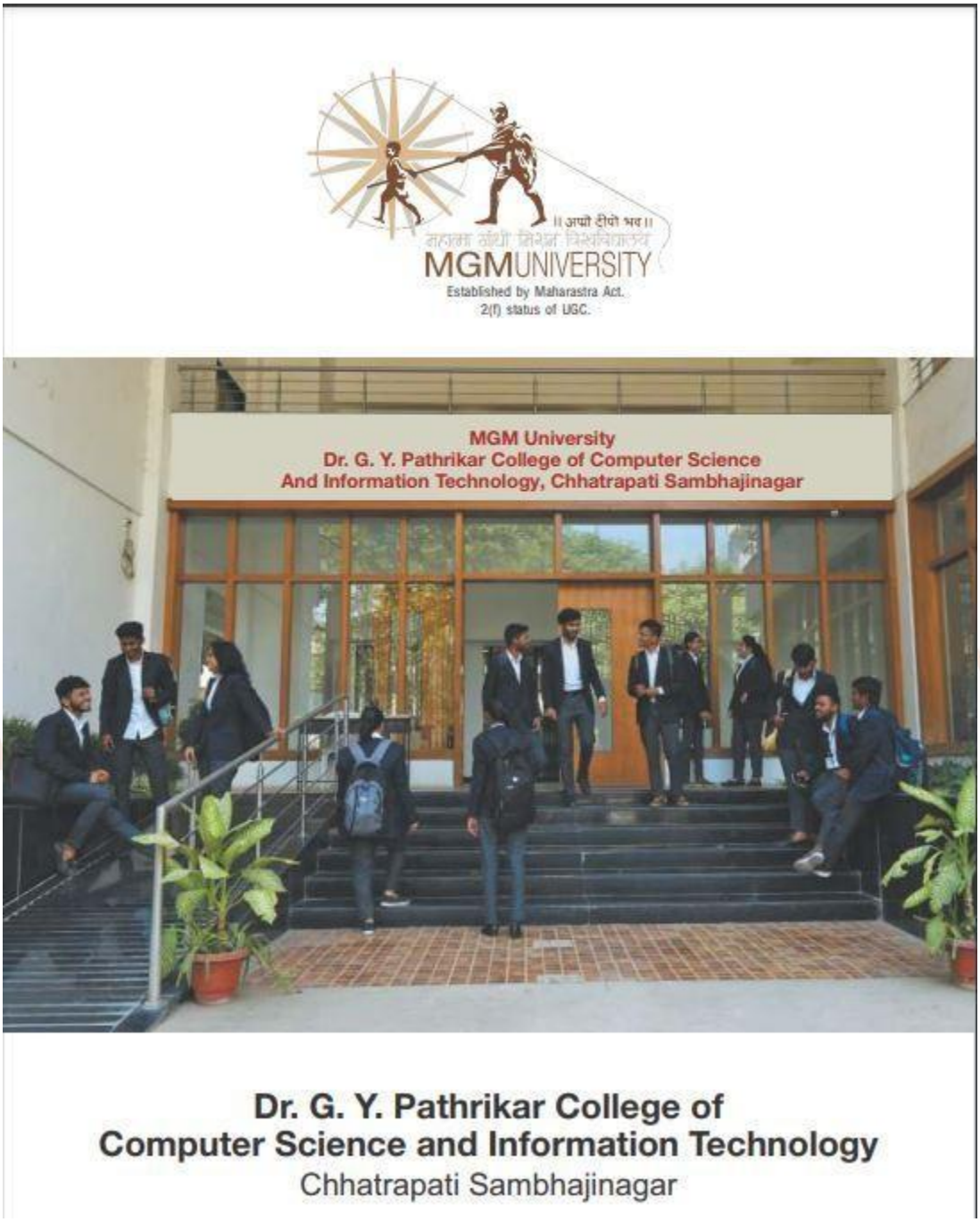

B.Sc. (Hons. /Hons. with Research) Computer Science
Second Year (Syllabus)
With Effect from: ACADEMIC YEAR: 2024-25

MGM University

Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

- To impart state of art education and technical expertise to students and give necessary training to teachers to create self-reliant society for future.
- To encourage students to participate in Indian and International activities in sports, literature, etc. so that future generation becomes base for free and liberal society
- To educate students in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society.
- To inculcate culture of non-violence and truthfulness through Vipassana.

  To sustain activities of Indian culture (viz. classical dance, music and fine arts) through establishing institutes like Mahagami, Naturopathy, etc.

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 अप्रमाि से 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 Sambhajinagar.

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-violance, truth, peace through Gandhian Philosophy.

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

Undergraduate Programmes	Postgraduate Programmes	PhD Programmes
B.Sc(Computer Science) Honours / Honours with Research	M.Sc. (Computer Science)	Ph.D. in Computer Science and Information Technology
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		

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**

	GYP	IBT	UDBAS
Minor options for basic and applied science Faculty	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

	Faculty of Engineering and Technology	Faculty of Social Sciences & Humanities	Faculty of Design	Faculty of Management and Commerce	Interdisciplinary Faculty	Performing Arts
Minor options from Other Faculty	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	CSC41MML101	Operating System	Lecture	2	2		30	20	50		08	20
MM	CSC41MML102	Data Structure	Lecture	2	2		30	20	50		08	20
MM	CSC41MMP101	Practical on Operating System	Practical	1		2	30	20	50		08	20
MM	CSC41MMP102	Practical on Data Structure	Practical	1		2	30	20	50		08	20
IKS	CSC41IKT101	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	CSC41VSP101	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	CSC41MML101	Basket of VEC From University	Lecture	2	2	-	30	20	50		08	20
CC	CSC41MML102	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: M**M-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	CSC41MML103	Data Base Management System	Lecture	2	2		30	20	50		08	20
MM	CSC41MML104	Microprocessor	Lecture	2	2		30	20	50		08	20
MM	CSC41MMP103	Practical on Data Base Management System	Practical	1		2	30	20	50		08	20
MM	CSC41MMP104	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	CSC41VSP102	Object Oriented Programming in C++	Practical	2		4	30	20	50		08	20
SEC	CSC41SEL102	Internet of Things	Lecture	2	2		30	20	50		08	20
VEC	CSC41MML103	Basket of VEC From University	Lecture	2	2		30	20	50		08	20
CC	CSC41MML104	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	CSC41MML201	Data Communication Network-I	Lecture	2	2	-	30	20	50		08	20
MM	CSC41MML202	Computer Graphics	Lecture	2	2	-	30	20	50		08	20
MM	CSC41MML203	Statistical Method	Lecture	2	2	-	30	20	50		08	20
MM	CSC41MMP201	Practical on Data Communication Network-I	Practical	1	-	2	30	20	50		08	20
MM	CSC41MMP202	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	CSC41VSP201	Programming in Java	Practical	2		4	30	20	50		08	20
FP	CSC41FPJ201	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: M**M-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	CSC41MML204	Software Engineering	Lecture	2	2		30	20	50		08	20
MM	CSC41MML205	Numerical Computational Technique	Lecture	2	2		30	20	50		08	20
MM	CSC41MML206	Data Communication Network II	Lecture	2	2		30	20	50		08	20
MM	CSC41MMP203	Practical on Software Engineering	Practical	1		2	30	20	50		08	20
MM	CSC41MMP204	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	CSC41SEP201	Web Programming	Practical	2		4	30	20	50		08	20
CEP	CSC41CEP201	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	CSC41MML301	Cloud Computing	Lecture	2	2		30	20	50		08	20
MM	CSC41MML302	Machine Learning	Lecture	2	2		30	20	50		08	20
MM	CSC41MML303	Introduction to Robotics	Lecture	2	2		30	20	50		08	20
MM	CSC41MMP301	Practical Based on Cloud Computing	Practical	1		2	30	20	50		08	20
MM	CSC41MMP302	Practical Based on Machine Learning	Practical	1		2	30	20	50		08	20
ME	CSC41MEL301	Artificial Intelligence	Lecture	3	3		60	40	100		16	40
	CSC41MEL302	Blockchain Technology	Lecture	3	3		60	40	100		16	40
ME	CSC41MEP301	Practical Based on Artificial Intelligence	Practical	1		2	30	20	50		08	20
	CSC41MEP302	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	CSC41VSP301	Python Programming	Practical	2		4	30	20	50		08	20
FP	CSC41FPJ301	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	CSC41MML304	Digital Image Processing	Lecture	2	2		30	20	50		08	20
MM	CSC41MML305	Deep Learning	Lecture	2	2		30	20	50		08	20
MM	CSC41MML306	Theory of Computation	Lecture	2	2		30	20	50		08	20
MM	CSC41MMP303	Practical on Digital Image Processing	Practical	1		2	30		50		08	20
MM	CSC41MMP304	Practical on Deep Learning	Practical	1		2	30	20	50		08	20
ME	CSC41MEL303	Software cost estimation	Lecture	3	3		60	40	100		16	40
	CSC41MEL304	Data Analytics	Lecture	3	3						16	40
ME	CSC41MEP303	Practical Based on Software cost estimation	Practical	1		2	30	20	50		08	20
	CSC41MEP304	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	CSC41JTP301	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: M**M-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	CSC41MML401	Neural Network	Lecture	3	3		60	40	100		16	40
MM	CSC41MML402	Data Ware Housing and Data Mining	Lecture	3	3		60	40	100		16	40
MM	CSC41MML403	Network Security	Lecture	3	3		60	40	100		16	40
MM	CSC41MMP401	Practical based on Neural Network	Practical	1		2	30	20	50		08	20
MM	CSC41MMP402	Practical on Data Ware Housing and Data Mining	Practical	1		2	30	20	50		08	20
MM	CSC41MMP403	Practical Based on Network Security	Practical	1		2	30	20	50		08	20
ME	CSC41MEL401	Geographical Information System	Lecture	3	3		60	40	100		16	40
	CSC41MEL402	Remote Sensing	Lecture	3	3		60	40	100		16	40
ME	CSC41MEP401	Practical Based on Geographical Information System	Practical	1		2	30	20	50		08	20
	CSC41MEP402	Practical Based on Remote Sensing	Practical	1		2	30	20	50		08	20
RM	CSC41RML401	Research Methodology	Lecture	3	3		60	40	100		16	40
RM	CSC41RMP401	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: M**M-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	CSC41MML404	Biometric Technique	Lecture	3	3		60	40	100		16	40
MM	CSC41MML405	Quantum Computing	Lecture	3	3		60	40	100		16	40
MM	CSC41MML406	Software Testing	Lecture	3	3		60	40	100		16	40
MM	CSC41MMP404	Practical on Biometric Technique	Practical	1		2	30	20	50		08	20
MM	CSC41MMP405	Practical on Quantum Computing	Practical	1		2	30	20	50		08	20
MM	CSC41MMP406	Practical on Cyber Security	Practical	1		2	30	20	50		08	20
ME	CSC41MEL403	Cyber Security	Lecture	3	3		60	40	100		16	40
	CSC41MEL404	Augmented Reality	Lecture	3	3		60	40	100		16	40
ME	CSC41MEP403	Practical Based on Cyber Security	Practical	1		2	30	20	50		08	20
	CSC41MEP404	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: M**M-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	CSC41MML407	Medical Image Processing	Lecture	3	3		60	40	100		16	40
MM	CSC41MML408	Pattern Recognition	Lecture	3	3		60	40	100		16	40
MM	CSC41MMP406	Practical on Medical Image Processing	Practical	1		2	30	20	50		08	20
MM	CSC41MMP407	Practical on Pattern Recognition	Practical	1		2	30	20	50		08	20
ME	CSC41MEL405	Human Computer Interaction	Lecture	3	3		60	40	100		16	40
	CSC41MEL406	Data Analytics	Lecture	3	3		60	40	100		16	40
ME	CSC41MEP405	Practical Based on Human Computer Interaction	Practical	1		2	30	20	50		08	20
	CSC41MEP406	Practical based on Data Analytics	Practical	1		2	30	20	50		08	20
RM	CSC41RML401	Research Methodology	Lecture	3	3		60	40	100		16	40
RM	CSC41RMP401	Practical based on Research Methodology	Practical	1		2	30	20	50		08	20
RP	CSC41RPJ401	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: M**M-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	CSC41MML408	Biometric Technique	Lecture	3	3		60	40	100		16	40
MM	CSC41MML409	Biomedical Image and Visualization	Lecture	3	3		60	40	100		16	40
MM	CSC41MMP408	Practical base on Biometric Technique	Practical	1		2	30	20	50		08	20
MM	CSC41MMP409	Practical based on Biomedical Image and Visualization	Practical	1		2	30	20	50		08	20
ME	CSC41MEL407	Natural Language Processing	Lecture	3	3		60	40	100		16	40
	CSC41MEL408	Fuzzy Logic	Lecture	3	3		60	40	100		16	40
ME	CSC41MEP407	Practical Based on Natural Language Processing	Practical	1		2	30	20	50		08	20
	CSC41MEP408	Practical Based on Fuzzy Logic	Practical	1		2	30	20	50		08	20
RP	CSC41RPJ402	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: M**M-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	**Introduction:** Concept of Operating System, History of Operating System, Operating System Structure, Types of Operating System ,Function of Operating System, Components of Operating system **Process Management**: Concept of Process, Process States, Process,Scheduling, operation on process Inter process communication **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.	10
2	**Concurrent Programming:** Monitors,Deadlock concept, Four Necessary condition for deadlock Deadlock Presentation, Deadlock avoidance, deadlock detection, deadlock recovery **Memory Management:** Swapping, Contiguous Memory allocation, paging, Structure of the Page Table ,Segmentation, Example, the Intel Pentium,	10
3	**Virtual Memory Management:** Demand Paging, copy on write, Page replacement, allocation of Frames, thrashing, Memory Map Files, Allocating Kernel Memory **Device Management:** Techniques for device management, Device Characteristics, Device Allocation Considerations, Virtual Devices	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 **category:** Major Mandatory	**Course name:** Practical on Microprocessor	
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 two8-bit numbers with programs based on different Addressing modes of 8086.	1
2	Addition and subtraction of two 16-bitnumbers.(Using2's Complement method, also programs which access numbers from specified memory location	1
3	Multiplication of two8-bit numbers using the method of successive Addition and Shift & add.	1
4	Division of two8 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 Madisetti , 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,VlasiosTsiatsis ,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 (CSMAlCD) , Carrier Sense Multiple Access with Collision Avoidance (CSMAlCA)	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, textnet, 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, andH. 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 edition. Birmingham: Packt Publishing, 2018.
Reference Books:
1. Z. Zheng, S. Xie, H. Dai, X. Chen, andH. 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, 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: 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 Knell 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 kutosis.	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 Matl off 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 Knell Amazon Digital South Asia Services Inc.