operations.	9
4	Feature Extraction and Analysis: Shape, texture, intensity features, Feature selection/dimensionality reduction (e.g., PCA), Classification basics (clustering, supervised methods), Evaluation metrics (accuracy, sensitivity, and specificity), Classification and Machine-Learning Methods: Supervised classifiers (e.g., Linear Discriminant Analysis — LDA), k-Nearest Neighbours, Neural Networks, and Support vector machine.	9
5	Visualization Techniques: Importance of visualization in medical imaging, 2D visualization and GUI concepts, 3D visualization: surface rendering (iso-surfaces), volume rendering, Visualization tools and libraries (e.g., VTK, Para View, 3D Slicer)	9

Text Books: 1. P. Suetens — Fundamentals of Medical Imaging — Cambridge University Press- Provides comprehensive coverage of the physics and technology of medical imaging.

2. Rafael C. Gonzalez & Richard E. Woods — Digital Image Processing — Pearson, Thorough textbook covering image processing essentials applicable to biomedical data.

Reference Books: 1.G. Dougherty — Digital Image Processing for Medical Applications — Cambridge University Press

2.J. Jan — Medical Image Processing, Reconstruction and Analysis R. M. Rangayyan — Biomedical Image Analysis — CRC Press

Syllabus
Semester-VIII

Course code: CSC41MMP408	Course name: Practical Based on Biometric Technique
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA-30, ESE-20	
Pre-requisites: Basics of mathematics, Image Processing Technique	
Course Objectives: Acquire knowledge about various biometric technologies.	
Course Outcomes: At the end of the course, the students will be able to -	
CO 1: Learn the process of designing and implementing biometric systems, including system architecture, database management, integration with existing systems, and security considerations.	
CO 2: Gain hands-on experience in biometric data acquisition techniques, including sensor technologies, image processing, feature extraction, and template matching algorithms	
CO 3: Learn about the practical applications of biometric systems in different domains such as security, access control, identity verification, surveillance, and forensic science.	

Contents -

Sr.No.	Description of Practical
1	Read the image of the fingerprint and use different techniques of noise reduction
2	Preprocess fingerprint images, including tasks such as ridge detection.
3	Enhance the image by using Linear Filter.
4	Perform the segmentation on fingerprint.
5	Extract key features such as finger length, width, and hand shape from the captured images.
6	Evaluate the performance of the system in terms of accuracy, speed, and robustness.
7	Investigate vulnerabilities like spoofing attacks and assess the system's resilience.
8	Design Graphical User Interface for Face Recognition..
9	Design Graphical User Interface for Fingerprint Recognition.
10	Design Graphical User Interface for Iris Recognition.
11	Project

Text Books: 1.Essentials of Bioinformatics, Jin Xiong,CAMBRIDGE UNIVERSITY PRESS
2..Handbook of Multibiometrics , Anil K. Jain, Arun A. Ross, KarthikNandakumar, Springer Science & Business Media

Reference Books: 1.Biometrics: Theory, Methods and Applications, N. V. Boulgouris, Konstantinos, N. Plataniotis, Evangelia, Micheli-Tzanakou, John Wiley & Sons

Syllabus
Semester-VIII

Course code: CSC41MML409 Course name: -Practical based on Biomedical Image and Visualization
Course category: - Major Mandatory
Credits: 1 Teaching scheme: L-0 P-2 Evaluation scheme: CA: 30 ESE-20
Pre-requisites: Basic computer skills, understanding of digital images, representation, filtering concepts, knowledge of segmentation, statistics, and feature representation.
Course Objectives: Integrating imaging techniques with clinical type datasets for analysis and interpretation
Course Outcomes: At the end of the course, the students will be able to -
CO1: Handle and interpret medical image formats (DICOM).
CO2: Apply preprocessing techniques for cleaning medical images.
CO3: Use segmentation & morphological operations on biomedical data.
CO4: Extract meaningful features from medical images.
CO5: Perform 2D & 3D visualization of medical image sets.

Contents-

Sr.No.	Content	Practical Hours
1	Introduction to Medical Image Formats: Install/configure necessary software (3D Slicer, VTK, ParaView), Load and inspect DICOM images, Display metadata and pixel properties.	2
2	Image Pre-processing: Apply noise removal (median/Gaussian filters), Contrast stretching & histogram equalization, Edge enhancement.	2
3	Edge Detection and Morphological Operations: Perform Sobel, Prewitt, and Canny edge detection, Apply dilation, erosion, opening, and closing.	2
4	Region-Based Segmentation: Threshold segmentation, Region growing, Contour extraction.	2
5	Feature Extraction: Extract shape, texture, intensity features. Build feature vectors for sample classification.	2
6	2D Visualization: Implement slice-wise viewing of multi-slice medical volumes. Add annotations (labels, scale).	2
7	3D surface Rendering: Generate surface renderings (isosurfaces), Visualize organ/structure render.	2
8	Volume Rendering: Employ direct volume rendering (ray casting), Adjust transfer functions interactively.	2
9	To develop system for Select a clinical dataset (e.g., brain scans), Integrate pre-processing ,segmentation , visualization chain, Prepare a report and presentation.	2
10	To develop system for Select a clinical dataset (e.g., Hear scans), Integrate pre-processing, segmentation ,visualization chain, Prepare a report and presentation	2
11	Project	10

Text Books: 1. Gonzalez & Woods — Digital Image Processing — Pearson Covers filtering, segmentation, feature extraction approaches.

2. P. Suetens — Fundamentals of Medical Imaging — Cambridge Provides clinical perspective & image acquisition context that informs lab analysis.

Reference Books: 1.Geoff Dougherty — Digital Image Processing for Medical Applications — Cambridge Univ. Press

2.R. M. Rangayyan — Biomedical Image Analysis — CRC Pres

3.C. D. Hansen & C. R. Johnson — The Visualization Handbook

Syllabus Semester-VIII

Course Code: CSC41MEL407	Course Name: Natural Language Processing	Course Category: Major Elective
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: natural language processing is a solid understanding of linguistics, probability/statistics, and machine learning fundamentals.		
Course Objectives: To develop Natural Language Processing course is to equip students with the knowledge and skills to design, implement, and evaluate systems that enable computers to understand and generate human language.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To develop a strong understanding of core natural language processing concepts and techniques.		
CO2: To familiarize students with text preprocessing methods, linguistic analysis, and NLP tools.		
CO3: To enhance the ability to apply NLP algorithms to real-world language processing problems.		
CO4: To understands ethical considerations and limitations of Natural Language Processing systems.		
CO4: Apply and evaluate n-gram-based language models and probabilistic text classification techniques		

Course Contents –

Unit	Content	Teaching hours
1	Foundations of Natural Language Processing and Text Preprocessing: Introduction to Natural Language Processing (NLP), its historical development, and the relationship between text analytics and NLP. Overview of the various stages involved in NLP. Understanding different types of data, including structured and unstructured data. Text data preprocessing techniques such as data cleaning and stop-word removal. Feature extraction and feature engineering from text data, including basic methods for textual feature extraction.	09
2	Machine Learning Techniques for Text Processing and Topic Modeling: Machine learning algorithms applied to text data and techniques for text classification. Overview of text classifiers and pipeline-based methods for building NLP models. Methods for collecting text data from the web, including web scraping and requesting web content. Handling and processing semi-structured text data. Introduction to topic modeling techniques using Latent Semantic Analysis (LSA) and Latent Dirichlet Allocation (LDA).	09
3	Text Processing, Linguistic Analysis, and Data Extraction Techniques: Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, POS tagging, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance Extract and process data from web pages, Describe different kinds of semi-structured data, such as JSON and XML, Extract real-time data using Application Programming Interfaces, Extract data from various file formats	09
4	Parsing Techniques, Text Summarization, Generation, and Vector Representations in NLP : Context Free Grammar Top-Down and Bottom-up parsing, Text Summarization and Text Generation Describe the Text Rank algorithm, Implement text summarization using Gensim , Implement text summarization using word frequency, Generate text using Markov chains ,Vector Representation Describe the need for vector representation in Natural Language Processing (NLP),Identify the various ways that text can be represented as vectors ,Describe word vectors and their various forms, Implement vector arithmetic, Describe document vectors	09
5	Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Back off, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. Module 6: Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis-	09

	Describe sentiment analysis and its applications, Describe various tools in sentiment analysis, Perform sentiment analysis using the Text Blob library, Demonstrate how to load data for sentiment analysis, Demonstrate the training of a sentiment analysis model Opinion Mining and Emotion Analysis, Resources and Techniques	
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Text Books: 1. Speech and Language Processing by Daniel Jurafsky and James H. Martin
2. Natural Language Processing with Python by Steven Bird, Ewan Klein, and Edward Loper

Reference Books: 1. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schütze
2. Neural Network Methods in Natural Language Processing by Yoav Goldberg

Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus Semester-VIII

Course code: CSC41M EL408	Course name:- Fuzzy Logic	Course category:- Major Elective
Credits: 3	Teaching scheme: L-3 P-0	Evaluation scheme: CA-60 ESE-40
Pre-requisites: Basic knowledge of fuzzy logic systems		
Course Objectives: Fuzzy logic is to provide a systematic, mathematical framework for modeling, interpreting, and controlling systems that are vague, imprecise.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Recall definitions and properties of classical sets, fuzzy sets, and membership functions.		
CO2: Explain operations on classical and fuzzy sets, and the mapping between them.		
CO3: Perform fuzzification, defuzzification, and operations on fuzzy relations.		
CO4: Compare crisp and fuzzy relations, and examine compositions and properties of fuzzy rules.		
CO5: Design a fuzzy rule-based system with aggregation, decomposition, and inference mechanisms.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Fuzzy Logic Classical Sets and Fuzzy Sets: Operations on Classical Sets, Properties of Classical Sets, Mapping of Classical Sets to a Function, Fuzzy Set Operations, Properties of Fuzzy Sets,	9
2	Classical and Fuzzy Relations : Cardinality of Crisp Relation, Operations on Crisp Relation , Properties of Crisp Relations, Composition, Cardinality of Fuzzy Relations, Operations on Fuzzy Relations , Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition	9
3	Crisp Relations and Fuzzy Relation, Membership Functions Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, and Membership Value Assignments.	9
4	Defuzzification Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods	9
5	Fuzzy Rule-Based System Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules , Properties of Set of Rules , Fuzzy Inference System.	9

Text Books: 1.Introduction to Fuzzy Logic using MATLAB ,S.N. Sivanandam, S. Sumathi and S.N. Deepa,
2. INTRODUCTION TO FUZZY LOGIC”, SHINGHAL, RAJJAN.

Reference Books: 1. Introduction to Fuzzy Logic , James K. Peckol
2.Fuzzy Logic Concepts in Computer Science and Mathematics

Syllabus Semester-VIII

Course Code: CSC41MEP407	Course Name: Practical Based on Natural Language Processing
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30 ,ESE-20	
Pre-requisites: Fundamental knowledge of probability, statistics, and linear algebra	
Course Objectives: Proficiency in working with text data and manipulating strings.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Implement NLP applications such as information retrieval, question answering, and machine translation	
CO2: Apply NLP techniques to solve real-world problems in various domains such as healthcare, finance, customer service, and social media analysis.	
CO3: Stay updated with the latest advancements in NLP research and adapt to new techniques and technologies in the field.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Study and implementation of basic text preprocessing techniques: tokenization, stop-word removal, and stemming using Python.	2
2	Implementation of text normalization techniques including lowercasing and lemmatization using NLTK/spaCy.	2
3	Perform sentence segmentation and Part-of-Speech (POS) tagging on given text data.	2
4	Implement Named Entity Recognition (NER) using Python libraries.	2
5	Feature extraction from text using Bag of Words and TF-IDF models.	2
6	Text classification using machine learning algorithms such as Naive Bayes or Logistic Regression.	2
7	Implement sentiment analysis on textual data using Python.	2
8	Topic modeling using Latent Dirichlet Allocation (LDA) or Latent Semantic Analysis (LSA).	2
9	Text summarization using frequency-based method and Gensim library.	2
10	Word vector implementation using Word2Vec / GloVe and performing basic vector arithmetic.	2
11	Project	10

Text Book : 1. Natural Language Processing – Jacob Eisenstein

Reference Book: 1 Foundations of Statistical Natural Language Processing – Christopher D. Manning and Hinrich Schütze

Syllabus Semester-VIII

Course Code: CSC41MEP408	Course Name: Practical Based on Fuzzy Logic
Course Category: Major Elective	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30 ,ESE-20	
Pre-requisites: Basic knowledge of fuzzy logic and MATLAB Tool.	
Course Objectives: To focus on enabling students to model uncertainty, design fuzzy inference systems	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Translate real-world concepts into fuzzy sets and membership functions.	
CO2: Construct and implement fuzzy controllers for specific domains.	
CO3 : To Analyze and manage imprecise or vague information in data.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Mat LAB – An Overview of Fuzzy logic Tool	2
2	Fuzzy Logic in Image Processing	2
3	Fuzzy Logic in Biomedicine	2
4	Fuzzy Logic Applications in Industrial Automation	2
5	Fuzzy Logic in Automotive Applications	2
6	Fuzzy Logic Applications in Power Systems	2
7	Fuzzy Logic in Control	2
8	Fuzzy Pattern classification	2
9	Fuzzy Pattern Recognition	2
10	Fuzzy Logic Projects Using Matlab	2
11	Project	10

Text Book : 1.Introduction to Fuzzy Logic using MATLAB ,S.N. Sivanandam, S. Sumathi and S.N. Deepa,
2. INTRODUCTION TO FUZZY LOGIC”, SHINGHAL, RAJJAN.

Reference Book: 1. Introduction to Fuzzy Logic , James K. Peckol
2.Fuzzy Logic Concepts in Computer Science and Mathematics