



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

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

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 Vipassana meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

Mission

- 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 अप्रमासे है िुझे

चलना सब्ब का कल्याण हो ,

वो कार्गकुशल करना

सब्ब का उत्तम मंगल , पथप्रिशगक हो

अत्त दिप भव भव प्रदिप भव , स्वरूप

रूप भव हो

ज्ञान सब्ब दवज्ञान सब्ब भव ,

सब्ब दिप भव हो बुद्धमं

शरनं गच्छादम : धम्मं

शरनं गच्छादम :

संघं शरनं गच्छादम :

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

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

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

Vision

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

Mission

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

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

Undergraduate Programmes	Postgraduate Programmes	PhD Programmes
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 B.Sc.-M.Sc. (Data Science)		
BCA(Digital Marketing) Honours		
B.Sc.(Robotics) Honours		

MGMUNIVERSITY

Name of Program – B.Sc. (Information Technology) 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.

MGMUNIVERSITY

Name of the College/Institute/Department/School: Dr. G.Y Pathrikar College of CS & IT MGMU Name of the Programme: B.Sc. (Information Technology) 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	
Information Technology	
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	ITH41M ML101	Introduction to Information and Communication Technology	Lecture	2	2		30	20	50		08	20
MM	ITH41M ML102	Computer Architecture	Lecture	2	2		30	20	50		08	20
MM	ITH41M MP101	Practical based on Information and Communication Technology	Practical	1		2	30	20	50		08	20
MM	ITH41M MP102	Practical based on Computer Architecture	Practical	1		2	30	20	50		08	20
IKS	ITH41IK T101	Indian Psychology and yoga	Lecture	2	2	-	30	20	50		08	20
AEC		Basket of AEC From University	Lecture	2	2	-	30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2	-	30	20	50		08	20
OE		Basket of OE From University	Lecture	2	2	-	30	20	50		08	20
VSC	ITH41VS P101	C Programming	Practical	2		4	30	20	50		08	20
SEC	ITH41SE L101	Programing Logic and Design	Lecture	2	2	-	30	20	50		08	20
VEC		Basket of VEC From University	Lecture	2	2	-	30	20	50		08	20
CC		Basket of CC From University	Practical	2	-	4	50	-	50	20	-	20
Total				22	16	12	380	220	600			

Note:

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

First Year - Semester II												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	ITH41MML103	Database Management System	Lecture	2	2		30	20	50		08	20
MM	ITH41MML104	Data Structure	Lecture	2	2		30	20	50		08	20
MM	ITH41MMP103	Practical based on DBMS	Practical	1		2	30	20	50		08	20
MM	ITH41MMP104	Practical based on Data Structure	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	ITH41VSP102	Web Fundamental	Practical	2		4	30	20	50		08	20
SEC	ITH41SEL102	Operating System	Lecture	2	2	-	30	20	50		08	20
VEC		Basket of VEC From University	Lecture	2	2	-	30	20	50		08	20
CC		Basket of CC From University	Practical	2	-	4	50	-	50	20	-	20
Total				22	16	12	380	220	600			

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

Level 4.5 Award of UG certificate with 40 credits and an additional 4-credits core NSQF course / internship OR continue with major and minor

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	ITH41MML201	Data Warehousing	Lecture	2	2	-	30	20	50	-	08	20
MM	ITH41MML202	Object Oriented Programming Using C++	Lecture	2	2	-	30	20	50	-	08	20
MM	ITH41MML203	Statistical Method	Lecture	2	2	-	30	20	50	-	08	20
MM	ITH41MMP201	Practical Based on Data warehousing	Practical	1	-	2	30	20	50	-	08	20
MM	ITH41MMP202	Practical Based on Object Oriented Programming Using C++	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	Practical	2	2	-	30	20	50	-	08	20
VSC	ITH41VSP201	Advance Excel	Practical	2	-	4	30	20	50	-	08	20
FP	ITH41FPJ201	Field Project	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

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		Total
MM	ITH41MML204	Data Mining	Lecture	2	2	-	30	20	50	-	08	20
MM	ITH41MML205	Core Java	Lecture	2	2	-	30	20	50	-		20
MM	ITH41MML206	Software Engineering	Lecture	2	2	-	30	20	50	-	08	20
MM	ITH41MMP203	Practical Based on Data Mining	Practical	1	-	2	30	20	50	-	08	20
MM	ITH41MMP204	Practical Based on Core Java	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	-		20
SEC	ITH41SEP 201	Bootstrap	Practical	2	-	4	30	20	50	-	08	20
CEP	ITH41CEP 201	Community Engagement Program	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	Natur of Course	No .of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	ITH41MML301	Introduction to Data Science	Lecture	2	2	-	30	20	50		08	20
MM	ITH41MML302	Python Programming	Lecture	2	2	-	30	20	50		08	20
MM	ITH41MML303	Computer Networks	Lecture	2	2		30	20	50		08	
MM	ITH41MMP301	Practical Based on Introduction to Data Science	Practical	1	-	2	30	20	50		08	20
MM	ITH41MMP302	Practical Based on Python Programming	Practical	1	-	2	30	20	50		08	20
ME	ITH41MEL301	Java Script	Lecture	3	3	-	60	40	100		16	40
	ITH41MEL302	Agile software development										
ME	ITH41MEP301	Practical based on Java Script	Practical	1	-	2	30	20	50		08	20
	ITH41MEP302	Agile software development										
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
VSC	ITH41VS P301	Mobile App Development	Practical	2	-	4	30	20	50		08	20
FP	ITH41FPJ 301	Field Project	Project	2	-	4	50	-	50	20	-	20
Total				20	12	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	ITH41MML304	Data Analytics	Lecture	2	2	-	30	20	50		08	20
MM	ITH41MML305	Cloud Computing	Lecture	2	2	-	30	20	50		08	20
MM	ITH41MML306	Drone Technology	Lecture	2	2	-	30	20	50		08	20
MM	ITH41M MP303	Practical Based Data Analytic	Practical	1	-	2	30	20	50		08	20
MM	ITH41M MP304	Practical Based on Cloud Computing	Practical	1	-	2	30	20	50		08	20
ME	ITH41MEL303	PHP	Lecture	3	3	-	60	40	100		16	40
	ITH41MEL304	UI/UX										
ME	ITH41MEP303	Practical based on PHP	Practical	1	-	2	30	20	50		08	20
	ITH41MEP304	Practical based on UI/UX										
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
OJT	ITH41JTP 301	On Job Training	Practical	4		8	30	20	50		08	20
Total				20	12	16	390	260	650			

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

Fourth Year - Semester VII												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	ITH41MML401	Artificial Intelligence	Lecture	3	3		60	40	100		16	40
MM	ITH41MML402	Internet of Things	Lecture	3	3		60	40	100		16	40
MM	ITH41MML403	Network Security	Lecture	3	3		60	40	100		16	40
MM	ITH41MMP401	Practical Based Artificial Intelligence	Practical	1		2	30	20	50		08	20
MM	ITH41MMP402	Practical Based on Internet of Things	Practical	1		2	30	20	50		08	20
MM	ITH41MMP403	Practical Based on Network Security	Practical	1		2	30	20	50		08	20
ME	ITH41MEL401	Cloud Web Services	Lecture	3			60	40	100		16	40
	ITH41MEL402	Basics of Power BI										
ME	ITH41MEP401	Practical Based on Cloud Web Services	Practical	1		2	30	20	50		08	20
	ITH41MEP402	Practical Based on Power BI										
RM	ITH41RML401	Research Methodology	Lecture	3		-	60	40	100		16	40
RM	ITH41RMP401	Practical based on Research Methodology	Practical	1		2	30	20	50		08	20
Total				20	15	10	450	300	750			

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

Fourth Year - Semester VIII

Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	ITH41MML404	Introduction to DevOps	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MML405	Business Intelligence	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MML406	Machine Learning	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MMP404	Practical Based on DevOps	Practical	1	-	2	30	20	50		08	20
MM	ITH41MMP405	Practical Based on Business Intelligence	Practical	1	-	2	30	20	50		08	20
MM	ITH41MMP406	Practical Based on Machine Learning	Practical	1	-	2	30	20	50		08	20
ME	ITH41MEL403	Geospatial Technology	Lecture	3	3	-	60	40	100		16	40
	ITH41MEL404	Ethical Hacking										
ME	ITH41MEP403	Practical based on Geospatial Technology	Practical	1	-	2	30	20	50		08	20
	ITH41MEP404	Practical based on Ethical Hacking										
OJT	ITH41JTP401	On Job Training	Practical	4		8	60	40	100		16	40
				20	12	16	420	280	700			
Total												

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.

Four Year (Semester VII) Honours with Research

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	ITH41MML407	Machine Learning	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MML408	Natural Language Processing	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MMP406	Practical Based on Machine Learning	Practical	1	-	2	30	20	50		08	20
MM	ITH41MMP407	Practical Based on Natural Language Processing	Practical	1	-	2	30	20	50		08	20
ME	ITH41MEL405	Remote Sensing	Lecture	3	3	-	60	40	100		16	40
	ITH41MEL406	Digital Image Processing	Lecture									
ME	ITH41MEP405	Practical based on Remote Sensing	Practical	1	-	2	30	20	50		08	20
	ITH41MEP406	Practical based on Digital Image Processing	Practical									
RM	ITH41RML401	Research Methodology	Lecture	3	3	-	60	40	100		16	40
RM	ITH41RMP401	Practical based on Research Methodology	Practical	1	-	2	30	20	50		08	20
RP	ITH41RPJ401	Research Project	Practical	4	-	8	60	40	100		16	40
Total				20	12	16	420	280	700			

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

Fourth Year - Semester VIII Honours with Research												
Course Category	Course Code	Course Title	Nature of Course	No. of Credits	Teaching (Contact hrs/week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
MM	ITH41MML408	Big Data Analytics	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MML409	Deep Learning	Lecture	3	3	-	60	40	100		16	40
MM	ITH41MMP408	Practical Based on Big Data Analytics	Practical	1	-	2	30	20	50		08	20
MM	ITH41MMP409	Practical Based on Deep Learning	Practical	1	-	2	30	20	50		08	20
ME	ITH41MEL407	Geographical Information systems	Lecture	3	3	-	60	40	100		16	40
	ITH41MEL408	Multimodal Biometrics	Lecture									
ME	ITH41MEP407	Practical based on Geographical Information systems	Practical	1	-	2	30	20	50		08	20
	ITH41MEP408	Practical based on Multimodal Biometrics	Practical									
RP	ITH41RPJ402	Research Project	Practical	8		c	120	80	200		32	80
			Total	20	09	22	390	260	650			

Note:

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

Semester: FIRST

Syllabus

Semester-I

Course code: - ITH41MML101	Course name: Introduction to Information and Communication Technology	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA–30, ESE–20
Pre-requisites: Basic Knowledge of Computer		
Course Objectives:		
1. To understand basic topics and the current trends that are essential to the ICT industry		
2. To analysis the challenges & job opportunities in the Information Technology fraternity		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the current trends, job opportunities and challenges of IT industries.		
CO2: Identify the different elements of an information system, including input, output and processing elements.		
CO3: Identify Digital Model: E-commerce & M-commerce		
CO4: Recognize and distinguish the role of IT.		

Contents:-

Unit	Content	Teaching hours
1	<p>Information Technology Basics - What is ICT, ICT and IT, Functional Areas of an Organization, Applications of ICT Tools, Introduction Internet Telephony, Webcasting, Social Networking, and Computer Supported Cooperative Working (CSCW) New Model in Digital Economy: E-commerce, M-Commerce</p> <p>Role of ICT in Organization Role of ICT in Human Resource Management, Role of ICT in Finance and Account Management, Role of ICT in Marketing Management Role of ICT in Information System Management Role of ICT in Operations Management. Role of ICT in Business.</p>	10
2	<p>Communications and Devices – Computer architecture, Computer and its Characteristics Identify the different hardware components of a computer system, including CPU, RAM. Input/output devices and storage devices; Evaluate examples of software applications. Use of Software in ICT, New Communication Models: Internet, Intranet, extranet, Video-conferencing, Audio Conferencing</p>	10
3	<p>Emerging Trends in Information Communication Technologies job opportunities in the fields. – Machine Learning with advance Artificial Intelligence (AI), Quantum Computing (Supercomputing), Augmented Reality (AR) and Virtual Reality (VR), Global Internet of Things (IoT), Block chain technology, Data Science & Business Analytics, Deep Learning Drones Technology, Cloud computing Robotic Process Automation (RPA), Design Thinking.</p>	10

Text Books: 1. Information Technology: Theory And Practice By Sinha, Pradeep K., Sinha, Priti

Reference Books: 1.Introduction to Information Technology By V.Rajaraman.

Syllabus **Semester-I**

Course code ITH41MMP101	Course name: Practical based on Introduction to Information and Communication Technology	
	Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Basic Knowledge of Computer.		
Course Objectives:		
1. Support functions: administrative, technical and supportive functions		
2. New learning: new teaching and learning methods, techniques and tools		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Basic knowledge in hardware/software methods and tools for solving real-life and practical problems with an orientation to lifelong learning.		
CO2: Identify Possess strong fundamental concepts in Information Communication Technology to address technological challenges.		
CO3: Learning the formatting skills on paragraphs, tables, lists, pages and awareness of new communication models.		
CO4: An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as an IT professional.		

Contents –

Sr. no.	Description of Practical	Practical hours
1	1. Computer Fundamental -Input Devices 2. Central processing Unit component 3. Output Devices 4. Computer Booting 5. Introduction to Binary Number System	10
2	6. Operating System Installation 7. M.S Word Introduction 8. Internet Browsing , 9. M.S. PowerPoint introduction 10. M.S. Excel introduction	10
3	11. New Communication Models 12. Video-conferencing, Audio Conferencing 13. Webcasting, 14. Social Networking 15. E-commerce, M-Commerce	10

Text Books:

1. Information Technology: Theory And Practice By Sinha, Pradeep K., Sinha, Priti
2. Introduction to Information Technology By V.Rajaraman

Reference Books:

1. Introduction to Information Technology By V.Rajaraman.
- 2.. Information Technology: Theory And Practice By Sinha, Pradeep K., Sinha,

Syllabus Semester-I

Course code: - ITH41MML102	Course name: Computer Architecture
Course category: Major Mandatory	
Credits: 2	Teaching scheme: L-2 P-0 Evaluation
Evaluation scheme: CA–30, ESE–20	
Pre-requisites: Basics of Computer Hardware & Software	
Course Objectives:	
1. Student understands of the basic structure and operation of a digital computer and various processors.	
2. To analysis the challenges & job opportunities in the Information Technology fraternity	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Student understands of the basic structure and operation of a digital computer.	
CO2: To learn the architecture and assembly language Programming of microprocessor	
CO3: To study the different Processors	

Contents –

Unit	Content	Teaching hours
1	Computer Arithmetic – Number System: Decimal System Binary Number System, Hexadecimal Number System, Octal Number System, Number Conversion: Decimal to Other, Binary to Other, Octal to Other, Hexadecimal to Other, BCD Numbers, ASCII Code, Computer Arithmetic: Addition, Subtraction. Logic Gates & Boolean Algebra- Positive & Negative Logic, Truth Table Logic Gates: AND, OR, NOT, NAND, NOR and Exclusive-OR Gate, Universal Gates. Postulates & Theorems of Boolean Algebra (Idempotent, Complementation, Commutative, Associative, Distributive, De-Morgan's Theorem)	10
2	Arithmetic Circuits – Combinational Circuits, Implementing Combinational logic. Arithmetic Circuits: Half-Adder, Full-Adder, Half-Sub tractor, Full-Sub tractor. Fundamentals of Microprocessors- Comparison of 8-bit, 16-bit and 32-bit microprocessor. 8086 Pin configuration, 8086 Internal Architectures, Execution Unit & Bus Interface, Flag Registers, Introduction to Addressing Modes	10
3	8086 Interrupt and Interrupt Applications- Interrupts of 8086, Hardware Interrupts, Software Interrupts Latest Trends in Microprocessor- RISC and CISC Architectures, Design: Multicore Processor and Multicore Processing, Multicore Technology and Intel, Dual Core and Core Duo Processors, Core i3, i5, Mobile Processors.	10

Text Books:
1. Digital Electronics: Principles, Devices and Applications
2. Microprocessors & Multi core systems By Lyla B Das
Reference Books:
1. Microprocessor and Interfacing By Douglas V Hall
2. Digital Design By M. Morris Mano

Syllabus

Semester-I

Course code: - ITH41MMP102 Course name: Practical Based on Computer Architecture		
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA–30, ESE–20
Pre-requisites: Pre-university mathematics.		
Course Objectives:		
1. Student understands of the basic structure and operation of a digital computer and various processors.		
2. To analysis the challenges & job opportunities in the Information Technology fraternity		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Student understands of the basic structure and operation of a digital computer.		
CO2: To learn the architecture and assembly language Programming of microprocessor		
CO3: To study the different Processors.		

Contents –

Sr.no.	Description of Practical	Practical hours
1	1. To Perform Number systems Conversations 2. To Perform Binary Arithmetic operations 3. To Verify the truth table of Basic Logic Gates 4. To Verify the truth table of Universal Logic Gates 5. To verify the truth table of Special Purpose Logic Gates.	10
2	6. State and Prove Demorgan's Theorem 7. To Study and Verify Combinational Logic Circuits (Half adder) 8. To Study and Verify Combinational Logic Circuits (Fulladder) 9. ToStudyGeneralPurposeRegistersof8086Microprocessor 10. To Study Special Purpose Registers of8086Microprocessor	10
3	11. To Study 8086 Pin Diagram and its Functioning 12. ToStudy8086 Interruptandits Applications 13. ToStudyPentium Pro Architecture 14. ToAnalyzeandCompare PentiumandCore-i3Processor 15. ToAnalyzeandCompareRISCandCiSCArchitecture	10

Text Books:

1. Digital Electronics: Principles, Devices and Applications By Anil K. Maini
2. Micro Processors & Multi core systems By Lyla B Das

Reference Books:

1. Microprocessor and Interfacing By Douglas V Hall
2. Digital Design By M. Morris Mano

Syllabus

Semester-I

Course code: - ITH41VSP101	Course name: Practical Based on C Programming	
Course category: - Vocational skill course		
Credits: 2	Teaching scheme: L-0 P-4	Evaluation scheme: CA–30, ESE–20
Pre-requisites: Pre-university mathematics.		
Course Objectives:		
1. Programming Paradigm help students to create properly designed programs.		
2. Learning algorithms and practicing coding		
3. Come up with varieties of solutions to a single problem		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Describe the Modularization and basic structure of program.		
CO2: Implements and Analyze the usage of flowcharts and pseudo code so as to become comfortable with logic development tools and understand their interrelationship.		
CO3: Determine and explore the workings of decision making, looping, and array manipulation.		
CO4: Create Complex programs to build and process using significant amount of data and solve the real-life problem.		

Contents –

Unit	Description of Practical	Practical hours
1	<ol style="list-style-type: none"> 1. Introduction to C, Syntax and basic structure of C program, Execution of C program 2. Get students familiar with different data types in C. 3. Get students familiar with different operators and expressions in C. 4. Understanding decision making using forms of IF statements 5. Programs to understand the concepts of loops in the programming.(For loop) 	10
2	<ol style="list-style-type: none"> 1. Programs to understand the concepts of loops in a program. (do and while loop) 2. Understanding decision making using forms of switch statements 3. Understanding decision making using forms of break, continue etc. statements 4. Perform different programs to understand the concept of Array. 5. To apply the knowledge of array to upgrade it on multidimensional array 	10
3	<ol style="list-style-type: none"> 1. Perform different programs to understand the concept of Array. 2. To apply the knowledge of array to upgrade it on multidimensional array (Project) 	10

Text Books:	1. C Programing E. Balaguruswamy
	2. Programming in ANCI C
Reference Books:	1. Programming Language Design Concepts 2. Programming Logic and Design

Syllabus

Semester-I

Course code: ITH41SEL101	Course name: Programming logic and Design	
Course category: - Skill Enhancement course		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Pre-university mathematics.		
Course Objectives:		
1. Programming Paradigm help students to create properly designed programs.		
2. Learning algorithms and practicing coding		
3. Come up with varieties of solutions to a single problem		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Recognize and understand components of Computer System, Programming and most importantly summarize the advantages of structured programs		
CO2: Describe the Modularization and basic structure of program.		
CO3: Implements and Analyze the usage of flowcharts and pseudo code so as to become comfortable with logic development tools and understand their interrelationship Determine and explore the workings of decision making, looping, and array manipulation.		

Contents –

Unit	Content	Teaching hours
1	<p>An Overview of Computers and Programming- Computer System, Programming Logic, Program Development Cycle, Pseudo code Statements & Flowchart, Programming and User Environments, Evolution of Programming Model.</p> <p>Elements of High-Quality Programs- Declaring and Using Variables and Constants, Operators: Performing Arithmetic Operations, Modularization: Modularizing a Program and its Advantages, Creating Hierarchy Charts, Features of Good Program Design</p> <p>Understanding Structure- The Disadvantages of Unstructured Spaghetti Code, Three Basic Structures - sequence, selection and loop, using a Priming Input to Structure a Program, Reasons for Structure, Recognizing Structure, Structuring and Modularizing Unstructured Logic.</p>	10
2	<p>Making Decisions- Boolean Expressions and the Selection Structure, Using Relational Comparison Operators, Understanding AND Logic, OR Logic & NOT Logic, Making Selections within Ranges, Precedence Combining AND & OR operators.</p> <p>Looping- Advantages of Looping, Loop Control Variable, Nested Loop, Avoiding Common Loop Mistakes, Using a '<i>for</i>' Loop, Common Loop Applications.</p>	10

3	Arrays- Storing Data in Arrays, How an Array Can Replace Nested Decisions, Using Constants with Arrays Searching an Array for an Exact Match, Using Parallel Arrays, Searching an Array for a Range Match, Remaining within Array Bounds, Using a for Loop to Process an Array	10
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Text Books:
1. C Programing E. Balaguruswamy
2. Programming in ANCI C
Reference Books:
1. Programming Language Design Concepts By David A Watt
2. Programming Logic and Design By Joyce Farrell

MGMUNIVERSITY

Semester: SECOND

Syllabus

Semester-II

Course code: ITH41MML103	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: Pre-university mathematics		
Course Objectives:		
1. Discuss Database management systems, databases and its applications		
2. Familiarize the students with a good formal foundation on the relational model		
3. Outline the various systematic database design approaches		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL		
CO2: Describe Recognize and understand the basic concepts of database, knowledge, classifications of Architecture of database, database users, define advantages of the database		
CO3: Draw E-R diagram, schema diagram, classify attributes, entity, entity set, relationship		
CO4: Learn DDL, DML.DCL Commands, set operations		

Contents –

Unit	Content	Teaching hours
1	Introduction to basic concepts of DBMS- Database System Application , Purpose of Database System, Database Architecture : 3-Level architecture Database Users & Administrators Responsibilities, Functional Components of Database system: Storage & Query Processor, Transaction Management	10
2	Data Modeling & Design- Type of Data Model Relation Data Model , E-R Data Model, Object Based Data Model, Semi-Structured Data Model Hierarchical & Network Data Model, E-R Data Model: Entity, Entity set, Entity types, Attributes, Types of Attributes, E-R diagram. Mapping Cardinalities , Data Association , Constraints : Integrity constraints I & II, Database Design : Overview of Design Process, Designing Phase, Normalization(1NF,2NF,3NF)	10
3	Relational Data Model- Basic Structure, Database Schema, Integrity Rules, E.F.Codds Rules, Relational Algebra: Union , Intersection , Difference, Cartesian Product, Selection , Projection, Join : Natural, & Outer Join, Division, Trigger, Stored procedure with advantages and disadvantages	10

Text Books:

1. Database System concepts Korth, Siberschatz
2. An Introduction to Database System B. Desai

Reference Books:

1. Database System concepts Korth, Siberschatz
2. An Introduction to Database System B. Desai

Syllabus

Semester-II

Course code ITH41MMP103	Course name: Practical Based on Database Management System	
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Information about computer system		
Course Objectives:		
1. This course provides an introduction to relational database systems. The topics covered include the relational model,		
2. SQL transactions, database design, and concepts and algorithms for building database management systems.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression from queries		
CO2: Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS		
CO3: Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.		
CO4: Demonstrate a rudimentary understanding of programmatic interfaces to a database and be able to use the basic functions of one such interface.		

Contents –

Sr.no.	Description of Practical	Practical hours
1	<ol style="list-style-type: none"> 1. Design and draw E-R diagrams. 2. Study of DDL commands(create & Alter) 3. Study of DML commands (Insert, update & delete) & DCL commands (GRANT & REVOKE) with examples 4. Write & execute queries using select command using where, group by, order by and having clauses 5. Study of Single Row Functions with examples 	10
2	<ol style="list-style-type: none"> 6. Study of conversion functions with examples 7. Study of Join (natural, Inner) 8. Study of Join (outer, left & right) and Division Operations with examples 9. Study of Constraints primary key, foreign key, unique and check constraints on tables with Examples 10. Study of Basic Operations of Relational Algebra with examples (Union, Intersection) 	10

3	<ol style="list-style-type: none">11. Create emp table and dept table with appropriate field and apply table constraints12. Create student table with appropriate fields and apply DDL and DML commands.13. Use any table and do select operations using operators14. Use any table and do select operations using clauses.15. Use any tables and do select operations using aggregate functions	10
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Text Books:

1. Database System concepts Korth, Siberschatz
2. An Introduction to Database System B. Desai

Syllabus
Semester-II

Course code: - ITH41MML104	Course name: Data Structure	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE- 20
Pre-requisites: Information about computer system		
Course Objectives:		
1. Apply the Knowledge of Data Structure to flexibly work with various types of data structure.		
2. Implement various algorithms of Data Structures using their programming logics		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Recognize and Understand basic terminologies of Data structure, classification, and most importantly summarize the advantages of Data structure with Arrays and its operations		
CO2: Describe the Modularization and basic structure of algorithms and programs of Linked list and Trees.		
CO3: Determine and explore the workings of making, looping, and array manipulation and many more concepts of programming		
CO4: Create Complex programs to build and process using significant amount of data and solve the real-life problems with all the concept of data structure		

Contents –

Unit	Content	Teaching hours
1	Introduction to Data Structure – Define data structure, classification and types of data structure, Data Organization and Data Structure, Basic Terminology: Data item, Fields, Records, Files, Entity, Attributes Arrays- Representation of Linear Arrays, Traversing, Insertion and Deletions Sorting & Searching Algorithms, Multidimensional Arrays: 2D & M-D Concept, Record: Record Structures, 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 & Deletion in Linked List, Header Linked List & Two way List	10
3	Stacks, Queues- Stack: Operation, Array Representation of Stack, linked representation of stack, Arithmetic Expression POLISH & POSTFIX, Application of stacks: Quicksort, Queue: Representation of queues & link. Types of Queues: Deques & Priority Queue, Liner and non-liner DS	10

Text Books:

1. Fundamentals of Data structures Horowitz & Sahani
2. An introduction to data structures and application Jean Paul Tremblay & Pal G. Sorenson

Reference Books:

1. Fundamentals of Data structures Horowitz & Sahani
2. An introduction to data structures and application Jean Paul Tremblay & Pal G. Sorenson

Syllabus Semester-II

Course code: ITH41MMP104	Course name: Practical Based on Data Structure	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-0 P-2	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Basic Knowledge of Computer		
Course Objectives:		
1. Apply the Knowledge of Data Structure to flexibly work with various types of data structure		
2. Implement various algorithms of Data Structures using their programming logics		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Recognize and Understand basic terminologies of Data structure, classification, and most importantly summarize the advantages of Data structure with Arrays and its operations		
CO2: Describe the Modularization and basic structure of algorithms and programs of Linked list.		
CO3: Implements and Analyze the usage of Graph, Stack, Queues and Recursion.		
CO4: Determine and explore the workings of making, looping, and array manipulation and many more concepts of programming		

Contents –

Sr.no.	Description of Practical	Practical hours
1	1. Write a program using DIV (J, K) which reads a positive integer $N > 10$ and determines whether or not N is a prime number. 2. Write a program which counts the number of particular character/word in the String. 3. Write a program which reads words WORD1 and WORD2 and then replaces each occurrence of word1 in text by word2 4. Implementation Traversing algorithm of Array: 5. Write the programs for traversing of n item using the array.	10
2	6. Implement linear search algorithm using C. 7. Implement binary search algorithm using C. 8. Implement Bubble sort algorithm using C. 9. Implementation traversing algorithm of Linked List: 10. Write the programs for traversing of an item from the linked list	10
3	11. Implementation Insertion and Deletion algorithms of Stack: 12. Write the programs for push and pop operation using the stacks. 13. Implementation Insertion and Deletion algorithms of Queue: 14. Write the programs for insertion and deletion of an item from the queues. 15. Implementation Deletion algorithm of Array:	10

Text Books: 1. Fundamentals of Data structures Horowitz & Sahani.

Reference Books: 1. An introduction to data structures and application Jean Paul Tremblay & Pal G. Sorenson

Syllabus Semester-II

Course code ITH41VSP102	Course name: Web Fundamental	
Course category: Vocational skill course		
Credits: 2	Teaching scheme: L-0 P-4	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Pre-university mathematics.		
Course Objectives:		
1. Describe HTML document structure and associated elements: doctype		
2. Describe the purpose of, and use additional HTML tags		
3. Explain how CSS allows for separation of display and document structure		
4. Identify the main parts of a URL and describe the role of each: protocol, host, port, path, query parameter, fragment		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: After completing this course, students will be able to create structure, organize, and publish a website using HTML and CSS.		
CO2: Learning HTML & CSS is also an essential first step in learning how to code web pages professionally.		
CO3: Students will work as Web Developers, Visual Designers, Front-End Web Developers in the IT field.		

Contents –

Sr.no.	Description of Practical	Practical hours
1	1. Introduction to HTML. Create a basic HTML file 2. Create a static webpage using table tags of HTML 3. Create a static web page which defines all text formatting tags of HTML in tabular format 4. Create webpage using list tags of HTML 5. Create webpage to include image using HTML tag	10
2	6. Write a program to create a web page to print paragraphs in colors. 7. Create a form using the Element & Formatting tag. 8. Create a Form using Image Tag. 9. Create a Form using Image Tag. 10. Create employee registration webpage using HTML form objects	10
3	11. Create freem webpage using HTML form objects 12. Linking to a document in the same directory 13. Viewing the document source 14. Using the SSH File Transfer window to transfer files 15. Website creating using various tools	10

Text Books:

1. HTML & CSS By Jon Duckett
2. The complete reference HTML & CSS Thomas A. Powell

Reference Books: 1.HTML, CSS, and JavaScript All in One: Covering HTML5, CSS3, and ES6, Sams Teach Yourself By Julie C. Meloni and Jennifer Kyrin

Syllabus Semester-II

Course code: - ITH41SEL102	Course name: Operating System
Course category: Skill Enhancement course	
Credits: 2	Teaching scheme: L-2 P-0
Evaluation scheme: CA–30, ESE–20	
Pre-requisites: Basic Knowledge of Computer	
Course Objectives:	
1. Introduce modern operating systems basic concepts, policies, and mechanisms.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Compare various process scheduling algorithms.	
CO2: Describe the Apply the principles of concurrency.	
CO3: Design deadlock, prevention and avoidance algorithms	
CO4: Compare and contrast various memory management schemes.	

Contents –

Unit	Content	Teaching hours
1	Introduction to Operating System- Operating System Definition, OS as resource management, Structure of Operating System, Component of Computer System, Services provided by Operating System, Types of Operating System	10
2	Processes and Threads – Process concept: PCB, Process State, Operation on Process. Concurrency: Concurrent process, Threads, Multithreading Synchronization Deadlock CPU Scheduling- Time-slicing and the quantum, Preemptive and non-preemptive algorithms Memory Management – Main memory organization and management, Virtual memory organization, Paging and Segmentation, Virtual memory management algorithms and issues	10
3	Linux System – Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen, VMware on Linux Host and Adding Guest OS Docker: Overview, Features, Components of Docker, Architecture.	10

Text Books: 1. Operating System Concepts A. Silberschatz ,By P.B. Galvin & G. Gagne
2. Guide to Operating Systems By Greg Tomsho
Reference Books: 1. Operating System Concepts and Basic Linux Commands By Shital Ghate
2. Docker: A Quick-start Beginner's Guide By Andy Hayes

Semester: THIRD

Syllabus Semester-III

Course code ITH41MML201	Course name: Data Warehousing	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Basic RDBMS Concept		
Course Objectives:		
1. To introduce the concept of data Mining as an important tool for enterprise data management and as a cutting edge technology for building competitive advantage.		
2. To enable students to effectively identify sources of data and process it for data mining.		
3. To make students well versed in all data mining algorithms, methods, and tools.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Design the database architecture for storing large data.		
CO2: Understand and implement various operations used for data mining		
CO3: Analyze the data using existing data mining tools		
CO4: Prepare the data needed for data mining algorithms in terms of attributes and class inputs, training, validating, and testing files.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Data Warehouse Architecture and Infrastructure: Data Warehouse Architecture, Infrastructure and Metadata Management, Extract Transform Load Cycle introduction, ETL overview Extraction, Loading, Transformation techniques.	6
2	Information Access and Delivery: - Matching information to classes of users OLTP and OLAP System, OLAP – the need, Design of the OLAP database. OLAP operations: slice, dice, rollup, drill-down etc. OLAP implementations. Data Mart, Type of Data Mart, OLAP Tools and The Internet.	8
3	Trends in Data Warehousing: Continued growth in data warehousing, expansion, significant trends: Real time data warehousing, multiple data types, data visualization, parallel processing, data warehouse appliances, query tools, browser tools, data fusion, data integration, Analytics, Data Warehousing and CRM, Agile development. Emergence of Standards: Metadata, OLAP	8
4	Web Enabled Data warehouse: The warehouse to the web, The web to the warehouse, The web enabled configuration. Planning and project management: Planning your Data Warehouse, Justify how different is your project, assessment of readiness, The life cycle approach, and The development Phases: Adopting Agile technology, The Project team organization and management. Data Design and architectural plan: Structure for Business Dimensions, Structure for Key measurements, levels of detail, composition of components, tools and products.	8

Text Books:
1. Data Warehousing C.S.R. Prabhu PHI Publication
2. Web Warehousing and Knowledge Management Mattision TMH ASIN, Osborne/McGraw-Hill (1 June 1999)
3. Data Warehousing – Fundamentals for IT professionals, Willey Publication, Paulraj Ponniah, 2nd Edition.
Reference Books:
1. Data Mining Data Warehousing- Nilesh magar Vision Publication.
2. The Data Warehouse Lifecycle Toolkit, Thornthwaite, Kimball, Reeves Ross, John Wiley & Sons.

Syllabus Semester-III

Course code ITH41MML202	Course name: Object Oriented Programing Using C++	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Knowledge of C Programming Language		
Course Objectives:		
1. Students are able to implement the applications and can develop the Programs with classes and objects.		
2. Developing in C++ the application is more optimized and efficient than C.		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Understanding Object Oriented Concepts.		
CO2: Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs		
CO3: Demonstrate the use of various OOPs concepts with the help of programs.		
CO4: Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.		

Contents -

Unit	Content	Teaching hours
1	Principles of Object oriented Programming • Object oriented concepts; Features, advantages and Applications of OOPS. Introduction to C++ Programming Language Tokens, Expressions, Control structures, Data types, new operators and keywords, using namespace concept	6
2	Structure of C++: Simple C++ Program, Introduction to Reference variables, pointer, Classes and Objects, Access specifiers, Defining Data members and Member functions, Array of objects.	8
3	Functions in C++ • Call by reference, Return by reference, Function overloading and default arguments; Inline function; Static class members, Friend Function Constructors and destructor Constructor: • Types of constructors; Memory allocation (new and delete); Destructor.	8
4	Operator overloading Overloading function: Overloading Unary and Binary operators, Overloading using friend function, Type casting and Type conversion Inheritance: Types of inheritance with examples, Virtual base classes, Virtual functions and Pure virtual function, Abstract base classes Managing console I/O; C++ stream classes, Usage of manipulators.	8

Text Books:

- Object oriented programming with C++, E. Balaguruswamy, Tata Mc-Graw Hill Publication. 4th Edition.
- The C++ Programming Language, Bjarne Stroustrup, Addison Wesley, 1997.
- Object-Oriented Programming with C++, A.K. Sharma, January 2014, Pearson India.

Reference Books:

- Object oriented programming in C++ Robert Lafore Galgotia Publication, 2002 by Sams Publishing
- Object Oriented Programming with C++ | 8th Edition, E.Balagurusamy, 2020.

Syllabus Semester-III

Course code ITH41MML203	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 mathematics.		
Course Objectives:		
1. The emphasis of course is on descriptive statistics. It gives an idea about the various statistical methods, measures of central tendency, measure of dispersion and correlation. Statistics mainly indulge on mathematics and logic.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the elementary statistical methods.		
CO2: Apply the measures of central tendency, measure of dispersion and co-relation to solve our day-to-day life problem.		
CO3: Analyze the data to represent it graphically or tabulate and interpret it to generate information.		
CO4: Have the critical thinking in the theory of probability and its applications in real life problems.		

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, Numerical (discrete, continuous), Categorical and Ordinal. Cross-section, time series, failure, industrial, directional data. Attributes, variables.	6
2	Processing of Data: Completeness, Consistency, Accuracy and Editing. Accuracy of Measurement. 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 and Ogive.	8
3	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., Harmonic Mean (H.M.): computation for frequency, non-frequency data, merits & demerits of H.M.	8
4	Median: Definition, Median for grouped and non-grouped data, Properties and Merits & demerits. Mode: Definition, Mode for grouped & Non-grouped data, Graphical Method for finding mode, Merits and demerits.	8

Text Books:

1. Basic Statistics, B.L. Agarwal, New Age International (P) Limited.
2. Fundamental of Mathematical Statistics, S. C. Gupta & V. K. Kapoor, Sultan Chand & Sons, 2002.

Reference Books:

1. Fundamentals of Statistics, S.C. Gupta, Himalaya Publishing House Pvt. Ltd.
2. Fundamentals of Statistics (English, Paperback, K.N. Nagar)

Syllabus Semester-III

Course code ITH41MMP201	Course name: Practical Based on Data warehousing
Course category: Major Mandatory	
Credits: 1	Teaching scheme: L-0 P-2
Evaluation scheme: CA–30, ESE–20	
Pre-requisites: Basics of excel, DBMS	
Course Objectives:	
This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the functionality of the various data mining and data warehousing component	
CO2: Appreciate the strengths and limitations of various data mining and data warehousing models	

Contents -

Sr. No.	Description of Practical	Practical Hours
1	Creation of a Data Warehouse. (Google Big Query, Amazon Redshift)	2
2	Study on Apriori Algorithm.	2
3	Implementation of FP-Growth Algorithm.	2
4	Build and demonstrate the K-means clustering.	2
5	Design and implement one Hierarchical clustering algorithm.	2
6	Classify the Bayesian Classification.	2
7	Implement the Decision Tree structure.	2
8	Apply the Support Vector Machines.	2
9	Implement the classification for web mining.	2
10	Case Study on Text Mining.	2
11	Project	10

Text Books:

1. Data Warehousing C.S.R. Prabhu, PHI Publication.
2. Web Warehousing and Knowledge Management Mattision, Osborne/McGraw-Hill (1 June 1999)
3. Data Mining Data Warehousing- Nilesh magar, Vision Publication

Reference Books:

1. A Practical Guide to Data Mining for Business and Industry, Andrea Ahlemeyer-Stubbe, Shirley Coleman, Wiley
2. Data Mining and Data Warehousing Principles and Practical Techniques, Parteek Bhatia

Syllabus

Semester-III

Course code ITH41MMP202	Course name: Practical Based on Object Oriented Programming Using C++	
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA–30, ESE–20
Pre-requisites: Basic knowledge of programming.		
Course Objectives:		
To understand how C++ improves C with object-oriented features.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand how C++ improves C with object-oriented features.		
CO2: apply how to write inline functions for efficiency and performance.		
CO3: Understand the syntax and semantics of the C++ programming language		
CO4: Learn how to design C++ classes for code reuse		

Contents-

Sr. No	Description of Practical	Practical Hours
1	Program on Check Whether a Given Number is Even or Odd	2
2	Program to Find Sum of Digits of a Number	2
3	Implement the program whether a given Year is a Leap Year	2
4	Program to Check Whether a Character Is Uppercase, Lowercase Alphabet A Digit Or A Special Symbol.	2
5	Program to Find Greatest Among Three Numbers	2
6	Illustrate the Program to Check Number Is Positive Or Negative	2
7	Program to Find Number Is Prime Or Not	2
8	Program to Find Area of a Triangle / Square / Circle / Rectangle Using Switch Statement.	2
9	Program to Print All Value Of An Array.	2
10	Program to Illustrate Inheritance.	2
11	Project	10

Text Books:

- Object Oriented programming with C++, E. Balaguruswamy, Tata Mc-Graw Hill, 4th Edition
- The C++ Programming Language, Bjarne Stroustrup, Addison Wesley

Reference Books:

- Object oriented programming in C++ Robert Lafore Galgotia Publication, 2002 by Sams Publishing
- Object Oriented Programming with C++ | 8th Edition, E.Balagurusamy, 2020.

Syllabus Semester-III

Course code: ITH41VSP201	Course name: Advance Excel
Course category: Vocational skill course	
Credits: 2	Teaching scheme: L-0 P-4
Evaluation scheme: CA-30, ESE-20	
Pre-requisites: Basics of Excel.	
Course Objectives:	
Possessing the ability to use spreadsheets, graphs, tables, calculations, and automation	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Create templates after writing complex worksheets and workbooks.	
CO2: Work with named ranges and create lists.	

Contents -

Sr. No	Description of Practical	Practical Hours
1	Practical on Chart Recommendations	4
2	Practical on Format Charts	4
3	Practical on Chart Design.	4
4	Practical on Richer Data Labels.	4
5	Practical on Leader Lines	4
6	Perform the New Functions	4
7	Practical on Instant Data Analysis	4
8	Practical on Sorting Data by Color	4
9	Practical on Slicers. Practical on Flash Fill	4
10	Practical on Pivot Table Tools.	4
11	Project	20

Text Books:

- Excel Formulas and Functions: Cool Tips and Tricks With Formulas in Excel, Caprioru 2019
- Beginner Excel Essentials 2019 by M. L. Humphrey.

Reference Books:

- Advanced Excel: How to Use Vlookup & Index Match Functions, Sterling Libs Fcca, Straight Street Publishing, 2016
- Simplified Practical Guide to Microsoft Excel: Learning Microsoft Excel from Basic to Advanced by Karl Brian, 2022

Semester: FOURTH

Syllabus Semester-IV

Course code: ITH41MML204	Course name: Data Mining	
Course category: Major mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Basic knowledge of DBMS and Data Organizations & applications.		
Course Objectives:		
To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining.		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Evaluate different models used for OLAP and data preprocessing.		
CO2: Learn to differentiate between situations for applying different data-mining techniques		
CO3: Explore data, Mean and Median.		
CO4: Data Mining Classifiers and comparative study.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Data Mining: Why Mine Data, Data Commercial Viewpoint, Scientific Viewpoint, Motivation, Definitions, Origins of Data Mining, Data Mining Tasks, Classification, Clustering, Association Rule, Discovery, Sequential Pattern Discovery, Regression, Challenges of Data Mining.	6
2	Data Mining Data: What is Data, Attribute Values, Measurement of Length, Types and Properties of Attributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density.	8
3	Data Mining: Exploring Data: Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location, Mean and Median, Measures of Spread, Range and Variance, Visualization, Representation, Arrangement, Selection, Visualization Techniques, Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations.	8
4	Data Mining Classification: Basic Concepts, Decision Trees, Model Evaluation, Classification: Definition, Classification Techniques, Tree Induction, Measures of Node, Impurity, Practical Issues of Classification, ROC curve, Confidence Interval for Accuracy, Comparing Performance of Two Models. Comparing Performance of Two Algorithms. Alternative Techniques: Rule- Based Classifier, Rule Ordering Schemes, Building Classification Rules, Instance- Based Classifiers, Nearest Neighbor Classifiers, Bayes Classifier, Naive Bayes Classifier, Artificial Neural Networks (ANN), Support Vector Machines.	8

Text Books:

1. Introduction to Data Mining, Tan, Steinbach, Kumar
2. Data mining concepts and techniques, Han, J. Kamber, M. Pei, J. Morgan, Kaufmann, 3rd Edition.
3. Principles and Theory for Data Mining and Machine Learning, Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, Springer Publishing

Reference Books:

1. JavaScript and jQuery for Data Analysis and Visualization, Jon Raasch, Graham Murray, Vadim Ogievetsky
2. Data Mining: The Textbook, by Charu C. Aggarwal

Syllabus Semester-IV

Course code: ITH41MML205	Course name: Core Java	Course category: Major Mandatory
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Knowledge of Programming language C or C++ is helpful but not mandatory.		
Course Objectives:		
Learn OOP concepts helps to become Java developer.		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.		
CO2: Able to solve real world problems using OOP techniques (Objects and Classes).		
CO3: Able to understand the use of Inheritance and Interface.		
CO4: Apply classes, objects, members of a class and the relationships among them needed for a specific problem.		

Contents -

Unit	Content	Teaching hours
1	An Introduction to Java:- A Short History of Java o Features or buzzwords of Java o Comparison of Java and C++ , Java Environment o Simple java program , Java Tools – jdb, javap, javadoc, Java IDE – Eclipse/Net Beans , Types of Comments , Data Types, Final Variable, Declaring 1D, 2D array.	6
2	Objects and Classes:- Defining Your Own Classes, Access Specifiers (public, protected, private, default), Array of Objects , Constructor, Overloading Constructors and use of ‘this’ Keyword , static block, static Fields and methods, Predefined class – Object class methods (equals(), toString(), hashCode(), getClass()), Inner class, Creating, Accessing and using Packages, Wrapper Classes.	8
3	Inheritance and Interface:- Inheritance Basics (extends Keyword) and Types of Inheritance, Superclass, Subclass and use of Super Keyword , Method Overriding and runtime polymorphism, Use of final keyword related to method and class, Use of abstract class and abstract methods, Defining and Implementing Interfaces.	8
4	Exception Handling:- Dealing Errors, Exception class, Checked and Unchecked exception, Catching exception and exception handling, Creating user defined exception Strings, Streams and Files o String class and StringBuffer Class, Formatting string data using format() method.	8

Text Books:

1. Complete reference Java, Herbert Schildt, 5th edition, McGraw-Hill
2. Beginning Programming with Java For Dummies (5th Edition)
3. Head First Java: A Brain-Friendly Guide (2nd Edition)

Reference Books:

1. Programming with Java, A primer, E. Balagurusamy, 4th edition
2. Java: Programming Basics for Absolute Beginners (1st Edition)

Syllabus Semester-IV

Course code: ITH41MML206	Course name: Software Engineering	
Course category: Major Mandatory		
Credits: 2	Teaching scheme: L-2 P-0	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Basics of Software tools. Problem solving skill.		
Course Objectives:		
Be successful professionals in the IT field with solid fundamental knowledge of software engineering.		
Course Outcomes: Students will be able to-		
CO1: Decompose the given project in various phases of a lifecycle		
CO2: Choose appropriate process model depending on the user requirements.		
CO3: Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.		
CO4: Enhance ability to function effectively on User Interface and Risk Management.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Software Engineering: Study of Different Models, Software Characteristics Components, Applications, Layered Technologies, Processes, Methods and Tools, GenericView of Software Engineering, Process Models- Waterfall model, Incremental, Evolutionary process models- Prototype, Spiral, and Concurrent Development Model.	6
2	Requirements Engineering Problem Recognition: Requirement Engineering tasks, Processes, Requirements Specification, Use cases, and Functional specification, requirement validation, Requirements Analysis, Modeling – different types,	8
3	Structured System Design: Design Concepts, Design Model, Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Alternative architectural designs, Modeling Component level design and its modeling, Procedural Design, Object Oriented Design.	8
4	User Interface Design: Concepts of UI, Interface Design Model, Internal and External Design, Evaluation, Interaction, and Information Display Software 02 05 5. Planning a Software Project Scope and Feasibility, Effort Estimation, Schedule and staffing, Quality Planning, Risk management-identification, assessment, control, project monitoring plan, Detailed Scheduling.	8

Text Books:
1. Fundamentals of Software Engineering, Rajib Mall, PHI Learning, 2014
2. Software Engineering: A Practitioner's Approach Roger Pressman, McGraw Hill Education
Reference Books:
1. Software Engineering – An Engineering Approach, James F.Peters & Witold Pedrycz, Wiley
2. Software Engineering – Principles and Practice, Waman Jawadekar, McGraw Hill Education

Syllabus Semester-IV

Course code: ITH41MMP203	Course name: Practical Based on Data Mining	
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Practical knowledge of RDBMS is helpful		
Course Objectives:		
To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Evaluate different models used for OLAP and data preprocessing.		
CO2: Learn to categorize and carefully differentiate between situations for applying different data-mining techniques.		
CO3: Apply Data Mining Classification.		
CO4: Understand Data Mining Classifiers and comparative study.		

Contents -

Sr.No.	Description of Practical	Practical Hours
1	Preprocessing on dataset student.arff	2
2	Preprocessing on dataset labor.arff	2
3	Association rule process on dataset contactlenses.arff using apriori algorithm	2
4	Association rule process on dataset test.arff using apriori algorithm	2
5	Classification rule process on dataset student.arff using j48 Algorithm	2
6	Classification rule process on dataset employee.arff using j48 algorithm	2
7	Implementation of classification rule process on dataset employee.arff using id3 algorithm	2
8	Implementation of classification rule process on dataset employee.arff using naïve bayes algorithm	2
9	Implementation of clustering rule process on dataset iris.arff using simple k-means	2
10	Implementation of clustering rule process on dataset student.arff using simple k-means.	2
11	Project	10

Text Books:

1. Introduction to Data Mining, Tan, Steinbach, Kumar
2. Data mining concepts and techniques, Han J., Kamber M., Pei J. Morgan, Kaufmann, 3rd Edition.

Reference Books:

1. Data Mining, Fourth Edition: Practical Machine Learning Tools and Techniques, 2016, Fourth Edition, Ian H. Witten, Eibe Frank, Mark A. Hall, Morgan Kaufmann Publishers Inc.
2. Principles and Theory for Data Mining and Machine Learning, Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, Springer Publishing

Syllabus Semester-IV

Course code: ITH41MMP204	Course name: Practical Based on Core Java	
Course category: Major Mandatory		
Credits: 1	Teaching scheme: L-0 P-2	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Knowledge of Programming Language C or C++ is helpful		
Course Objectives:		
1. Learn how to implement object-oriented designs with Java.		
2. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.		
CO2: Validate input in a Java program.		
CO3: Able to understand the use of abstract classes.		
CO4: classes, objects, members of a class and the relationships among them needed for a specific problem.		

Contents -

Sr. No.	Description of Practical	Practical Hours
1	Broadcast a program to print —Hello World on the screen.	2
2	Implement the Java program to display the following pattern. i. ***** ii. **** iii. *** iv. ** v. *	2
3	Broadcast the Java program to print the area and perimeter of a circle.	2
4	Create a Java program to add two binary numbers	2
5	Build a Java program to reverse a string.	2
6	Program to count the letters, spaces, numbers and other characters	2
7	Implement a Java function that calculates the sum of digits for a given char array	2
8	Find the smallest and largest element from the array.	2
9	Designed a class that demonstrates the use of constructor and destructor.	2
10	Program to implement single level inheritance.	2
11	Project	10

Text Books:

1. Complete reference Java, Herbert Schildt, 5th edition, McGraw-Hill
2. Programming with Java, A primer, E. Balagurusamy, 4th edition

Reference Books:

1. Beginning Programming with Java For Dummies (5th Edition)
2. Java: Programming Basics for Absolute Beginners (1st Edition)

Syllabus Semester-IV

Course code: ITH41SEP201	Course name: Bootstrap	
Course category: Skill Enhancement course		
Credits: 2	Teaching scheme: L-0 P-2	Evaluation scheme: CA-30, ESE-20
Pre-requisites: Knowledge of HTML and CSS helps to understand Bootstrap		
Course Objectives:		
This course is oriented towards students whose primary purpose is just to get a mobile-first responsive design up and running quickly and immediately.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Learn how to build Responsive Websites with ease.		
CO2: understand How Bootstrap Components Work and apply it.		

Contents-

Sr.no.	Description of Practical	Practical Hours
1	BS Functions: BS Get Started, BS Grid Basic, BS Typography, BS Tables, BS Images, BS Jumbotron, BS Wells, BS Alerts.	4
2	BS Buttons, BS Button Groups, BS Glyphicons.	4
3	BS Badges/Labels: BS Progress Bars, BS Pagination, BS Pager, BS List Groups, BS Panels, BS Dropdowns, BS Collapse, BS Tabs/Pills, BS Navbar, BS Forms, BS Inputs, BS Inputs 2, BS Input Sizing.	4
4	BS Media Objects, BS Carousel, BS Modal, BS Tooltip, BS Popover, BS Scrollspy, BS Affix, BS Filters.	4
5	Bootstrap Grids: BS Grid System, BS Stacked/Horizontal.	4
6	BS Grid: Small, BS Grid Medium, BS Grid Large, BS Grid Examples.	4
7	Bootstrap Themes: BS Templates, BS Theme "Simply Me" BS Theme "Company", BS Theme "Band"	4
8	Bootstrap CSS Ref: CSS All Classes, CSS Typography, CSS Buttons, CSS Forms, CSS Helpers, CSS Images, CSS Tables.	4
9	CSS Dropdowns, CSS Navs Glyphicons.	4
10	Bootstrap JS Ref: JS Affix,, JS Alert, JS Button, JS Carousel, JS Collapse, JS Dropdown JS Modal, JS Popover, JS Scrollspy, JS Tab, JS Tooltip	4
11	Project	20

Text Books:

1. Bootstrap by Jake Spurlock Released May 2013, Publisher(s): O'Reilly Media, Inc.
2. Tutorials point Book PDF
3. Bootstrap in 24 Hours, Sams Teach Yourself, Jennifer Kyrnin, 2015.

Reference Books:

1. Bootstrap Jake Spurlock, O'Reilly Media, Inc.
2. Mastering Bootstrap 4 – Second Edition: Master the latest version of Bootstrap 4 to build highly customized responsive web apps, Benjamin Jakobus, Jason Marah, 2018

Semester: FIFTH

Syllabus Semester-V

Course code: ITH41MML301	Course name: Introduction to Data Science	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2 P-0	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Mathematical background and programming skills sufficient enough to learn new languages and software are required. Basic knowledge of statistics.		
Course Objectives:		
Understand and learn the lifecycle and phases of data science and work comfortably with data science		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To develop fundamental knowledge of concepts underlying data science		
CO2: To develop practical data analysis skills, which can be applied to practical problems		
CO3: To explain how math and information sciences can contribute to building better algorithms and software.		
CO4: To develop applied experience with data science software, programming, applications and processes.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Data Science: Definition and applications, Skills needed basic steps in Data Science, Benefits and uses of data science and big data. Facets of Data: Structured data, unstructured data, Natural Language, Machine generated data; Graph based or network data, Audio, Image and Video, Streaming data, Data Science Process: Overview of data science process. Basics of retrieving data, data cleansing, transforming data, data modeling.	06
2	Steps for Data Science Process: Step 1: Setting the research goal, Step 2: Retrieving data, Step 3: Cleansing, Integrating and transforming data. Step 4: Exploratory data analysis, Step 5: Build the model, Step 6: Presentation and automation. Sentiment analysis and its applications: Definition, types of sentiments, applications, case study. Uses of Text mining.	08
3	Data with R Studio: Using an integrated development environment, installing R studio, Creating R Script, History, overview. Data types variable, operators, and string. Syntax of R objects. R functions: Statistical functions, Built in functions, User defined functions.	08
4	Objects in R Language: Creating and manipulation of R Objects Vector, List, Matrices, Arrays, Factors, Data frames, Data Interfaces: CSV file, Excel file, Text file, Charts and Graphs: Pie chart, Bar chart, Boxplot, Histogram, Advanced visualization techniques.	08

Text Books :

1. Jeffrey S.Saltz,Jeffrey M.Stanton Introduction to Data Science Ebook SAGE Publications
2. Galit Shmueli, Peter C. Bruce, Inbal Yahav, Nitin R. Patel, Kenneth C. Lichtendahl Jr.,Data Mining for Business Analytics: Concepts, Techniques and Applications in R, Wiley

Reference Books:

1. Rachel Schutt & Cathy O'Neil Doing Data Science, O' Reilly, First Edition, 2013
2. B. Ram Computer Fundamental, BPB Publication

Syllabus Semester-V

Course code: ITH41MML302	Course name: Python Programming	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2 P-0	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Programming skills sufficient enough to learn new languages and software are required. Basic knowledge of programming language		
Course Objectives:		
Understand and learn the lifecycle and phases of data science and work comfortably with data science projects		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To understand importance of Python for development.		
CO2: Develop a skill to implement Python Programming.		
CO3: Hands-on Python experience for professional advancement.		
CO4: Render and export projects optimized for various platforms, including web, broadcast, and social media.		

Contents -

Unit	Content	Teaching hours
1	Introduction to Python: Getting Started: Introduction to Python- an interpreted high level language, interactive mode and script mode. Variables, Expressions and Statements. Variables and Types-mutable and Immutable variable and Keywords. Operators and Operands in Python. (Arithmetic, relational and logical operators), Operator precedence, Expressions and Statements (Assignment statement) Taking input (using raw input() and input()) and displaying output - print statement, Comments in Python.	06
2	Conditional and Looping Construct if - else statement and nested if – else while, for, use of range function in for, Nested loops break, continue, pass statement Use of compound expression in conditional constructs. Functions: Built-In Function, invoking built in functions Module(Importing entire module or selected objects using from statement) Functions from math, random, time & date module. Composition User Define Function: Defining , invoking functions, passing parameters (default parameter values, keyword arguments) Scope of variables, void functions and functions returning values	08
3	String : Creating, initializing and accessing the elements, String operators: +, *, in, not in, range, slice [n:m] String built in functions & methods: len, capitalize, find, isalnum, isalpha, isdigit, lower, islower, isupper, upper, lstrip, rstrip, isspace, istitle, partition, replace, join, split, count, decode, encode, swapcase Strings constants defined in string module. Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions(try - finally)	08

4	<p>Concept of mutable list: creating, initializing and accessing the elements of list List operations (Concatenation, Repetation, Membership, list slices), List comprehensions List functions & methods: len, insert, append, extend, sort, remove, reverse, pop, Tuples, Immutable concept, creating, initializing and accessing the elements in a tuple, Tuple functions: cmp(), len(), max(), min(), tuple(), Sets , Concept of Sets: creating, initializing and accessing the elements of Sets operation (Membership, union, intersection, difference, and symmetric difference, Dictionaries: Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, Traversing, appending, updating and deleting elements Dictionary functions & Methods: cmp, len, clear(), get(), has_key(), items(), keys(), update(), values()</p>	08
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Reference Books:

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|---|
| 1. Mark Lutz's Programming Python O'Really. |
| 2. Jake VanderPlas Python Data Science Handbook O' Reilly |

Syllabus Semester-V

Course code: ITH41MML303	Course name: Computer Networks	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2 P-0	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: A foundational understanding of key concepts in computer science or information technology, covering basic programming concepts and fundamental computer architecture.		
Course Objectives:		
To gain knowledge of computer networks and essential terminologies related to network hardware, software models, and topologies. To learn network architectures and protocols, services that enable seamless communication.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Knowledge of basics of computer network, architectures, network hardware, software types of network, reference models including OSI and TCP/IP, network standardization.		
CO2: Understanding of the physical and data link layer design issues, transmission medias, multiplexing, switching, framing, error detection and control mechanism.		
CO3: Understanding of Ethernet, multiple access protocol, wireless LANs, broadband, Bluetooth, addressing & routing schemes, congestion control algorithms.		
CO4: Knowledge of transport protocols-UDP, TCP, its design issues and concepts of application, layer & protocols.		

Contents -

Unit	Content	Teaching hours
1	Introduction: Uses of computer networks, types of network, network hardware, network software, OSI reference model, TCP/IP reference model, example networks, network standardization.	06
2	Physical Layer: Theoretical basis for data communication, network topologies, guided transmission media, wireless transmission, communication satellites, Digital modulation and multiplexing, public switched telephone network, mobile telephone system, cable television. Data Link Layer: Data link layer design issues, error detection and correction, elementary data link protocols, sliding window protocol.	08
3	Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet, wireless LANs, broadband wireless, Bluetooth, data link layer switching. Network Layer: design issues, routing algorithms, congestion control algorithms, internetworking, and network layer in the internet.	08
4	Transport Layer: Services provided to the upper layers, transport service primitives, Berkeley sockets, elements of transport protocols, congestion control, transport protocols-UDP & TCP. Application Layer: Domain name system, electronic mail, world wide web, streaming audio and video, content delivery.	08

Reference Books: 1. Data Communications and Networking -Behrouz A. Forouzan, Fifth Edition, McGraw Hill.
2. Computer Networks- A Systems Approach – Larry L. Peterson & Bruce S. Davie, Fifth Edition.

Syllabus Semester-V

Course code: ITH41MMP301	Course name: Practical Based on Introduction to Data Science	
Course category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basics Knowledge of programming & Data Mining.		
Course Objectives: Understand and learn the lifecycle and phases of data science and work comfortably with data science projects.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To develop fundamental knowledge of concepts underlying data science		
CO2: To develop practical data analysis skills, which can be applied to practical problems		
CO3: To explain how math and information sciences can contribute to building better algorithms and software.		
CO4: To develop applied experience with data science software, programming, applications and processes.		

Content -

Sr.no.	Description of Practical	Practical Hours
1	Write an R program to create student records using different data types (numeric, character, logical). Store the records in an Excel file using appropriate R packages.	2
2	Develop an R program to store student marks and apply at least 10 statistical functions	2
3	Create a dataset of student marks and visualize the data using: Bar Chart, Line Graph, Histogram, Pie Chart	2
4	Write an R program to create a vector and perform basic operations	2
5	Demonstrate how to create and manipulate a list object containing different data types	2
6	Write a program to create a matrix and perform the following operations: Matrix addition, subtraction, and multiplication	2
7	Create a data frame containing student details (Name, Age, Marks).	2
8	Create a multi-dimensional array and perform basic operations like accessing elements and slicing data	2
9	Write an R program to calculate statistical measures such as mean, mod, median, etc.	2
10	Develop an R program to write a data frame to a CSV file	2
11	Project	10

Reference Books:

1. Rachel Schutt & Cathy O'Neil Doing Data Science, O' Reilly, First Edition, 2013.
2. B. Ram Computer Fundamental, BPB Publication.

Syllabus Semester-V

Course code: ITH41MMP302	Course name: Practical Based on Python Programming	
Course category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic C, C++ programming Computer Skills.		
Course Objectives:		
Understand and use variables. Work with common Python data types like integers, floats, strings, characters, lists, dictionaries, as well as pandas Data Frames Advanced techniques such as 3D layers,		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To understand importance of Python.		
CO2: Develop a skill to implement Python Programming.		
CO3: Hands-on Python experience for professional advancement.		
CO4: To use and implement standard programming constructs like development phase.		

Content -

Sr.no.	Description of Practical	Practical Hours
1	Calculate the Area of a Triangle in Python	2
2	Swap Two Variables Without a Third Variable in Python	2
3	Find the Largest Number Among Three in Python	2
4	Generate Fibonacci Series Using a Function in Python	2
5	Swap First and Last Elements in a List Using Python	2
6	Display a Multiplication Table Using Functions in Python	2
7	Split a List into Chunks of Size N in Python	2
8	Find Duplicate Characters in a String Using Counter in Python	2
9	Generate Possible Words from Given Characters in Python	2
10	Implement the Tower of Hanoi Algorithm in Python	2
11	Project	10

Reference Books:

1. Jake VanderPlas Python Data Science Handbook O' Reilly.
2. Mark Lutz's Learning Python O'Really.

Syllabus Semester-V

Course code: ITH41MEL301	Course name: Java Script	
Course category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60 ESE-40
Pre-requisites: Basic Programming Knowledge of HTML and CSS.		
Course Objectives:		
Learn how JavaScript works and how it is used in web development		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Ability to understand the fundamental of JavaScript.		
CO2: Demonstrate objects and arrays usage.		
CO3: Define functions and methods.		
CO4: Proficiency in developing interactive and dynamic web applications.		

Contents -

Unit	Content	Teaching hours
1	Introduction to JavaScript, Features of JavaScript, Advantages and Disadvantages of JavaScript, Writing JavaScript into HTML, Basic Programming Techniques: Data Types and Literal: Number, Boolean, String, Null, Structure of a JavaScript program, Type Casting, Creating Variables, Incorporating Variables in a Script, The JavaScript Array.	09
2	Operators and Expressions in JavaScript: Arithmetic Operators, Logical Operators, Comparison Operators, String Operators, Assignment Operators, The Conditional Expression Ternary Operator, Special Operators: delete, new, void, JavaScript Programming Constructs, Conditional Checking: if, if else, if else if, switch	09
3	Super Controlled- Endless loops: for loop, while loop, do-while loop, for-in loop, Functions in JavaScript: Built-in Functions, User Defined Functions, Placing Text in a Browser, Dialog Boxes: Alert Dialog Box, Prompt Dialog Box, Confirm Dialog Box	09
4	The JavaScript Document Object Model, Handling Events Using JavaScript, Forms Used By a Website: The Form Object-The Form Object's Methods, The Text Element, Password Element, Button Element, Checkbox Element, Radio Element, Text Area Element, Select and Option Elements, Other Built-in Objects in JavaScript	09
5	Introduction to Full-Stack Development Role of a Full-Stack Developer, Overview of Front-End, Back-End, and Databases, Understanding Client-Server Architecture, Front-End Development (UI/UX & Client-Side Programming), A. HTML & CSS (Structure & Styling), HTML5 Fundamentals (Tags, Forms, Media, Tables, etc.), Responsive Web Design (Media Queries, Bootstrap, Tailwind) CSS Animations & Transitions AJAX Basics & Asynchronous JavaScript (Callbacks, Promises, Async/Await)	09

Text Book :

1. Ivan Bayross, Web Enabled Commercial Applications Development Using-HTML, JavaScript, DHTML and PHP, 4th Revised Edition, BPB Publications.
2. A Smarter Way to Learn JavaScript by Mark Mayers.

Reference Books:

1. JavaScript 2.0-The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider

Syllabus Semester-V

Course code: ITH41MEL302	Course name: Agile software development	
Course category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60 ESE-40
Pre-requisites: Basic knowledge of software development processes and working experience within a team-based environment. Exposure to traditional project management methodologies		
Course Objectives:		
1. Deep understanding of agile principles and methodologies		
2. Working in team under agile Frameworks and methodologies		
3. Understand the role of agile leadership and servant leadership		
4. Guide learners in Agile Process and Frameworks with continuous improvements		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Students will start to manage software development effectively		
CO2: Create, Manage, and facilitate Agile Team to enhance collaboration		
CO3: Improve project delivery through continuous feedback and iterative development.		
CO4: Able to generate a demonstrative and adaptive environment that project needs in an organizational environments		

Contents -

Unit	Content	Teaching hours
1	Introduction to Software Project Management:- Introduction to Project Management Concepts, Role of Project Manager, Management Level, structure and its process, Overview of Software Project Management (SPM) and Importance Project Spectrum , Software Development Life Cycle (SDLC), Tools and Techniques in Traditional Project Management. Project Planning and Scheduling Project Scope Management: Defining Scope, Resources, Work Breakdown Structure, process and importance, Estimation Techniques: Effort and Cost Estimation, COCOMO model, Project Scheduling: Gantt Charts, Project Evaluation & Review Technique (PERT), Critical Path Method (CPM).	09
2	Introduction to Agile & Agile Project Management :- Agile principles & values, Traditional vs. Agile project management, Agile frameworks: - Agile Manifesto, Adopting Agile Mindset, -Benefits of Agile, -Agile Lifecycle, Agile Roles and Responsibilities , -Agile /Scrum Roles, -Agile responsibilities, -Comparisons on Agile Roles	09
3	Agile Frameworks & Methodologies:- Overview of Agile frameworks, Scrum framework: Roles, artifacts, ceremonies, Overview of Sprint, Kanban: Flow management, Kanban Board, Work In Process(WIP) limits, Lean principles & Agile scaling frameworks , Scaling Agile for Large Enterprise, Large Scale Scrum , Extreme Programming (XP) – Agile for Developers, Disciple Agile Delivery	09

4	Agile Planning, Estimation & Execution:- AGILE EPICS, Features, User stories and Tasks, Framework under EPICS, Backlog management & User Stories, Agile estimation: User Story Points, Planning, Sprint planning & estimation, Agile Leadership, Collaboration & Stakeholder Management:- Handling Team Conflicts & Agile Coaching, Agile Roles: Product Owner, Scrum Master, Developers, Team Collaboration in Agile, Leadership with Agile Roles: Product Owner, Scrum Master, Developers, Stakeholder Communication & Expectation Management	09
5	Agile Metrics, Continuous Improvement & Certifications Agile Metrics – Measuring Success in Agile Projects Velocity, Burndown Chart, Burnup Chart Cycle Time, Lead Time Escaped Defects, Cumulative Flow Diagram (CFD) ,Continuous Improvement – Retrospectives & Process Enhancement, Agile Retrospective - Importance Types of Retrospective, Mad, Sad, Glad – Understanding team emotions Start, Stop, Continue – Actionable improvements, Sailboat Retrospective Identifying risks and goals, Agile Certifications- Career aspects	09

Text Books:

1. Agile Software Development, Principles, Patterns, and Practices-Robert C. Martin Pearson Publications
2. Software Project Management- Hughes Bob- McGraw Hill Education Imprint

Reference Books:

1. The Art of Agile Development- James shore & Shane Warden -O'reilly Publications
2. Agile Project Management - J. Ross - BPB Publications

Online Resources:

1. NPTEL / SWAYAM lectures, <https://www.pmi.org/certifications/agile-certifications>, <https://www.atlassian.com/agile/kanban>

Syllabus Semester-V

Course code: ITH41MEP301	Course name: Practical Based on Java Script	
Course category: Major Elective		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic Programming Knowledge of HTML and CSS		
Course Objectives: Learn how JavaScript works and how it is used in web development		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Ability to understand the fundamental of JavaScript.		
CO2: Proficiency in developing interactive and dynamic web applications.		

Content -

Sr. No	Description of Practical	Practical Hours
1	Using the alert() Method in JavaScript	02
2	Assigning and Adding Variables in JavaScript	02
3	Defining and Using User-Defined Functions in JavaScript	02
4	Calling a Function from Another Function in JavaScript	02
5	Implementing Conditional Statements in JavaScript	02
6	Working with Loops in JavaScript	02
7	Handling Dates with Date(), getDate(), and getDay() in JavaScript	02
8	Applying String Methods to Text in JavaScript	02
9	Using min(), max(), and round() Functions in JavaScript	02
10	Accessing Elements with getElementById() and getElementsByClassName() in JavaScript	02

Text Books:

- Ivan Bayross, Web Enabled Commercial Applications Development Using-HTML.
- JavaScript, DHTML and PHP, 4th Revised Edition, BPB Publications.
- A Smarter Way to Learn JavaScript by Mark Mayers.

Reference Books:

- JavaScript 2.0-The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider.

Syllabus Semester-V

Course code: ITH41MEP302	Course name: Practical Based on Agile software	
Course category: Major Elective		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic knowledge of software development processes and working experience within a team-based environment. Exposure to traditional project management methodologies		
Course Objectives:		
1. Deep understanding of Agile principles and methodologies		
2. Working in team under Agile Frameworks and methodologies		
Course Outcomes: At the end of the course, the students will be able to -		
CO 1: Students will start to manage software development effectively		
CO 2: Create, Manage, and facilitate Agile Team to enhance collaboration		
CO 3: Improve project delivery through continuous feedback and iterative development.		
CO 4: Confidently conduct stand-ups, sprint reviews, and retrospectives.		

Content -

Sr.no.	Description of Practical	Practical Hours
1	Project Charter Creation with Agile Mindset & Principles Define a project vision, objectives, stakeholders, scope, and constraints. Create a charter document outlining roles and responsibilities. Compare and Explore Agile values from the Agile Manifesto.	2
2	Work Breakdown Structure (WBS) Development Break the project into smaller, manageable tasks. Implement as per Agile works and how it improves software development. Use tools like MS Project, Trello, or Jira to visualize tasks.	2
3	Project Scheduling with Gantt Chart Develop a timeline using Gantt charts in MS Project or online tools. Identify task dependencies and milestones	2
4	Implement Agile Frameworks in Real-World Projects Hands-on application of Scrum, Kanban, and Lean principles use tool like JIRA Work with Sprint planning, user stories, and iterative development.	2
5	Use Agile Tools & Techniques in Live Projects Set up a Scrum board in Jira, Trello, or Azure DevOps. Manage and understand backlog, sprints, and task tracking in an Agile tool.	2
6	Develop Estimation & Planning Skills Use real techniques like Story Points, Planning Poker, and Velocity tracking, Perform backlog refinement and sprint forecasting.	2

7	Facilitate Agile Ceremonies Practice conducting Daily Stand-ups, Sprint Reviews, and Retrospectives, Learn techniques for improving team collaboration.	2
8	Manage Agile Teams & Stakeholders: - Lead cross-functional teams in an Agile environment, Handle stakeholders' expectations using Agile reporting tools.	2
9	Adapt Agile in Different Business Scenarios Work with Agile in startups, enterprises, and hybrid project management setups, Learn how to integrate Agile with DevOps.	2
10	Handle Agile Challenges & Continuous Improvement Learn to manage scope creep, risk, and impediments in Agile projects, Focus on continuous learning and delivery improvement.	2
11	Project	10

Text Books:
1. Agile Software Development, Principles, Patterns, and Practices-Robert C. Martin Pearson Publications
2. Software Project Management- Hughes Bob- McGraw Hill Education Imprint
Reference Books:
1. The Art of Agile Development- James shore & Shane Warden -O'reilly Publications
2. Agile Project Management - J. Ross - BPB Publications
Online Resources: 1. NPTEL / SWAYAM lectures.
1. https://www.pmi.org/certifications/agile-certifications
2. https://www.atlassian.com/agile/kanban

Syllabus Semester-V

Course code: ITH41VSP301	Course name: Practical Based on Mobile App Development	
Course category: Vocational skill Course		
Credits: 2	Teaching Scheme: L-0 P-4	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic knowledge of Understand Java/Kotlin for Android development		
Course Objectives:		
1. To enable students to have a good understanding of smart phones and developing apps for Android phones.		
2. To engineer effective software systems for mobile phones		
3. To develop android apps		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Perform advanced rotoscoping and motion tracking. Interpreted features of Android Operating System.		
CO2: Configure Android environment and development tools.		
CO3: Develop rich user Inferences by using layouts and controls.		
CO4: Use user Interface component for android application development.		

Content:

Sr.no.	Description of Practical	Practical Hours
1	Compare Various operating System with Android os.	2
2	Install/ Configure JDK, Android Studio & Android SDK.	2
3	Create a simple mobile app that displays "Hello, World!" on the screen.	2
4	Develop a program to implement Frame layout, Table layout & relative layout.	2
5	Program to implement text view & edit view.	2
6	Program to implement Button, Image Button & Toggle button.	2
7	Program to implement Checkbox.	2
8	Develop a program to implement Radio Button & Radio Group.	2
9	Develop a program to implement Progress Bar.	2
10	Develop a program to implement date & Time Picker.	2
11	Project	10

Reference Books:

1. Rotoscoping: Techniques and Tools for the Aspiring Artist by Benjamin Bratt
2. Matchmoving: The Invisible Art of Camera Tracking by Tim Dobbert

Semester: SIXTH

Syllabus Semester-VI

Course code: ITH41MML304	Course name: Data Analytics	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2 P-0	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basics of Programming and Data Science Applications		
Course Objectives:		
The objective of this course is to provide comprehensive knowledge of python programming paradigms and Data Analytics		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Demonstrate the use of built-in objects of Python		
CO2: Demonstrate significant experience with python program development environment.		
CO3: Implement numerical programming, data handling and visualization through NumPy modules		

Contents -

Unit	Content	Teaching hours
1	Explorative Analysis:- Understanding the Dataset, Checking the structure of the data (head(), info(), describe()), Identifying missing values and handling them, Checking data types of each column, Summary Statistics, Calculating mean, median, mode, standard deviation, etc., Identifying outliers and anomalies, Data Visualization, Univariate Analysis (Analyzing a single variable), Histograms, boxplots, density plots, Bivariate Analysis (Relationships between two variables), Scatter plots, correlation matrices, pair plots, Multivariate Analysis, Heatmaps, clustering, PCA (Principal Component Analysis), Handling Missing Data.	08
2	Data Analytics Library:- Using Numpy Basics of NumPy-Computation on NumPy-Aggregations-Computation on Arrays Comparisons, Masks and Boolean Arrays-Fancy Indexing-Sorting Arrays-Structured Data: NumPy's Structured Array.	06
3	Data Manipulation With Pandas:- Introduction to Pandas Objects - Data indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Hierarchical Indexing - Combining Data Sets - Aggregation and Grouping - Pivot Tables.	08
4	Visualization And Matplotlib:- Basic functions of matplotlib - Simple Line Plot, Scatter Plot - Density and Contour Plots - Histograms, Binnings and Density - Customizing Plot Legends, Colour Bars - Three Dimensional Plotting in Matplotlib.	08

Reference Books:

1. Python Data Science Handbook - Essential Tools for Working with Data Jake VanderPlas O'Reilly Media Inc., 2016.
2. An Introduction to Python and Computer Programming Zhang.Y Springer Publications, 2016
3. Data Science from Scratch First Principles with Python, Joel Grus O'Reilly Media, 2016.

Syllabus Semester-VI

Course code: ITH41MML305	Course name: Cloud Computing	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2 P-0	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic Knowledge of networking & Operating system		
Course Objectives:		
Understanding basics of cloud computing and Key concepts of Cloud Analytics and different cloud computing services.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand Cloud Computing Basics		
CO2: Understand the use of Cloud Computing in Data Analytics		
CO3: Learn the Concept of Cloud Infrastructure		
CO4: Understand Business imperative of Cloud Computing		

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.	06
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.	08
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	08
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	08

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
CloudMark Wilkins-First Edition.
- 2."Handbook of cloud computing" by Borko Furht, Armando Escalante published by springer(2010)

Syllabus Semester-VI

Course code: ITH41MML306	Course name: Drone Technology	
Course category: Major Mandatory		
Credits: 2	Teaching Scheme: L-2 P-0	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Knowledge of Networking, peripheral devices and sensors.		
Course Objectives:		
To familiarize the students with the concepts and techniques used in design of a small drones and its applications.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Learn about the various types of Drones and its applications.		
CO2: Learn about the various components of drone design		
CO3: Design basic types of drone systems.		
CO4: Develop a Drone mechanism for specific applications		

Contents -

Unit	Content	Teaching hours
1	Introduction to Drones: Definition and history of drones, Types of drones, Drone components and terminology, Regulations and Guidelines for drone usage. Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employ ability, Basics of Aero Dynamics Drone Design and Assembly: Design considerations for drone airframe and propulsion systems, Selecting and assembling drone components such as motors, batteries, flight controllers, and cameras, Basic wiring and soldering techniques.	10
2	Drone Flying and Operations: Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity - Removable storage-devices- Linked mobile devices and applications Drone Motors: Working, Types: Brush and Brushless Motors, motor sizing and identification, mounting patterns and thread size, Thrust to Weight ratio, KV ratings, advanced motor selection.	10
3	Future Drones and Safety: The safety risks- Guidelines to fly safely - Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms Applications of Drone: Overview of commercial and industrial drone applications, Case studies and examples of successful drone deployments, GPS based navigation system, Drone Camera Systems, Agro application, Drone Delivery, Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing. Future trends and developments in the drone industry.	10

Reference Books:

1. Practical Drones: Building, Programming, and Applications E. Tooley Apress, 2021.
2. Getting Started with Drone: How to Build, Fly, and Program Your Own Drone D. McLeod Apress, 2019

Syllabus Semester-VI

Course code: ITH41MMP303	Course name: Practical Based on Data Analytics	
Course category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basics of Programming and Data Science Applications.		
Course Objectives: The objective of this course is to provide comprehensive knowledge of python programming paradigms and Data Analytics.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Learn User interface. Course Outcomes: At the end of the course, the students will be able to –		
CO2: Demonstrate the use of built-in objects of Python		
CO3: Demonstrate significant experience with python program development environment		
CO4: Implement numerical programming, data handling and visualization through NumPy modul		

Content -

Sr.no.	Description of Practical	Practical Hours
1	Demonstrate usage of branching and looping statements	2
2	Demonstrate Recursive functions and Demonstrate Lists	2
3	Demonstrate Tuples and Sets	2
4	Data Analytics Using Numpy.	2
5	Demonstrate handling of missing data.	2
6	Demonstrate hierarchical indexing.	2
7	Data Manipulation With Pandas.	2
8	Visualization And Matplotlib	2
9	Demonstrate Scatter Plot	2
10	Demonstrate 3D plotting	2
11	Project	10

Reference Books :

1. Python Data Science Handbook - Essential Tools for Working with Data
2. Jake VanderPlas O'Reilly Media Inc., 2016.

Syllabus Semester-VI

Course code: ITH41MMP304	Course name: Practical Based 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 networking & Operating system.		
Course Objectives:		
Understanding basics of cloud computing and Key concepts of Cloud Analytics and different cloud computing services.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand Cloud Computing Basics		
CO2: Understand the use of Cloud Computing in Data Analytics		

Content -

Sr.no.	Description 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 CloudSim and run a scheduling algorithm that is not present in CloudSim	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 trystack (Online Openstack Demo Version)	2
10	Install Hadoop single node cluster and run simple applications like wordcount.	2
11	Project	10

Reference Books:

1. Cloud Computing Dr.Pandey U.S. & Dr. Chaudhary Kavita S. Chand Publishing
2. Cloud Computing Miller Pearson Education India.
3. Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud Mark Wilkins-First Edition.

Syllabus Semester-VI

Course code: ITH41MEL303	Course name: PHP	
Course category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60 ESE-40
Pre-requisites: Basic of knowledge of programming language.		
Course Objectives:		
The objective of this course is to provide the necessary knowledge to design and develop dynamic, database-driven web applications using PHP.		
Course Outcomes: At the end of the course, the students will be able to - Understand the server side programming language.		
CO1: Create PHP programs that use various PHP library functions, And that manipulates the Web-site.		
CO2: Understand the Form Handling in PHP.		
CO3: Understanding to the database connectivity.		
CO4: Understanding different type's displays and tracking. Basics of Visualization.		

Contents -

Unit	Content	Teaching hours
1	Introduction to PHP: Evaluation of PHP, Basic Syntax, Defining variable and constant, PHP Data type, Operator and Expression, Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html, Function :What is a function, Define a function, Call by value and Call by reference, Recursive function, Library function, Concept of String.	09
2	Array : Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(), Some useful Library function. Handling Html Form with PHP :GET & POST Method, Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission.	09
3	PHP Include and Require Working with file in PHP : Directories Understanding file& directory, Opening and closing, a file, Coping, renaming and deleting a file, working with directories, Creating and deleting folder, File Uploading & Downloading. Session and Cookie: Introduction to Session Control, Session Functionality What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session.	09
4	Database Connectivity with MySQL: Introduction to DBMS, Connection with MySQL Database, Performing basic database operation (DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.)	09
5	Exception Handling Understanding: Exception and error, Try, catch, throw. Error tracking and debugging	05

Text Book :

1. Learning PHP and MySQL Michele E. Davis, Jon A. Phillips
2. Beginning PHP and MySQL W Jason Gilmore Build Your Own Database Driven
3. Web Site Using PHP & MySQL Kevin Yank.

Reference Books:

1. Virtual and Augmented Reality (VR/AR), Bernhard Jung, Paul Grimm, Ralf Doerner, Wolfgang Broll 2022.

Syllabus Semester-VI

Course code: ITH41MEL304	Course name: UI / UX	
Course category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60 ESE-40
Pre-requisites: Basic knowledge of Graphic Design & Design Principals		
Course Objectives:		
The basic objective of User Experience & User Interface Design is to Design user friendly simple, functional website And Mobile Apps.		
Course Outcomes: At the end of the course, the students will be able to –		
CO1: Understand the concept of User Experience Design, solve problems using UX Techniques, Structure and manage the User Requirements for Projects.		
CO2: Learn to create personas, journey maps, Empathy map, and wireframes.		
CO3: Students efficiently use Design principles when design user interface for websites or mobile apps.		
CO4: Create Mockup design for mobile apps.		

Contents -

Unit	Content	Teaching hours
1	Basics of User Experience Design Define User Experience Design, UXD Myths, Need of User Experience Design, Definition, Advantages of UXD, UXD Strategy, Principals of UXD, Project Objective and Approach, Business Requirements, UXD Elements, characteristics of UXD, UX Laws.	10
2	Research Using UX Process Design thinking phases, Exploring the problem, generating ideas, Refining solution, Empathy map, User Research: User interviews, contextual inquiry, survey, focus group, card sorting, research techniques, personas: what are Personas, why create personas, finding information for personas.	10
3	Generating Ideas and Content Management Better Deliverables, Defining to Design, Information Architecture, Wireframing, Sitemaps, Grids and Layouts, user flow diagram, Prototyping, wireframe vs Prototype, Usability Testing, Feedback.	10
4	The Importance & Principals of User Interface Defining the User Interface, Importance of good design, Graphical User Interface, difference between UI and UX, Screen Design, color theory, Design Principals: Typography, Imagery, Emphasis, Balance, Alignment, Contrast, Repetition, color, space, Proximity, Hierarchy, Naturalness, Consistency, Friendliness, Clarity, Interaction, Transparency.	10
5	Elements of User Interface Design Input controls, Informational Components, other components, Interaction Design, Color Psychology, Mobile-first design approach, Flexible grids and responsive design, media queries.	05

Text Book :

1. A Project Guide to UX Design by Russ Unger and Carolyn Chandler, Second Edition New Riders publication.
2. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Wilbert O. Galitz, third edition WILEY publication.
3. Design Thinking for Dummies by Christian Muller-Roterberg , Wiley publication.

Reference Books:

1. The UX Design Field Book, Doug Collins, 2022.
2. UI/UX Design Basics and Fundamentals, John RICHARDS, Independently Published, 2018

Syllabus Semester-VI

Course code: ITH41MEP303	Course name: Practical Based on PHP	
Course category: Major Elective		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic Knowledge of Simulation.		
Course Objectives:		
Basic of knowledge of programming language		
Course Outcomes: At the end of the course, the students will be able to –		
CO 1: Understand the server side programming language.		
CO 2: Create PHP programs that use various PHP library functions and that manipulates the Web-site.		
CO 3: Understand the Form Handling in PHP.		
CO 4: Understanding to the database connectivity.		

Contents -

Sr. No	Description of Practical	Practical Hours
1	Program to Compute the Sum of Individual Digits of a Number	2
2	Script to Determine Whether a Number is Odd or Even	2
3	Implementation to Check if a Given Number is Prime	2
4	Code to Calculate the Factorial of a Number	2
5	Program to Verify if a Number is a Palindrome	2
6	Script to Generate the Fibonacci Series Without Recursion	2
7	Program to Generate the Fibonacci Series Using Recursion	2
8	Code to Reverse a Given Number	2
9	Program to Display the Multiplication Table of a Number	2
10	Script to Swap Two Numbers (With and Without Using a Third Variable)	2
11	Implementation to Determine if a Given Year is a Leap Year	2
12	Based Registration Form Using HTML and Basic PHP Processing	2
13	Registration Form with Session and Cookies Management	2
14	Program to Compute the Sum of Individual Digits of a Number	2
15	Script to Determine Whether a Number is Odd or Even	2

Text Books :

1. Learning PHP and MySQL Michele E. Davis, Jon A. Phillips
2. Beginning PHP and MySQL W Jason Gilmore Build Your Own Database Driven
3. Web Site Using PHP & MySQL Kevin Yank.

Reference Books:

1. Virtual and Augmented Reality (VR/AR), Bernhard Jung, Paul Grimm, Ralf Doerner, Wolfgang Broll 2022

Syllabus Semester-VI

Course code: ITH41MEP304	Course name: Practical Based on UI/UX	
Course category: Major Elective		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Basic Knowledge of Graphic Design.		
Course Objectives:		
Create Empathy map, User Persona and journey map for user research design user friendly simple, functional website And Mobile Apps.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Create empathy map for understanding user requirements		
CO2: Design user persona and journey map for product information.		
CO3: Draw information architecture and wireframe for organizing and presenting information.		
CO4: Design mobile app screen.		

Contents -

Sr.no.	Description of Practical	Practical Hours
1	Write five features of any mobile app.	2
2	Design Empathy map for Coffee shop app.	2
3	Write User Persona for Designing E-Commerce Website.	2
4	Write Journey Map for Traveling app.	2
5	Create wireframe structure for Music app.	2
6	Create Information Architecture for E-Commerce Website.	2
7	Design mobile app screens for educational website.	2
8	Design animated screens for app journey information.	2
9	Design animated slideshow for app features.	2
10	Design text animation for app feature.	2
11	Project.	10

Text Books :

1. A Project Guide to UX Design by Russ Unger and Carolyn Chandler, Second Edition New Riders publication.
2. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Wilbert O. Galitz, third edition WILEY publication.
3. Design Thinking for Dummies by Christian Muller-Roterberg , Wiley publication.

Reference Books:

1. UI/UX Design Basics and Fundamentals, John RICHARDS, Independently Published, 2018

Semester: Seven

Syllabus Semester-VII

Course Code: ITH41MML401	Course Name: Artificial Intelligence	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3, P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basics of Mathematical Concepts		
Course Objectives: This course introduces students to advanced concepts of Artificial Intelligence with an emphasis on intelligent agents, problem-solving strategies, knowledge representation, reasoning, learning, developing ethical awareness and societal understanding of AI systems and real-world AI applications		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain core AI concepts, intelligent agents, and problem-solving paradigms		
CO2: Apply search algorithms and optimization techniques to solve AI problems		
CO3: Implement knowledge representation and reasoning models		
CO4: Analyze learning techniques including neural networks and deep learning		
CO5: Develop basic AI-driven applications using Python		

Contents –

Unit	Content	Teaching hours
1	Introduction to Artificial Intelligence :- Definition, scope, and foundation of AI, History of AI, The state of Art, AI vs Human Intelligence, Applications of AI in IT, healthcare, finance, education, and defense, Intelligent Agents: types, architecture, environments, Rationality and performance measures.	8
2	Problem Solving and Search Techniques :- Problem formulation and state space representation, Uninformed search: BFS, DFS, Uniform Cost Search, Informed search: Heuristic search, A*, Best First Search, Game playing: Minimax, Alpha-Beta pruning, Constraint Satisfaction Problems (CSPs).	10
3	Knowledge Representation and Reasoning:- Propositional Logic, Predicate Logic, Inference mechanisms, Knowledge-based agents, Uncertainty handling: Bayesian Networks, an introduction to Fuzzy Logic	8
4	Machine Learning and Neural Networks :- Overview of Machine Learning, Supervised, Unsupervised, and Reinforcement Learning, Artificial Neural Networks: perceptron, multilayer networks, Introduction to Deep Learning, Popular frameworks: TensorFlow, PyTorch (conceptual).	10
5	Expert Systems and Advanced AI Applications and its Ethics :- Need & Justification for Expert Systems- Cognitive Problems, Expert System Architecture , Rule Based Systems, Non Production System, Knowledge Acquisition, Case Studies: Mycin, R1, Natural Language Processing: concepts and applications, Computer Vision: image recognition basics, Ethical AI: bias, fairness, transparency, AI governance, regulations, and future trends.	9

Text Books: 1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson
Elaine Rich & Kevin Knight, Artificial Intelligence, McGraw-Hill, 3. Ian Goodfellow et al., Deep Learning, MIT Press, 4. Introduction To Expert Systems- Peter Jackson

Reference Books: 1. Introduction To AI And Expert Systems - D.W . Paterson

Online Resources: 1. NPTEL: AI and ML Courses, Coursera / edX AI programs

Syllabus Semester-VII

Course Code: ITH41MML402	Course Name: Internet of Things	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Knowledge of Hardware and sensors and basics of programming		
Course Objectives:		
<ol style="list-style-type: none"> 1. Introduce the fundamental concepts, architecture, and components of IoT systems. 2. Enable understanding of sensors, actuators, and embedded devices used in IoT applications. 3. Provide knowledge of IoT communication protocols and networking models. 4. Develop skills to design, implement, and analyze basic IoT solutions using hardware and software platforms. 5. Create awareness about IoT security, privacy issues, and real-world applications in domains such as smart cities, healthcare, and industry. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To learn fundamentals of Internet of Things		
CO2: To Understand IOT Reference Architecture		
CO3: To learn about the basics of IOT protocols		
CO4: Analyze IoT security issues		
CO5: Develop real-world IoT solutions		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Internet of things: - Definition and evolution of IoT, Characteristics of IoT, Applications of IoT, Benefits of IOT, Architectural overview, How IOT works? Advantages of IoT, Disadvantages IOT, IoT Enabling Technologies, IoT design challenges, IoT and Associated Technologies, M2M (Machine to Machine Communications).	9
2	Elements of IoT: - Main components used in IoT, Hardware components – computing (Arduino, Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components- Programming APIs (Using python/Arduino) for communication protocols-MQTT, Cloud platforms for IoT.	9
3	Sensors & Actuators:- Sensor working, Sensor Characteristics, Types of sensors and working principle, Sensors used in IoT, Actuator, Types of Actuators, Basic of IoT Networking, Basic of IoT Networking	9
4	IoT Hardware platforms:- IoT Hardware platforms, Specifications and interfaces, Serial Communication Protocols, Arduino IDE, Interfacing various sensors, modules and devices to Arduino,	9
5	Wireless for IoT:- Overview of Wireless Sensor Networks, IEEE standards for IoT, Overview of Wireless Modems (RF, GSM/GPRS, Bluetooth, RFID, Wi-Fi etc.).	9

Text Books: Vijay Madiseti, ArshdeepBahga, “Internet of Things a Hands-On- Approach”.

Reference Books:

1. Dr SRN Reddy, RachitThukral and Manasi Mishra ,” Introduction to Internet of Things”: A practical Approach” ETI Labs
2. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus Semester-VII

Course Code: ITH41MML403	Course Name: Network Security	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic Computer Networks (OSI & TCP/IP models), Operating System Fundamentals, Fundamentals of Information Technology.		
Course Objectives:		
<ol style="list-style-type: none"> 1. Understand basic concepts of network security, threats and vulnerabilities. 2. Learn the fundamentals of cryptography and security algorithms used in secure communication. 3. Apply different network security protocols and mechanisms to protect data and systems. 4. Explore security tools and defense techniques to detect and prevent attacks. 5. Gain awareness of cyber security challenges and emerging technologies in security. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the fundamental concepts of network security, including security goals, threats, vulnerabilities, and types of attacks.		
CO2: Describe basic cryptographic concepts such as encryption, decryption, symmetric and asymmetric key algorithms, hash functions, and digital signatures.		
CO3: Understand and apply network security protocols and mechanisms like SSL/TLS, IPSec, authentication techniques, and secure web/email communication.		
CO4: Identify and use network defense mechanisms including firewalls, IDS/IPS, antivirus systems, VPNs, and wireless security techniques.		
CO5: Analyze cyber security issues, cybercrimes, ethical hacking concepts, and emerging security trends such as cloud and IoT security.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Network Security: Basics of Network Security, Need and Importance of Network Security, Security Goals: Confidentiality, Integrity, Availability, Types of Security Attacks: Active and Passive, Network Threats and Vulnerabilities, Security Policies and Risk Management.	9
2	Cryptography Basics: Introduction to Cryptography, Encryption and Decryption Techniques, Symmetric Key Cryptography, Asymmetric Key Cryptography, Hash Functions and Message Authentication, Digital Signatures and Certificates.	9
3	Network Security Protocols: Authentication Mechanisms, Secure Communication Concepts, Security Protocols: SSL / TLS, IPSec, Secure Email Systems (PGP, S/MIME – overview), Web Security and HTTPS.	9
4	Network Defense and Protection: Firewalls: Concept and Types, Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS), Antivirus and Anti-malware Software, Virtual Private Networks (VPN), Wireless Network Security (WEP, WPA, WPA2).	9
5	Cyber Security and Emerging Trends: Introduction to Cyber Security, Cyber Crimes and Types, Ethical Hacking – Basic Concepts, Social Engineering Attacks, Cloud Computing Security, Internet of Things (IoT) Security, Future Trends in Network Security	9

Text Books:

Reference Books: 1) Network Security” by William Stallings 2) Network Security and Cryptography” by S. K. Sharma – McGraw-Hill 3) Cryptography and Network Security” by Behrouz A. Forouzan – McGraw-Hill

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus Semester-VII

Course Code: ITH41MMP401	Course Name: Practical Based Artificial Intelligence	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic Programming (Python), Data Structures		
Course Objectives: This course introduces students to provide hands-on experience in implementing fundamental AI algorithms and to apply search, logic, and reasoning techniques to real-world problems		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Implement basic AI programs using Python and standard AI libraries		
CO2: Formulate a given real-world problem		
CO3: Design and evaluate the problem-solving models		
CO4: Represent knowledge using logical and probabilistic techniques		
CO5: Build and evaluate machine learning and neural network models		

Contents –

Unit	Content	Teaching hours
1	Installation and setup of Python, Jupyter Notebook / Google Colab and an introduction to AI libraries: NumPy, Pandas, Matplotlib, Scikit-learn	2
2	Implement simple AI programs using Python AI libraries: NumPy, Pandas, Matplotlib, Scikit-learn	2
3	Formulate a given real-world problem (e.g., Water Jug / 8-Puzzle).	2
4	Implement Tower of Hanoi using Python	2
5	Implement Monkey Banana Problem using Python.	2
6	Implement Breadth First Search algorithm for any given problem	2
7	Implement Depth First Search algorithm for the same problem used in BFS.	2
8	Implement Alpha-Beta Pruning using Python.	2
9	Implement A* search algorithm	2
10	Implement Best First Search Algorithm	2
11	Implement Travelling Salesman Problem using Python.	2
12	Implement the Minimax algorithm for turn-based games (like Tic-Tac-Toe or Chess)	2
13	Implement 8-Queens Problem using Python	2
14	Build a simple Neural Network	2
15	Mini project on AI-based application	2

Text Books: 1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson
 2. Elaine Rich & Kevin Knight, Artificial Intelligence, McGraw-Hill
 3. Ian Goodfellow et al., Deep Learning, MIT Press
 4. Introduction To Expert Systems- Peter Jackson

Reference Books: 1. Introduction To AI And Expert Systems - D.W . Paterson

Online Resources: 1. NPTEL: AI and ML Courses, Coursera / edX AI programs

Syllabus Semester-VII

Course Code: ITH41MMP402	Course Name: Practical Based on Internet of Things
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of embedded C/Python programming, electronics fundamentals (sensors) and networking basics.	
Course Objectives: To connect physical devices with sensors to the internet for real-time data collection, monitoring, and remote control, utilizing hardware like microcontrollers (e.g., Arduino)	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the basic concepts and applications of the Internet of Things	
CO2: Identify and use sensors and actuators in IoT systems	
CO3: Write and execute basic programs for IoT devices	
CO4: Visualize IoT data using simple software tools	
CO5: Collect and monitor real-time sensor data	

List of Practicals:

Sr. No.	Title of the Experiment	Practical Hours
1	Study of Internet of Things concepts and Architecture	2
2	Study of IoT hardware components	2
3	Introduction to YAML Language.	2
4	Installation of Arduino IDE , Basic Arduino program (LED blinking)	2
5	Perform Interfacing LED and buzzer	2
6	Perform Interfacing temperature sensor	2
7	Interfacing temperature sensor with Arduino	2
8	Perform Using Wi-Fi module for data transmission	2
9	Perform for Displaying sensor data on serial monitor	2
10	Introduction to IoT cloud platform	2
11	Simple IoT-based mini project	10

Reference Book / Hand Books/ Lab Manual

- 1) Dr SRN Reddy, RachitThukral and Manasi Mishra ,” Introduction to Internet of Things”: A practical Approach” ETI Labs.
2. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill
3. Vijay Madiseti, ArshdeepBahga, “Internet of Things a Hands-On- Approach”.

Syllabus

Semester-VII

Course Code: ITH41MMP403	Course Name: Practical Based on Network Security
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: basic knowledge of: Computer fundamentals and operating systems, Basics of computer networks, Fundamental concepts of information technology.	
Course Objectives:	
<ol style="list-style-type: none"> 1. Introduce students to fundamental concepts of network and information security through hands-on experiments. 2. Provide practical exposure to basic cryptography techniques used for secure communication. 3. Familiarize students with common network security tools and protection mechanisms. 4. Develop basic skills to identify, analyze, and prevent security threats in computer networks. 5. Create awareness about secure network configuration and cyber security practices. 	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand and demonstrate basic network security concepts, threats, and protection methods through practical experiments.	
CO2: Perform basic encryption, decryption, and hashing techniques to ensure data confidentiality and integrity.	
CO3: Demonstrate the use of cryptographic mechanisms such as digital signatures and certificates.	
CO4: Configure and analyze basic network security tools including firewalls, IDS/IPS, VPNs, and wireless security.	
CO5: Identify common cyber-attacks and apply basic security practices to protect systems and networks.	

List of Practicals:

Sr. No.	Title of the Experiment	Practical Hours
1	Study the basic concepts and importance of network security.	2
2	Identify different types of network security attacks and threats.	2
3	Perform basic encryption and decryption of text data.	2
4	Demonstrate symmetric key encryption using a simple tool or algorithm.	2
5	Demonstrate asymmetric key encryption using a simple tool or algorithm.	2
6	Generate hash values to check data integrity.	2
7	Study the working of digital signatures and certificates.	2
8	Configure basic firewall settings on a system.	2
9	Study the working of intrusion detection and prevention systems.	2
10	Study the concept and working of Virtual Private Networks (VPN).	2
11	Study basic wireless network security methods and configurations.	10

Reference Book / Hand Books/ Lab Manual

1. "Network Security Essentials" by William Stallings
2. "Cryptography and Network Security" by Behrouz A. Forouzan
3. "Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner

Syllabus Semester-VII

Course Code: ITH41MEL401	Course Name: Cloud Web Services	
Course Category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Computer Networks, Web Technologies, and Basic Server Concepts		
Course Objectives: Provide fundamental understanding of cloud computing concepts, architectures, and service delivery models.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Students will understand cloud service and deployment models, virtualization, and key cloud provider ecosystems.		
CO2: Students will identify and configure computer, networking, and storage services for cloud-based web applications.		
CO3: Students will deploy and manage scalable web applications using cloud hosting and container technologies.		
CO4: Students will integrate cloud databases, messaging, and storage services for distributed cloud application architectures.		
CO5: Students will implement IAM, monitor cloud resources, and apply cost governance and compliance controls.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Cloud Computing: - Concepts, characteristics, evolution and need for cloud-based computing, Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Cloud Deployment Models: Public cloud, Private cloud, Hybrid cloud, and Community cloud environments. Introduction to Web Services: - Fundamentals of Cloud Web Services and cloud-native architectures, Virtualization Technologies: Virtual Machines, Containerization and container runtimes (e.g., Docker), Overview of Major Cloud Platforms and their ecosystems: Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP).	10
2	Compute, Storage and Networking Services: - Virtual Machines (AWS EC2, Azure VMs, Google Compute Engine), Auto scaling strategies and Load Balancing mechanisms, Cloud Storage Services: Object Storage, Block Storage and File-based Storage models, Cloud Networking Concepts: VPC, Subnets, Gateways, CDN & DNS services (Cloud Front, Route 53, Azure CDN), Serverless Computing Overview (Lambda, Azure Functions)	9
3	Web Application Hosting & Deployment: - Hosting Types: Static, Dynamic, Multi-tier Web Apps, Web Server Services (AWS Elastic Beanstalk, Azure App Services, GCP App Engine), Containers & Kubernetes Basics (EKS, AKS, GKE),CI/CD Concepts and Pipelines, Integrating DNS, SSL/TLS Certificates, Traffic Management & Load Balancers	9
4	Cloud Databases, Messaging & Storage Services:- Cloud Databases: RDS, Cloud SQL, DynamoDB, Cosmos DB, NoSQL vs SQL Cloud Models, Messaging Queues & Event Services (SQS, SNS, Pub/Sub), Object Storage for Media (S3, Blob, Cloud Storage), Data Backup, Replication & Lifecycle Management, Cloud Caching (Redis, Elasti Cache)	9
5	Cloud Security, Billing, Monitoring & Governance: - Identity & Access Management (IAM), Policies, Roles & Permissions, Cloud Logs & Monitoring (Cloud Watch, Azure Monitor, Stack driver), Cost Management & Billing Optimization, Disaster Recovery & High Availability, Compliance, Standards & Cloud Governance (GDPR, ISO, SOC), Case Studies & Industry Applications,	8

Text Books: Cloud Computing: Concepts, Technology & Architecture Thomas Erl

Reference Books: Azure for Architects (2nd Ed.) 0 Ritesh Modi

Online Resources: 1.NPTEL / <https://nptel.ac.in/courses/106105167>

Syllabus Semester-VII

Course Code: ITH41MEL402	Course Name: Basics of Power BI
Course Category: Major Elective	
Credits: 3	Teaching Scheme: L-3 P-0
	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic Excel, Data Handling Concepts, Intro to Databases	
Course Objectives: To equip students with Power BI skills for BI-driven decision-making, covering data modeling, DAX analytics, visualization, and enterprise deployment.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Students will understand the BI landscape and explain features, components, and applications of Power BI.	
CO2: Students will import, clean, transform and model data in Power BI using Power Query and relational data modeling.	
CO3: Students will apply DAX functions to create measures and calculated fields for analytical decision-making.	
CO4: Students will design interactive dashboards using Power BI visuals, filters, and storytelling formats.	
CO5: Students will publish dashboards, manage workspaces, apply RLS, and demonstrate collaborative BI deployment.	

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Business Intelligence & Power BI: -Business Intelligences & Role of BI in organizational decision-making, BI vs Data Analytics vs Data Visualization, Power BI Ecosystem Overview, Power BI Ecosystem Overview, Data Sources and Supported File Types in Power BI, Power BI Interface and Workspace Concepts, Industry Use Cases and BI Workflow.	9
2	Data Extraction, Transformation & Data Modeling in Power BI: - Data Source Connectivity (Importing Data, Excel, CSV, Web & Databases), Power Query Editor (Interface overview and query management), Data Cleaning and Transformation (Handling missing values, Filtering, sorting, grouping and shaping data, values, rename fields and split/merge columns), Data Integration Operations, Data Modeling Concepts, Relationships and Constraints, Data Types and Hierarchies.	9
3	DAX Language & Calculations: - (Data Analysis Expressions), Measures vs Calculated Columns, Aggregation Functions: SUM, AVERAGE, COUNT, COUNTROWS, MIN, MAX, Filtering and Evaluation Context, Error Handling and Optimization Basics.	9
4	Data Visualization & Dashboard Design: - Visualization Basics (Bar, Line, Pie, Donut, Area, Slicers, Filters & Drill-through, Map Visuals & Geo-Analytics), KPI Cards & Matrix Tables, Custom Visuals from Marketplace, Report Formatting & Storytelling Principles.	9
5	Publishing, Sharing, Automation & Security: - Publishing reports to Power BI Service, Security & Governance, Compliance Considerations in BI, Refresh & Automation, Collaboration & Sharing (Embedding Power BI Reports (Internal/External), Integration & Productivity Tools, Future Trends in BI (Optional).	9

Text Books: 1. Mastering Microsoft Power BI

2. Collect, Combine, and Transform Data Using Power Query in Excel and Power BI

Reference Books: Introducing Microsoft Power BI – by Alberto Ferrari & Marco Russo

Online Resources: https://onlinecourses.swayam2.ac.in/imb25_mg221/preview

Syllabus

Semester-VII

Course Code: ITH41MEP401	Course Name: Practical Based on Cloud Web Services
Course Category: Major Elective	
Credits: 1	Teaching Scheme: L-0, P-2
	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Fundamentals of Cloud Computing concepts	
Course Objectives: To develop hands-on skills for deploying, managing, and optimizing cloud-based web services using industry-standard cloud platforms.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Deploy and configure virtualized computing environments and hosted applications on cloud platforms.	
CO2: Implement scalable web architectures using autoscaling, load balancing, containers, and serverless services.	
CO3: Integrate cloud-based databases, storage, and messaging services for multi-tier cloud applications.	
CO4: Apply cloud access control, security, monitoring, cost-management, and compliance features.	
CO5: Demonstrate cloud resilience through disaster recovery, backup, replication, and failover strategies.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Create a Setup AWS/Azure free-tier account and explore dashboard components	2
2	Create a Virtual Machine, configure VPC & security groups and Deploy static webpage on cloud instance	2
3	Configure Autoscaling + Load Balancer for web traffic distribution	2
4	Deploy multi-tier web app using serverless or App Services	2
5	Deploy containerized web service using Kubernetes (EKS/AKS/GKE)	2
6	Create Cloud Database (RDS/DynamoDB/Cloud SQL) and connect to hosted app	2
7	Implement cloud storage using S3/Blob and object lifecycle policies	2
8	Configure message queue (SQS/ Pub/Sub) for asynchronous processing	2
9	Implement IAM role-based access, permissions & MFA	2
10	Enable monitoring & cloud alerts (CloudWatch/Azure Monitor) and View billing & estimate cost usage	2
11	Project/Case Study	10

Reference Book / Hand Books/ Lab Manual

1. *Azure for Architects* (2nd Edition / Updated Editions) Author: Ritesh Modi
2. *Kubernetes Up & Running: Dive into the Future of Infrastructure*
Authors: Kelsey Hightower, Brendan Burns & Joe Beda
3. *Cloud Native DevOps with Kubernetes* Authors: John Arundel & Justin Domingus

Syllabus

Semester-VII

Course Code: ITH41MEP402	Course Name: Practical Based on Power BI
Course Category: Major Elective	
Credits: 1	Teaching Scheme: L-0, P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of MS Excel, data handling, and introductory programming/database concepts.	
Course Objectives: To introduce students to Business Intelligence concepts and enable them to design, analyze, and publish data-driven dashboards using Power BI.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand Business Intelligence fundamentals and Power BI ecosystem.	
CO2: Perform data extraction, cleaning, transformation, and data modeling using Power Query and relationships.	
CO3: Apply DAX expressions for analytical computations, KPIs, and time intelligence.	
CO4: Design interactive dashboards with effective visualizations, storytelling, and drill-through features.	
CO5: Publish reports to Power BI Service and implement workspace collaboration, RLS, and data refresh mechanisms.	

List of Practical's:

Sr. No.	Title of the Experiment	Practical Hours
1	Installation of Power BI Desktop, creation of workspace, loading sample databases, and displaying updated data	2
2	Loading dataset from CSV and Excel sources, exploring Power BI interface and basic visualization tools	2
3	Data cleaning and transformation using Power Query: replacing nulls, merging tables, filtering, and shaping data	2
4	Building star-schema data model, defining relationships, and applying Time Intelligence functions (YoY, MoM, YTD) using DAX	2
5	Designing an interactive Sales Dashboard with slicers, drill-through features, KPI cards, and maps	2
6	Handling duplicate rows, data type standardization, and creation of custom columns in Power Query (e.g., "Profit = Sales – Cost")	2
7	Visualizing Top 10 selling products, Sales by Region (Map), Store performance KPIs (Revenue, Profit, Quantity Sold, Margin%), and Category hierarchy (Category → Subcategory → Product)	2
8	Workforce Analytics Dashboard: Employee headcount by department, Attrition rate calculation using DAX, demographic distribution (Gender, Age, Experience), and KPIs (Avg Salary, Attrition %, Hiring Trend)	2
9	E-Commerce Order Insights Dashboard: Orders vs Shipment vs Delivery, Return % using DAX, Complaint analysis by category, and drill-through by Customer ID and Order ID	2
10	Publishing dashboards to Power BI Service, Workspace sharing, Row Level Security (RLS), scheduling data refresh, and collaboration settings	2
11	Mini Project: University Academic Performance Dashboard — Student scores by course/department, Pass/Fail metrics using DAX, Gender-based performance insights, and drill-through to individual student profile	10

Reference Book / Hand Books/ Lab Manual
1. Microsoft Power BI Documentation (Official Online Handbook)
2. Mastering Microsoft Power BI
3. Collect, Combine, and Transform Data Using Power Query in Excel and Power BI

Syllabus Semester-VII

Course code: ITH41RML401	Course Name: Research Methodology
Course Category: Research Methodology	
Credits: 3	Teaching Scheme: L-3 P-0
Evaluation Scheme: CA-60 ESE-40	
Pre-requisites: Basic understanding of subject fundamentals, elementary statistics, and academic reading and writing skills.	
Course Objectives: To develop an understanding of research methodology principles and techniques applicable to problem identification, analysis	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: To develops the ability to identify research problems and formulate objectives and hypotheses.	
CO2: To familiarizes students with research design, data collection, and analysis techniques relevant to robotics.	
CO3: To enhances skills in technical writing, documentation, and research ethics.	
CO4: Analyze and apply statistical techniques such as data processing, descriptive statistics, correlation, regression, and hypothesis testing to interpret and validate research data.	
CO5: Evaluate research findings and create a structured research report or mini proposal using appropriate referencing styles, ethical practices, and computer-based research tools.	

Contents -

Unit	Contents	Teaching Hours.
1	Introduction to Research & Research Process: Meaning of Research, objectives, motivation, and significance of research, Types of research (basic/applied, qualitative/quantitative, conceptual/empirical) Research methods vs. research methodology, Research Approaches, Significance of Research, Scientific method and research ethics, Steps in the research process, Criteria of Good Research, Problems Encountered by Researchers in India	9
2	Research Problem Formulation & Research Design: Identification and definition of research problems in engineering/robotics (Meaning and sources of research problems, Criteria for selecting a research problem, Defining and formulating research problems), Review of literature and research gap identification, Formulation of objectives and hypotheses, Research design: exploratory, descriptive, experimental, Features of a good research design	9
3	Sampling Design & Data Collection Methods: Sampling concepts, population, sample, sampling errors, Probability and non-probability sampling techniques (Sample size (basic concept)Types of sampling errors (Sampling error, Non-sampling error, Bias and sources of bias), Methods of data collection: observation, interview, questionnaire, experiments, Selection of appropriate sampling and data collection methods (Nature of research problem, Objectives of the study, Time, cost, and resource constraints, Accuracy and reliability requirements, Relevance to robotics and engineering research)	9
4	Data Processing, Analysis & Hypothesis Testing: Data processing (Editing, coding, classification, tabulation), Descriptive statistics) Measures of central tendency, Measures of dispersion, Correlation and regression, Hypothesis testing (Concepts and Procedure, parametric and non-parametric tests), Interpretation of Statistical results.	9

5	Research Reporting: Interpretation of research results, Research report writing (Structure of research report technical paper, and project report), Referencing styles and bibliography, Plagiarism and ethical issues in research, Role of computers in research (Data analysis tools, Documentation and presentation tools), Preparation of a mini research proposal / report	9
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Text Books :

- 1.C.R. Kothari — Research Methodology: Methods & Techniques
- 2.Ranjit Kumar — Research Methodology: A Step-by-Step Guide for Beginners

Reference Books:

- 1.Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. — An Introduction to Research Methodology
- 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design

Online Resources: 1.Alison – Essentials of Research Methodology

Syllabus Semester-VII

Course code: ITH41RMP401	Course name: Practical Based on Research Methodology	
Course category: Research Methodology		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Research Methodology practical is a basic understanding of research design, data collection methods, and fundamental statistical and analytical tools.		
Course Objectives: The Research Methodology course is to equip students with the skills to design, conduct, analyze, and interpret research systematically and ethically		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To develops the ability to identify research problems and formulate objectives and hypotheses.		
CO2: To familiarizes students with research design, data collection, and analysis techniques relevant to robotics.		
CO3: To enhances skills in technical writing, documentation, and research ethics.		
CO4: Analyze and apply statistical techniques such as data processing, descriptive statistics, correlation, regression, and hypothesis testing to interpret and validate research data.		
CO5: Evaluate research findings and create a structured research report or mini proposal using appropriate referencing styles, ethical practices, and computer-based research tools.		

Content -

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

Text Books :

- 1.C.R. Kothari Research Methodology: Methods & Techniques
- 2.Ranjit Kumar Research Methodology: A Step-by-Step Guide for Beginners

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. An Introduction to Research Methodology
- 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design

Online Resources: 1.Alison – Essentials of Research Methodology

Semester: Eight

Syllabus Semester-VIII

Course Code: ITH41MML404	Course Name: Introduction to DevOps	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Knowledge of Servers and AWS		
Course Objectives:		
<ol style="list-style-type: none"> 1. To understand DevOps concepts 2. To learn tools used for automation and continuous delivery 3. To implement CI pipelines 4. To understand containerization and cloud-based deployment 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain DevOps principles and lifecycle		
CO2: Use version control systems for collaboration		
CO3: Implement continuous integration and deployment		
CO4: Work with containers and orchestration tools		
CO5: Deploy applications using cloud and DevOps tools		

Course Contents –

Unit	Content	Teaching hours
1	Overview of DevOps: - Evolution of software development, Introduction to DevOps, Traditional SDLC vs Agile vs DevOps, DevOps principles, Benefits of DevOps, DevOps lifecycle and phases, Roles and responsibilities in DevOps.	9
2	Version Control Systems: -Introduction to version control, Centralized vs Distributed version control systems, Git basics: Repository, Commit, Branching and merging, GitHub / GitLab overview, Hands-on with Git commands, Git Fundamentals, Advanced Git Operations.	9
3	Continuous Integration (CI): CI Fundamentals, CI Tools Mastery, Pipeline Engineering, CD Concepts, Deployment Strategies, CD Tools Implementation.	9
4	Configuration Management and Automation: Infrastructure as Code (IaC), Configuration management tools overview, Ansible basics, Automated provisioning, Managing environments.	9
5	Cloud, Monitoring, and DevOps Tools: Cloud computing basics, DevOps on cloud platforms, Monitoring and logging tools, Security in DevOps (DevSecOps), Case studies	9

Text Books:

1. Gene Kim, Jez Humble, Patrick Debois, John Willis, *The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations*, IT Revolution Press.

Reference Books:

3. Len Bass, Ingo Weber, Liming Zhu, *DevOps: A Software Architect's Perspective*, Addison-Wesley.
4. Jennifer Davis and Ryn Daniels, *Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale*, O'Reilly Media

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus Semester-VIII

Course Code: ITH41MML405	Course Name: Business Intelligence	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: A core course on Business statistics is desirable, Knowledge about the Data Mining concepts		
Course Objectives: 1) Understand Business Intelligence Concepts. 2) Develop Data Literacy Skills.3) Apply Analytical and Critical Thinking		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain core concepts of Business Intelligence, data warehousing, data mining, and analytics for organizational decision-making.		
CO2: Apply data collection, cleaning, and integration techniques to prepare business data for analysis.		
CO3: Analyze business data using appropriate BI tools to identify trends, patterns, and performance indicators		
CO4: Design and interpret dashboards, reports, and visualizations to support evidence-based managerial decisions.		
CO5: Collaborate effectively in teams to complete BI projects and communicate analytical insights clearly.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Business Intelligence: - Meaning and Definition of Business Intelligence, Evolution of Business Intelligence, BI vs Business Analytics vs Data Science, Components and Architecture of BI Role of BI in Strategic Decision, Making, BI Applications in Industry, Decision support systems (DSS). Business Intelligence (BI), Framework for BI, BI architecture, DSS - BI Connection, BI use cases: Application in Patient Treatment, Application in Higher Education, Application in Logistics.	9
2	ETL and Data Integration: - Data Integration Concepts and Challenges Types of Data Sources (Internal, External, Structured, Unstructured), Data Consolidation and Data Federation ETL Process: - Extract Process, Transform Process, Load Process, Data Cleaning Techniques, Data Transformation Methods, Data Quality and Management:- Data Quality Issues, Data Profiling, Data Validation and Error Handling, Data Refresh Strategies.	9
3	OLAP and Analytical Processing:- OLAP Concepts and Features, Multidimensional Data Model, Measures, Dimensions, Hierarchies, OLAP Operations:- Roll-up, Drill-down, Slice, Dice, Pivot, OLAP Architectures:- MOLAP, ROLAP, HOLAP, Query and Reporting, Analytical Queries, Reporting Tools, Visualization Concepts, Ad-hoc Reporting, BI Tools: Tableau, Qlik, power BI, Dundas BI, Sisense, Webfocus, Oracle BI.	9
4	Data Mining, BI Tools, and Applications:- Data Mining Concepts, Definition and Objectives of Data Mining, Data Mining Process, Relationship between BI and Data Mining, Data Mining Techniques, Classification, Clustering, Association Rule Mining, Prediction and Forecasting, BI Tools and Technologies , Overview of BI Tools, Dashboards and Scorecards, Key Performance Indicators (KPIs), Performance Management Systems, Applications and Future Trends, Industry Use Cases and Case Studies, Real-Time BI, Self-Service BI, Cloud-Based BI, Future Trends in Business Intelligence.	9
5	Business Intelligence for Analytics: - The role of visual and business analytics (BA) in BI and how various forms of BA are supported in practice. ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance.	9

Text Books:

1) Business intelligence and analytics / edited by Drew Bentley

2).Wilfried Grossmann & Stefanie Rinderle-Ma “Fundamentals of Business Intelligence”, Springer, ISBN 978-3-662-46531-8 (eBook)

Reference Books: 1) Sabherwal, R. and Becerra-Fernandez, I. (2011). Business Intelligence: Practices, Technologies and Management. John Wiley. 2) Turban,E. and Volonino, L.(2011). Information Technology for Managment: Improving Strategic and Operational Performance. 8th edn.Wiley, ext 1: Han et al. (2023) Chapter 4, Data Warehouse and Online Analytical Processing (pp. 85-108)

Online Resources:1) <https://www2.deloitte.com/us/en/pages/deloitte-analytics/articles/business-analytics-casestudies.html>. 2. <https://www.blastanalytics.com/analytics-case-studies> 3. BI Foundations with SQL, ETL and Data Warehousing Specialization (Coursera) , NPTEL / SWAYAM lectures.

Syllabus Semester-VIII

Course Code: ITH41MML406	Course Name: Machine Learning
Course Category: Major Mandatory	
Credits: 3	Teaching Scheme: L-3 P-0
Evaluation Scheme: CA-60, ESE-40	
Pre-requisites: Basic knowledge of programming fundamentals, mathematics (algebra and basic statistics), and data handling concepts.	
Course Objectives: To provide fundamental knowledge and practical skills in machine learning concepts, data preprocessing, and basic predictive and clustering techniques using real-world data.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the fundamental concepts, types, applications, and workflow of Machine Learning.	
CO2: Apply data preprocessing and exploratory data analysis techniques to prepare datasets for machine learning.	
CO3: Build and interpret simple and multiple linear regression models for predictive analysis.	
CO4: Implement and evaluate classification models such as logistic regression and decision trees.	
CO5: Analyze unlabeled data using clustering techniques like K-Means and Hierarchical Clustering for segmentation.	

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Machine Learning: -Definition and scope of Machine Learning, Machine Learning vs Traditional Programming, Applications of ML in real-world domains, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Machine Learning workflow: Problem definition, Data collection, Model building, Evaluation and deployment.	5
2	Data Handling and Preprocessing: -Data collection and data types, Data cleaning: Handling missing values, Removing duplicates, Data transformation: Normalization and standardization, Encoding categorical data, Feature selection and feature engineering (basic concepts), Exploratory Data Analysis (EDA): -Descriptive statistics: Mean, median, variance, standard deviation, Data visualization: Histograms, box plots, scatter plots, Correlation and data interpretation, Identifying patterns and trends in data.	10
3	Linear Regression: -Introduction to regression analysis, Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model, Model Diagnostics, Multiple Linear Regression.	10
4	Classification Techniques: - Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Classification Tree (Decision Tree Learning)	10
5	Clustering: - Overview of clustering, Working of Clustering, K-Means Clustering, Creating Product Segments Using Clustering, Hierarchical Clustering.	10

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.3. Machine Learning, By Mitchell Tom, McGraw Hill Pub.

Reference Books: 1. *Introduction to Machine Learning*, Ethem Alpaydin, MIT Press
2. Machine Learning with Python, By Abhishek Vijayvargia, BPB Publications

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester- VIII

Course Code: ITH41MMP404	Course Name: Practical Based on DevOps	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0, P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Server knowledge		
Course Objectives:		
<ol style="list-style-type: none"> 1. Introduce students to DevOps concepts, culture, and lifecycle 2. Provide hands-on experience with Linux operating system and commands 3. Familiarize students with Continuous Integration tools 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the DevOps culture, lifecycle, and basic tools		
CO2: Use Linux commands for system and development tasks		
CO3: Manage source code using Git and GitHub		
CO4: Apply version control concepts such as branching and merging		
CO5: Create and manage Docker containers and images		

List of Practical's:

Sr. No.	Title of the Experiment	Practical Hours
1	Study of DevOps concepts and lifecycle	2
2	Installation and study of Linux operating system	2
3	Basic Linux commands for DevOps	2
4	Installation and configuration of Git	2
5	Creating and managing repositories using Git	2
6	Branching and merging using Git	2
7	Installation and basic configuration of Jenkins	2
8	Continuous Integration using Jenkins: Install Jenkins, Create Jenkins job, Connect GitHub repository, Trigger automatic build on code change.	2
9	Creating a simple CI pipeline using CI tools	2
10	Introduction to Docker and container concepts	2
11	Mini project using DevOps tools	10

Reference Book / Hand Books/ Lab Manual:- 1. Len Bass, Ingo Weber, Liming Zhu, *DevOps: A Software Architect's Perspective*, Addison-Wesley, Jennifer Davis and Ryn Daniels, *Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale*, O'Reilly Media

Syllabus

Semester- VIII

Course Code: ITH41MMP405	Course Name: Practical Based on Business Intelligence
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic Business Understanding, SQL, data modeling, ETL concepts, data visualization tools, Excel skills, and ability to analyze and communicate insights.	
Course Objectives: To transform raw data into meaningful insights that support informed business decision-making.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Improved decision-making	
CO2: Better business performance tracking	
CO3: Increased operational efficiency	
CO4: Identification of trends and opportunities	
CO5: Enhanced strategic planning	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Introduction to Business Intelligence Tools:- Familiarize students with BI concepts and popular tools (Excel, Power BI/Tableau, Google Data Studio).Understand BI environments and interfaces.	2
2	Data Collection from Multiple Sources:- Collect business data from CSV, Excel, databases, or online sources, Develop data acquisition and integration skills.	2
3	Data Cleaning and Preprocessing:- Handle missing values, duplicates, and inconsistencies, Prepare quality data for analysis.	2
4	Exploratory Data Analysis (EDA):- Perform basic statistical analysis and summarize business data, Identify trends, patterns, and anomalies.	2
5	Data Visualization Techniques:- Create charts, graphs, and KPIs using BI tools, Communicate insights effectively through visuals.	2
6	Dashboard Design:- Design interactive dashboards for sales, finance, or operations.come: Support managerial decision-making.	2
7	Business Performance Analysis:- Analyze KPIs such as revenue, profit, customer retention, and growth, Evaluate organizational performance.	2
8	Predictive Analysis (Introductory):- Perform basic forecasting or trend analysis using historical data, Understand predictive decision support.	2
9	Ethical and Secure Use of Business Data:- Case study on data privacy, security, and compliance, Apply ethical reasoning in BI applications.	2
10	Mini Project / Case Study:- End-to-end BI project: data collection → analysis → dashboard → presentation, Integrate technical, analytical, and communication skills.	2

Reference Book / Hand Books/ Lab Manual 1. <i>Business Intelligence Roadmap: The Complete</i> by Larissa T. Moss, Shaku Atre 2) <i>Project Lifecycle for Decision-Support Applications</i> by Addison-Wesley.
2. <i>Microsoft PowerBI Cookbook</i> Packt Publishing by Brett Powell
3. <i>Decision Support and Business Intelligence Systems</i> Pearson Education by Efraim Turban , Ramesh Sharda, Dursun Delen

Syllabus

Semester-VIII

Course Code: ITH41MMP406	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 programming fundamentals (preferably Python), elementary mathematics, and basic statistics.	
Course Objectives: To introduce fundamental machine learning concepts and enable students to preprocess data and implement basic regression, classification, and clustering techniques using Python.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the fundamental concepts of Machine Learning and its workflow	
CO2: Apply data preprocessing and exploratory data analysis techniques to prepare real-world datasets for machine learning.	
CO3: Implement and evaluate linear regression models for predictive analysis.	
CO4: Implement and assess classification models such as logistic regression and decision trees using appropriate evaluation metrics.	
CO5: Evaluate and compare machine learning models using appropriate performance metrics	

List of Practical's:

Sr. No.	Title of the Experiment	Practical Hours
1	Install and configure Python and Machine Learning libraries (NumPy, Pandas, Matplotlib, Scikit-learn) and study the basic Machine Learning workflow using a simple dataset	2
2	Perform data preprocessing on a real-world dataset: handling missing values, normalization, standardization, and splitting data into training and testing sets	2
3	Perform Exploratory Data Analysis by computing descriptive statistics: mean, median, variance, and standard deviation	2
4	Visualize data using histograms, box plots, and scatter plots	2
5	Implement Simple Linear Regression and evaluate the regression model	2
6	Implement Multiple Linear Regression and interpret the regression coefficients	2
7	Implement Binary Logistic Regression for classification problems	2
8	Evaluate Logistic Regression model using accuracy and confusion matrix	2
9	Implement Decision Tree classification and study entropy and information gain	2
10	Implement K-Means Clustering algorithm and visualize clusters	2
11	Evaluate and compare classification models using Confusion Matrix, Accuracy, Precision, Recall, and F1-score	10

Reference Book / Hand Books/ Lab Manual

- Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley
- M. Gopal Applied Machine Learning McGraw-Hill Education
- Hands-On Machine Learning with Scikit-Learn, Aurélien Géron , Keras & TensorFlow (O'Reilly)

Syllabus Semester-VIII

Course Code: ITH41MEL403	Course Name: Geospatial Technology	
Course Category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: 1.Basic understanding of computers and information technology concepts, 2. Introductory knowledge of maps, spatial concepts, or geography fundamentals, 3. Familiarity with basic data handling and database concepts (desirable).		
Course Objectives: 1) This course provides students with foundational to advanced knowledge of Geospatial Technology, covering Remote Sensing, GIS, GPS/GNSS, and spatial data analysis, It equips learners with practical skills using geospatial tools for applications in IT, data science, smart governance, and decision-making.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain basic concepts and components of Geospatial Technology.		
CO2: Understand principles of Remote Sensing and satellite systems.		
CO3: Create and manage GIS data and maps.		
CO4: Perform basic spatial and image analysis.		
CO5: Identify applications and emerging trends in Geospatial Technology.		

Course Contents –

Unit	Content	Teaching hours
1	Fundamentals of Geospatial Technologies: Understanding Geospatial Technology: Concepts and Definitions, Overview of Key Components: Geographic Information Systems (GIS), Remote Sensing, GPS/GNSS, Geospatial Data Models and file formats: Vector and Raster, Graphical Representation Of Objects: line, Points, Polygon.	10
2	Remote Sensing Principles and Satellite Systems: Basic of Remote sensing, Electromagnetic Spectrum and Energy Sources, Interaction of EMR with Atmosphere and Earth Surface, Types of Sensors: Passive and Active, Platforms: Ground, Airborne Satellite, Satellite Systems: LANDSAT, IRS, MODIS, Sentinel, Image Characteristics: Spatial, Spectral, Radiometric, Temporal Resolution, Introduction to Image Interpretation Elements.	10
3	Fundamentals of Mapping and Cartography: Principles of Cartography: Map Design and Interpretation, Types of Maps: Topographic, Thematic, and Cadastral Maps, Map Projections and Coordinate Systems, Map reading and interpretation skills, understanding map symbols, concept of scale and resolution, Introduction to Cartographic Software (QGIS, ArcGIS) for creating maps and visualizations.	10
4	Geographic Information Systems (GIS): Introduction to GIS, GIS Components: Hardware, Software, Data, People, and Methods, Data Collection and Processing in GIS: Collecting Spatial Data (Field Surveying, Remote Sensing), Basic GIS Operations and Applications, Mapping and analysis of satellite imagery For neighborhood exploration.	10
5	Advanced Geospatial Technologies & Applications: Global Navigation Satellite System (GNSS): GPS, GLONASS, Web GIS and Cloud-based GIS. GIS for Urban Planning & Smart Cities, Disaster Management, Agriculture & Precision Farming, Transportation, Logistics, Emerging Trends Geospatial Technology.	5

Text Books:

Reference Books: 1. Concepts and Techniques of Geographic Information Systems. C. P. Lo, Albert K. W. Yeung.
2. Remote Sensing and Image Interpretation, 7th Edition. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman.
3. Cartography: visualization of geospatial data, M. J. Kraak & F.J. Ormeling, Harlow, Essex: Longman

Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus Semester-VIII

Course Code: ITH41MEL404	Course Name: Ethical Hacking	
Course Category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic knowledge of computer systems, Fundamentals of networking		
Course Objectives: 1). Introduce students to the fundamental concepts of ethical hacking and cybersecurity. 2) Provide knowledge of ethical, legal, and professional responsibilities in cyber security practices. 3) Develop skills in information gathering, scanning, and vulnerability assessment techniques.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the principles of ethical hacking, cybersecurity fundamentals, and the role of ethical hackers in protecting information systems.		
CO2: Apply reconnaissance and footprinting techniques to collect system and network information using ethical hacking tools.		
CO3: Perform network scanning, enumeration, and vulnerability assessment to identify security weaknesses in a controlled environment.		
CO4: Analyze system, network, and web application vulnerabilities, including common attacks such as SQL Injection, XSS, and password attacks, and suggest suitable mitigation techniques.		
CO5:- Demonstrate knowledge of security defenses, incident handling, and professional reporting, ensuring compliance with cyber laws and ethical standards.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Ethical Hacking: - Fundamentals of ethical hacking and cybersecurity, Types of hackers (white, grey, black hat) and ethical hacker roles, Cyber threats, attack vectors, vulnerability assessments, Security goals: Confidentiality, Integrity, Availability (CIA), Phases/Stages of ethical hacking (Reconnaissance, Scanning, Exploitation, Maintaining Access, Covering Tracks).	9
2	Reconnaissance & Information Gathering:- Footprinting (passive & active) and reconnaissance methodology, Tools: WHOIS, nslookup, Google hacking, Network basics: TCP/IP, OSI model, IP addressing & subnetting (contextual intro), Scanning and enumeration concepts, Use of basic tools (e.g., Nmap, Wireshark) for gathering system/network data.	9
3	Scanning, Enumeration & Vulnerability Assessment:- Network scanning (port scanning, vulnerability scanning), Enumeration of services and hosts, Tools: Nmap, Nessus, Netcat, Identifying potential vulnerabilities and attack points.	9
4	System, Network & Application Exploitation:- System hacking: password attacks, privilege escalation, Network attacks: DoS/DDoS, sniffing, MITM, Web app vulnerabilities (OWASP Top 10): SQLi, XSS, Tools: Metasploit, Burp Suite, OWASP ZAP	9
5	Defense, Reporting & Professional Practice:- Network defenses: firewalls, IDS/IPS, VPN basics, Cryptography & secure protocols, Incident handling & reporting, Writing, vulnerability assessment and penetration test reports.	9

Text Books: *Penetration Testing: A Hands-On Introduction to Hacking* by Georgia Weidman

Reference Books: 1) Cryptography and Network by William Stallings Pearson Education, 2). ETHICAL HACKING AND PENETRATION TESTING GUIDE 3). Cryptography and Network Security Atul Kahate McGraw Hill 4). INTRODUCTION TO ETHICAL HACKING, ETHICS AND LEGALITY 5). Ethical Hacking: Complete Guide from Basic to Advanced (2025 Edition) By A. Khan

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester-VIII

Course Code: ITH41MEP403	Course Name: Practical Based on Geospatial Technology	
Course Category: Major Elective		
Credits: 1	Teaching Scheme: L-0,P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic of Geospatial Technology		
Course Objectives: To provide students with practical skills in GIS, Remote Sensing, and GPS/GNSS for spatial data handling, visualization, and analysis. To enable students to apply geospatial tools for creating maps, performing image interpretation, shapefile extraction, and thematic mapping for real-world applications.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Configure GIS software (QGIS and ArcGIS) and efficiently load, visualize, and manage vector and raster spatial data .		
CO2: Create and digitize point, line, and polygon layers , and design and edit attribute tables for geospatial features.		
CO3: Understand and apply map types, projections, coordinate systems, scale, and symbols for accurate geospatial representation.		
CO4: Generate thematic maps and spatial outputs using QGIS/ArcGIS and perform basic GNSS/GPS data collection and integration .		
CO5: Apply practical GIS and Remote Sensing techniques to solve real-world geospatial problems , including project-based spatial analysis and mapping tasks.		

List of Practicals:

Sr. No.	Title of the Experiment	Practical Hours
1	Configuration and Basic Setup of GIS Software: QGIS and ArcGIS	2
2	Loading , Viewing and Visualization of Spatial Data in QGIS	2
3	Creation and Visualization of Point, Line, and Polygon Layers in QGIS	2
4	Creation and Editing of Attribute Table in QGIS	2
5	Loading and Viewing Satellite Images in QGIS	2
6	Basic Visual Image Interpretation Using Tone, Texture, Shape, and Pattern	2
7	Shapefile Extraction and Region Extraction from Satellite Image Using ROI (AOI Masking) in QGIS	2
8	Understanding Map Types, Scale, and Map Symbols	2
9	Understanding Map Projections, Coordinate Systems, and Scale	2
10	Basic GNSS/GPS Data Collection and Location Mapping	2
11	project	10

Reference Book / Hand Books/ Lab Manual

1. Remote Sensing and Image Interpretation, 7th Edition. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman.
2. Burrough, Peter A., Rachael A. McDonnell, and Christopher D. Lloyd. *Principles of geographical information systems*. Oxford university press, 2015.
3. Software Tools (Practical / Lab Work): **QGIS** – Open-source GIS software (<https://qgis.org>), **ArcGIS Desktop** – Commercial GIS software by Esri (<https://www.esri.com>), **ERDAS Imagine**, **ENVI**.

Syllabus

Semester-VIII

Course Code: ITH41MEP404	Course Name: Practical Based on Ethical Hacking
Course Category: Major Elective	
Credits: 1	Teaching Scheme: L-0,P-2 Evaluation Scheme: CA-30,ESE-20
Pre-requisites: Basic knowledge of Networking and command prompt	
Course Objectives.	
<ol style="list-style-type: none"> 1. To understand the fundamental concepts of ethical hacking and cyber security. 2. learn legal and ethical responsibilities of an ethical hacker. 3. Study different types of cyber threats, attacks, and vulnerabilities. 4. Gain hands-on experience with basic ethical hacking tools and techniques. 5. Understand network scanning, reconnaissance, and footprinting methods 	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain ethical hacking concepts, phases, and legal boundaries.	
CO2: Identify security vulnerabilities in computer systems and networks.	
CO3: Perform basic reconnaissance and scanning using ethical hacking tools.	
CO4: Analyze network and system security weaknesses.	
CO5: Demonstrate password cracking and security testing techniques in a controlled	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Ethical Hacking Lab Setup (Hands-On), Install Virtual Box / VMware, Install Kali Linux.	2
2	Cyber Ethics & Legal Awareness (Hands-On), Study Indian IT Act 2000 (Sections 43, 66), Identify legal vs illegal hacking scenarios	2
3	Footprinting & Reconnaissance (Hands-On), Use whois , nslookup , Perform Google dorking (test domain), Use Nmap for basic host discovery , Identify IP address, domain info, open services.	2
4	Network Scanning using Nmap: -To scan open ports and services on a target system, Port scanning, Service detection, OS detection	2
5	Vulnerability Scanning: -To identify vulnerabilities in a target system, Scan vulnerable machines, Analyze vulnerabilities, Tools:Nessus (basic), OpenVAS	2
6	Password Cracking Techniques: -To understand password security and cracking methods,Dictionary attack, Brute force (demo only) Tools: John the Ripper, Hydra	2
7	Packet Sniffing and Analysis: -To capture and analyze network traffic, Capture packets, Analyze HTTP, DNS traffic, Tools: Wireshark	2
8	Social Engineering Awareness: To understand social engineering attacks and prevention, Phishing email analysis, Awareness, demonstration, Tools: SET Toolkit (demo mode)	2
9	Web Application Vulnerability Testing: -To identify common web vulnerabilities, SQL Injection (basic), XSS testing, Tools: DVWA, Burp Suite (Community)	2
10	Ethical Hacking Report Writing: -To prepare a professional ethical hacking report, Vulnerability summary, Risk level analysis, Mitigation steps, Tools: Report template, screenshots	2
11	Project/Case study	10

Reference Book / Hand Books/ Lab Manual

- 1). The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Second Edition Published by John Wiley & Sons, Inc.
- 2). ETHICAL HACKING AND PENETRATION TESTING GUIDE

Semester: Seven
B.Sc. (Hons. With Research)

Syllabus Semester-VII

Course Code: ITH41MML407	Course Name: Machine Learning
Course Category: Major Mandatory	
Credits: 3	Teaching Scheme: L-3 P-0
Evaluation Scheme: CA-60, ESE-40	
Pre-requisites: Basic knowledge of programming fundamentals, mathematics (algebra and basic statistics), and data handling concepts.	
Course Objectives: To provide fundamental knowledge and practical skills in machine learning concepts, data preprocessing, and basic predictive and clustering techniques using real-world data.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the fundamental concepts, types, applications, and workflow of Machine Learning.	
CO2: Apply data preprocessing and exploratory data analysis techniques to prepare datasets for machine learning.	
CO3: Build and interpret simple and multiple linear regression models for predictive analysis.	
CO4: Implement and evaluate classification models such as logistic regression and decision trees.	
CO5: Analyze unlabeled data using clustering techniques like K-Means and Hierarchical Clustering for segmentation.	

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Machine Learning:- Definition and scope of Machine Learning, Machine Learning vs Traditional Programming, Applications of ML in real-world domains, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Machine Learning workflow: Problem definition, Data collection, Model building, Evaluation and deployment.	5
2	Data Handling and Preprocessing:- Data collection and data types, Data cleaning: Handling missing values, Removing duplicates, Data transformation: Normalization and standardization, Encoding categorical data, Feature selection and feature engineering (basic concepts) Exploratory Data Analysis (EDA):- Descriptive statistics: Mean, median, variance, standard deviation, Data visualization:Histograms, box plots, scatter plots, Correlation and data interpretation, Identifying patterns and trends in data	10
3	Linear Regression :- Introduction to regression analysis, Simple Linear Regression, Steps in Building a Regression Model, Building Simple Linear Regression Model, Model Diagnostics, Multiple Linear Regression.	10
4	Classification Techniques:- Classification Overview, Binary Logistic Regression, Credit Classification, Gain Chart and Lift Chart, Classification Tree (Decision Tree Learning)	10
5	Clustering:- Overview of clustering, Working of Clustering, K-Means Clustering, Creating Product Segments Using Clustering, Hierarchical Clustering.	10

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.3. Machine Learning, By Mitchell Tom, McGraw Hill Pub.

Reference Books: 1. *Introduction to Machine Learning*, Ethem Alpaydin, MIT Press
2. Machine Learning with Python, By Abhishek Vijayvargia, BPB Publications

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus Semester-VII

Course Code: ITH41MML408	Course Name: Natural Language Processing
Course Category: Major Mandatory	
Credits: 3	Teaching Scheme: L-3 P-0
Evaluation Scheme: CA-60, ESE-40	
Pre-requisites: Basic knowledge of programming, data structures, and introductory concepts of artificial intelligence and linguistics.	
Course Objectives: To introduce the fundamental concepts, linguistic foundations, analysis techniques, and real-world applications of Natural Language Processing.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1:Understand the fundamentals of NLP.	
CO2: Apply basic text processing and language modeling techniques such as regular expressions, normalization, edit distance, and n-gram models.	
CO3: Analyze syntactic structures of sentences using constituency grammar, parse trees, and basic parsing algorithms.	
CO4: Interpret semantic meaning of words and texts using lexical semantics, word similarity, and word sense disambiguation.	
CO5: Describe and evaluate major NLP applications including information extraction, question answering, machine translation, and dialogue systems.	

Course Contents –

Unit	Content	Teaching hours
1	Introduction to NLP & Language Fundamentals Introduction to Natural Language Processing, Knowledge Sources in NLP, Ambiguity in Natural Language, The State of the Art in NLP, Overview of NLP Models and Algorithms	10
2	Text Processing & Language Modeling Regular Expressions, Text Normalization, Edit Distance and Spelling Correction, N-gram Language Models, Smoothing and Backoff Methods (conceptual only)	10
3	Syntax & Parsing Constituency Grammar, Parse Trees and Syntactic Ambiguity, Basic Parsing Algorithms	10
4	Semantics & Meaning Lexical Semantics, Word Similarity and Meaning, Word Sense Disambiguation, Basic Meaning Representation	10
5	Applications of NLP Information Retrieval / Information Extraction, Question Answering, Machine Translation, Dialogue Systems	5

Text Books: 1.Speech and Language Processing by Daniel Jurafsky, James H. Martin
2. "An Introduction to Language" by Victoria Fromkin, Robert Rodman, and Nina Hyams
3. "Semantics: A Coursebook" by James R. Hurford, Brendan Heasley, and Michael B. Smith
4. "Pragmatics and Discourse: A Resource Book for Students" by Joan Cutting

Reference Books: Introduction to Natural Language Processing - A Practical Guide for Beginners by Ansari Sakil White Falcon Publishing

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester-VII

Course Code: ITH41MMP406	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 programming fundamentals (preferably Python), elementary mathematics, and basic statistics.	
Course Objectives: To introduce fundamental machine learning concepts and enable students to preprocess data and implement basic regression, classification, and clustering techniques using Python.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the fundamental concepts of Machine Learning and its workflow	
CO2: Apply data preprocessing and exploratory data analysis techniques to prepare real-world datasets for machine learning.	
CO3: Implement and evaluate linear regression models for predictive analysis.	
CO4: Implement and assess classification models such as logistic regression and decision trees using appropriate evaluation metrics.	
CO5: Evaluate and compare machine learning models using appropriate performance metrics	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Install and configure Python and Machine Learning libraries (NumPy, Pandas, Matplotlib, Scikit-learn) and study the basic Machine Learning workflow using a simple dataset	2
2	Perform data preprocessing on a real-world dataset: handling missing values, normalization, standardization, and splitting data into training and testing sets	2
3	Perform Exploratory Data Analysis by computing descriptive statistics: mean, median, variance, and standard deviation	2
4	Visualize data using histograms, box plots, and scatter plots	2
5	Implement Simple Linear Regression and evaluate the regression model	2
6	Implement Multiple Linear Regression and interpret the regression coefficients	2
7	Implement Binary Logistic Regression for classification problems	2
8	Evaluate Logistic Regression model using accuracy and confusion matrix	2
9	Implement Decision Tree classification and study entropy and information gain	2
10	Implement K-Means Clustering algorithm and visualize clusters	2
11	Evaluate and compare classification models using Confusion Matrix, Accuracy, Precision, Recall, and F1-score	10

Reference Book / Hand Books/ Lab Manual

Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley

2. M. Gopal Applied Machine Learning McGraw-Hill Education

3. Hands-On Machine Learning with Scikit-Learn, Aurélien Géron, Keras & TensorFlow (O'Reilly)

Syllabus

Semester-VII

Course Code: ITH41MMP407	Course Name: Practical based on Natural Language Processing	
Course Category: Major Mandatory		
Credits: 1	Teaching Scheme: L-0,P-2	Evaluation Scheme: CA-30,ESE-20
Pre-requisites: Basic knowledge of Python programming, data structures, and introductory concepts of linguistics or artificial intelligence.		
Course Objectives: To develop practical skills in implementing core Natural Language Processing techniques using Python for linguistic analysis and real-world applications.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Use Python and NLP libraries to perform basic text preprocessing tasks such as tokenization and normalization.		
CO2: Apply regular expressions and edit distance techniques for pattern matching and spelling correction in text.		
CO3: Construct simple language models and analyze syntactic structure using parse trees and context-free grammars.		
CO4: Analyze lexical semantics and semantic similarity using WordNet and vector-based representations.		
CO5: Develop and demonstrate a basic NLP application such as information extraction, question answering, or machine translation at a conceptual level.		

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Install and configure Python and NLTK	2
2	Demonstrate word and sentence tokenization using NLP tools	2
3	Apply text normalization techniques: lowercasing, stop-word removal, stemming, and lemmatization.	2
4	Design and implement regular expressions for pattern matching in text.	2
5	Compute edit distance for spelling correction.	2
6	Generate unigram and bigram language models for sample text.	2
7	Identify syntactic categories and phrase types using parse trees.	2
8	Implement Context-Free Grammar (CFG) and perform sentence parsing.	2
9	Demonstrate lexical semantics using WordNet (synonyms, antonyms, hypernyms).	2
10	Compute word similarity and sentence meaning using vector-based representations.	2
11	Implement a simple NLP application (Information Extraction / Question Answering / Machine Translation – conceptual).	10

Reference Book / Hand Books/ Lab Manual

2. “Natural Language Processing with Python — Analyzing Text with the Natural Language Toolkit” — Steven Bird, Ewan Klein & Edward Loper
2. “Speech and Language Processing” — Daniel Jurafsky & James H. Martin
3. “Foundations of Statistical Natural Language Processing” — Christopher D. Manning & Hinrich Schütze

Syllabus Semester-VII

Course Code: ITH41MEL405	Course Name: Remote Sensing	
Course Category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Students should have a basic understanding of satellite systems and their working. Basic knowledge of different sensors, platforms, and scanning systems. Satellite data and its applications are expected.		
Course Objectives: This course provides students with a clear understanding of Remote Sensing principles, satellite platforms, and sensors. It develops skills in image acquisition, preprocessing, enhancement, and interpretation, enabling effective analysis and practical application of satellite data to real-world problems.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic principles of Remote Sensing and electromagnetic radiation.		
CO2: Explain energy interaction and radiation laws used in Remote Sensing.		
CO3: Identify different sensors, scanning systems, and resolutions.		
CO4: Apply basic digital image processing techniques for effective interpretation and enhancement of satellite images.		
CO5: Understand applications of Remote Sensing data in real-world problems.		

Course Contents –

Unit	Content	Teaching hours
1	Basic of Remote Sensing: Basic Principles of RS, Types of Remote Sensing Active and Passive, Concept of Electromagnetic Radiation and Spectrum, Wavelength and frequency Region used in Remote Sensing, Radiation Laws- Planck's Radiation Law, Wien's Displacement Law etc., EMR Interaction with Atmosphere and Earth's Surface-Absorption, Reflectance and Scattering. Spectral Reflectance and characteristics of Earth Surface Features-Vegetation, Water, Soil Built-up areas.	9
2	Data Acquisition and Image Interpretation: Concept of data acquisition, Role of sensors in data collection. Types of Sensors -Imaging and non-imaging sensors, Optical sensors, Thermal sensors, Microwave sensors. Sensor Scanning- Along Track (push broom) and Across Track (whiskbroom). Resolution of Sensor - Spatial, Spectral, Radiometric, Temporal Resolution. Satellite Image Interpretation -Tone, Texture, Shape, Size, Pattern. Atmospheric Effect, Image Interpretation From Single Band FCC and TCC.	9
3	Platforms and Sensors: Satellite Orbit- Concept of Geostationary & Sun Synchronous, Concept of Swath, Width, Path and Row. Different types of platforms- Balloon, UAV, Airborn and Spaceborn. Imaging Sensors-Panchromatic, Multispectral, Microwave and Hyperspectral Sensing. Satellites and Their Specification, Weather and Communication Satellite.	9
4	Digital Image Processing: Concept of Digital Data and Formats, Preprocessing of Remote Sensing Data, Radiometric and Geometric Errors and Correction, Image Enhancement-Techniques, Linear and Nonlinear Methods, Histogram Equalization. Spatial Filtering-Low Pass High Pass, Edge Detection, Edge Enhancement, Supervised, Unsupervised Classification Techniques.	12
5	Application: Application of Remote Sensing In Various Engineering And Science Discipline Such As Agriculture and Meterology, Forestry and Ecology Application, Soil and Land Degradation, Land Use Land Cover and Urban Studies, Geological Application, Water Resource Management, Disaster Management(flood, forest fire, drought, landslide) Etc.	6

Text Books: Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, Alfredo Huete (2010). CRC Press, Taylor & Francis Group.
2. Fundamentals of Remote Sensing, George Joseph (2004),

Reference Books: 1. Remote Sensing and Image Interpretation. 6th ed. Lillesand, T.M., Kiefer, 2. Introductory Digital Image Processing: A remote Sensing Perspective' John R. Jenson 3. Remote sensing: models and methods for image processing, schowengerdt. R.A. Academic press, 2007.
Online Resources: 1. NPTEL / SWAYAM lectures.

Syllabus Semester-VII

Course Code: ITH41MEL406		Course Name: Digital Image Processing
Course Category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites:		
Course Objectives:		
<ol style="list-style-type: none"> 1. To introduce the fundamentals of digital image processing 2. To understand image representation and transformation techniques 3. To learn image enhancement and restoration methods 4. To apply image processing techniques for real-world applications 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic concepts and terminology of image processing		
CO2: Represent and manipulate digital images		
CO3: Apply image enhancement techniques		
CO4: Perform image segmentation and feature extraction		
CO5: Implement image processing algorithms using software tools		

Course Contents –

Unit	Content	Teaching hours
1	Digital Imaging Fundamentals: Basic idea of Digital image, Image formation in human eye, Pixel, Mathematical operation of Digital Image, Sampling, Quantization, application of digital Image Processing Transform of Digital Images: Importance of Digital Image Transform, Fourier Transform of Digital Image (DFT), Inverse Fourier Transform (IDFT), Fast Fourier Transform, Inverse Fast Fourier Transform, Application of Digital Image Transform in different area	9
2	Digital Image Enhancement: Importance of Digital Image enhancement, enhancement in spatial and frequency domain, Bit plane slicing, Histogram, Histogram Equalization, Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images – LPF, HPF and BPF	9
3	Digital Image Compression: Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression	9
4	Digital Image Restoration: Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering Segmentation of Digital Images: Importance and applications of Digital Image Segmentation, Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Watershed algorithm,	9
5	Edge detection in Digital Image Processing: Importance of Edge detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator. Security in Digital Image Processing : Importance of Digital Image Security, Watermarking, Image encryption in spatial and frequency domain, Steganography	9

Text Books: Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

Reference Books: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

1. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
2. William K Pratt, “Digital Image Processing”, John Willey, 2002.

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester-VII

Course Code: ITH41MEP405	Course Name: Practical based on Remote Sensing		
Course Category: Major Elective			
Credits: 1	Teaching Scheme: L-0,P-2	Evaluation Scheme:	CA-30, ESE-20
Pre-requisites: 1.Basic understanding of image processing concepts such as digital images, pixels, bands, and basic enhancement techniques. 2. Fundamental knowledge of computers and GIS with the ability to use basic software tools. 3. Introductory knowledge of image interpretation elements like tone, texture, and shape.			
Course Objectives: This course aims to introduce the fundamental concepts of Remote Sensing and Digital Image Processing, including sensors, platforms, and satellite data acquisition. It also focuses on developing practical skills in image processing and interpretation using tools such as QGIS, ERDAS, and ENVI for real-world applications.			
Course Outcomes: At the end of the course, the students will be able to -			
CO1: Perform basic satellite image loading, layer stacking, and RGB composition using image processing software.			
CO2: Apply preprocessing, image enhancement, and spatial filtering techniques to satellite data.			
CO3: Identify and differentiate various sensors, satellite orbits, and imaging systems used in Remote Sensing.			
CO4: Execute basic supervised and unsupervised classification for land cover analysis.			
CO5: Interpret and apply Remote Sensing data for applications such as agriculture, urban studies, water resources, and disaster management.			

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Importing, Viewing, and Exploring Satellite Data in QGIS, ERDAS, and ENVI	2
2	Layer Stacking of Multispectral Satellite Images	2
3	RGB Band Combination and Creation of True Color Composite (TCC) and False Color Composite (FCC).	2
4	Single Band Image Analysis and Gray-Scale Interpretation	2
5	Geometric Correction and Image Registration Using Ground Control Points (GCPs)	2
6	Image Subsetting Using ROI and AOI Extraction.	2
7	Ground Truth Data Collection and Integration with Satellite Images	2
8	Unsupervised Image Classification (K-Means / ISODATA)	2
9	Supervised Image Classification (Maximum Likelihood / Minimum Distance)	2
10	Accuracy Assessment of Classified Images (Error Matrix and Kappa)	2
11	Thematic Map Generation and Layout Preparation for Applications	
12	Develop a basic project on Land Use and Land Cover (LULC) map, Vegetation Analysis or Crop Area estimation using multispectral satellite imagery and image processing techniques.	10

Reference Book / Hand Books/ Lab Manual

- Lillesand, Thomas, Ralph W. Kiefer, and Jonathan Chipman. *Remote sensing and image interpretation*. John Wiley & Sons, 2015.
 - Schowengerdt, Robert A. *Remote sensing: models and methods for image processing*. elsevier, 2006.
- 3. Software Tools:** open source QGIS, ERDAS Imagine, ENVI

Syllabus Semester-VII

Course Code: ITH41MEP406	Course Name: Practical based on Digital Image Processing	
Course Category: Major Elective		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30, ESE-20
Pre-requisites:		
Course Objectives:		
<ol style="list-style-type: none"> 1. To introduce the fundamentals of digital image processing 2. To understand image representation and transformation techniques 3. To learn image enhancement and restoration methods 4. To apply image processing techniques for real-world applications 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic concepts and terminology of image processing		
CO2: Represent and manipulate digital images		
CO3: Apply image enhancement techniques		
CO4: Perform image segmentation and feature extraction		
CO5: Implement image processing algorithms using software tools		

List of Practical's:

Sr.No.	Title of the Experiment	Practical Hours
1	Perform basic image reading, displaying, and convert RGB image into Gray and binary format.	2
2	Apply image resizing and display image information on 10 different images.	2
3	Practical based on histogram and histogram equalization on 5 different images.	2
4	Detect edges in an image using different edge detection techniques.	2
5	Practical based on different types of noise and noise removal techniques	2
6	Perform different image smoothing techniques on different images.	2
7	Implement basic morphological operations for binary image processing	2
8	Implement different image sharpening techniques.	2
9	Convert images between different color spaces	2
10	Apply thresholding technique on different images.	2
11	Mini project on Digital image processing	10

Reference Book / Hand Books/ Lab Manual

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
- William K Pratt, "Digital Image Processing", John Willey, 2002.

Syllabus Semester-VII

Course code: ITH41RML401	Course Name: Research Methodology	
Course Category: Research Methodology		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60 ESE-40
Pre-requisites: Basic understanding of subject fundamentals, elementary statistics, and academic reading and writing skills.		
Course Objectives: To develop an understanding of research methodology principles and techniques applicable to problem identification, analysis		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To develops the ability to identify research problems and formulate objectives and hypotheses.		
CO2: To familiarizes students with research design, data collection, and analysis techniques relevant to robotics.		
CO3: To enhances skills in technical writing, documentation, and research ethics.		
CO4: Analyze and apply statistical techniques such as data processing, descriptive statistics, correlation, regression, and hypothesis testing to interpret and validate research data.		
CO5: Evaluate research findings and create a structured research report or mini proposal using appropriate referencing styles, ethical practices, and computer-based research tools.		

Contents -

Unit	Contents	Teaching Hours.
1	Introduction to Research & Research Process: Meaning of Research, objectives, motivation, and significance of research, Types of research (basic/applied, qualitative/quantitative, conceptual/empirical) Research methods vs. research methodology, Research Approaches, Significance of Research, Scientific method and research ethics, Steps in the research process, Criteria of Good Research, Problems Encountered by Researchers in India	9
2	Research Problem Formulation & Research Design: Identification and definition of research problems in engineering/robotics (Meaning and sources of research problems, Criteria for selecting a research problem, Defining and formulating research problems), Review of literature and research gap identification, Formulation of objectives and hypotheses, Research design: exploratory, descriptive, experimental, Features of a good research design	9
3	Sampling Design & Data Collection Methods: Sampling concepts, population, sample, sampling errors , Probability and non-probability sampling techniques (Sample size (basic concept)Types of sampling errors (Sampling error, Non-sampling error, Bias and sources of bias), Methods of data collection: observation, interview, questionnaire, experiments, Selection of appropriate sampling and data collection methods (Nature of research problem, Objectives of the study, Time, cost, and resource constraints, Accuracy and reliability requirements, Relevance to robotics and engineering research)	9
4	Data Processing, Analysis & Hypothesis Testing: Data processing (Editing, coding, classification, tabulation), Descriptive statistics) Measures of central tendency, Measures of dispersion, Correlation and regression, Hypothesis testing (Concepts and Procedure, parametric and non-parametric tests), Interpretation of Statistical results.	9

5	Research Reporting: Interpretation of research results, Research report writing (Structure of research report technical paper, and project report), Referencing styles and bibliography, Plagiarism and ethical issues in research, Role of computers in research (Data analysis tools, Documentation and presentation tools), Preparation of a mini research proposal / report	9
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Text Books :

- 1.C.R. Kothari — Research Methodology: Methods & Techniques
- 2.Ranjit Kumar — Research Methodology: A Step-by-Step Guide for Beginners

Reference Books:

- 1.Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. — An Introduction to Research Methodology
- 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design

Online Resources: 1.Alison – Essentials of Research Methodology

Syllabus

Semester-VIII

Course code: ITH41RMP401	Course name: Practical Based on Research Methodology	
Course category: Research Methodology		
Credits: 1	Teaching Scheme: L-0 P-2	Evaluation Scheme: CA-30 ESE-20
Pre-requisites: Research Methodology practical is a basic understanding of research design, data collection methods, and fundamental statistical and analytical tools.		
Course Objectives: The Research Methodology course is to equip students with the skills to design, conduct, analyze, and interpret research systematically and ethically		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To develops the ability to identify research problems and formulate objectives and hypotheses.		
CO2: To familiarizes students with research design, data collection, and analysis techniques relevant to robotics.		
CO3: To enhances skills in technical writing, documentation, and research ethics.		
CO4: Analyze and apply statistical techniques such as data processing, descriptive statistics, correlation, regression, and hypothesis testing to interpret and validate research data.		
CO5: Evaluate research findings and create a structured research report or mini proposal using appropriate referencing styles, ethical practices, and computer-based research tools.		

Content -

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

Text Books :

- 1.C.R. Kothari Research Methodology: Methods & Techniques
- 2.Ranjit Kumar Research Methodology: A Step-by-Step Guide for Beginners

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, R., & Agarwal, U.K. An Introduction to Research Methodology
- 2.Paul D. Leedy& Jeanne Ellis Ormrod — Practical Research: Planning and Design

Online Resources: 1.Alison – Essentials of Research Methodology

List of

Semester: Eight
B.Sc. (Hons. With Research)

Syllabus Semester-VIII

Course Code: ITH41MML408	Course Name: Big Data Analytics	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic knowledge of databases, programming concepts, and data analytics fundamentals.		
Course Objectives: To introduce Big Data concepts, technologies, and processing frameworks, and to enable students to perform large-scale data analytics using distributed computing, NoSQL systems, and Spark-based solutions.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the fundamentals, characteristics, technologies, and ecosystem components of Big Data.		
CO2: Apply distributed storage and parallel processing frameworks to manage and process large datasets.		
CO3: Perform large-scale data analytics using Spark with RDD, Data Frames, SQL, and streaming components.		
CO4: Implement NoSQL models and real-time ingestion pipelines for analytical workloads.		
CO5: Apply analytical models & visualization in real-world Big Data applications.		

Course Contents –

Unit	Content	Teaching hours
1	Introduction to Big Data & Ecosystem: - Types of Digital Data, Introduction to Big Data and Big Data Analytics, Characteristics of Big Data (3V/5V/7V Models), Big Data vs Traditional Data, Data Sources: Structured, Semi-Structured, and Unstructured, Big Data Life Cycle, History of Hadoop & Apache Hadoop, Hadoop Ecosystem Overview (HDFS, MapReduce, YARN), MapReduce Paradigm: Concepts, Workflow & Data Flow	9
2	Distributed Storage & Parallel Processing with Hadoop:- Hadoop Distributed File System (HDFS) Architecture, Name Node, Data Node, Secondary Name Node and Their Roles, Data Replication, Block Placement Strategy, and Fault Tolerance, HDFS File Operations and Commands (Put, Get, Move, Delete, List, Copy, Permissions, etc.), MapReduce Programming Model and Internal Execution Workflow, Job Scheduling, Resource Allocation, and Performance Optimization Techniques.	9
3	Spark for Big Data Analytics: - Introduction to Apache Spark and Spark ecosystem, Resilient Distributed Datasets (RDD): architecture, transformations, and actions, Spark SQL: Data Frames, datasets, and query execution, Spark Streaming: micro-batch processing and stream processing concepts, Comparative analysis: Hadoop MapReduce vs. Apache Spark.	9
4	NoSQL Databases & Real-Time Systems: - Concept of NoSQL Databases, Classification of NoSQL Systems: Key-Value, Document, Column-family, Graph, HBase Architecture and Operations; Introduction to Cassandra, MongoDB: Data Model, Collections, CRUD Operations and Indexing, Real-Time Data Ingestion Systems: Kafka and Flume, Lambda Architecture for Real-Time Big Data Analytics,	9
5	Big Data Analytics & Applications:- Introduction to Machine Learning for Big Data, Overview of MLlib: Algorithms, Pipelines, Model Training and Evaluation, Big Data Visualization Techniques and Tools (Spark, Tableau, Power BI, Python), Applications of Big Data Analytics in Industry Domains (Retail, Financial Services, Healthcare, E-commerce, Customer Behavior), Big Data on Cloud Platforms: AWS EMR, Google Cloud Dataproc, Azure HDInsight.	9

Text Books: 1. <i>Hadoop: The Definitive Guide</i> Author: Tom White 2. <i>NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence</i> Authors: Pramod J. Sadalage, Martin Fowler
Reference Books: Big Data: Principles and Best Practices Author: Thomas Erl
Online Resources: 1.NPTEL https://nptel.ac.in/courses/106104189

Syllabus Semester-VIII

Course Code: ITH41MML409	Course Name: Deep Learning	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites:		
Course Objectives:		
<ol style="list-style-type: none"> 5. Understand various learning models to solve real world problems 6. To understand, learn and design GANs for the selected problems. 7. To understand the concept of Auto-encoders and enhancing GANs using auto-encoders 8. To understand the concept of Auto-encoders and enhancing GANs using auto-encoders. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: To understand the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems		
CO2: Design and develop various Neural Network Architectures		
CO3: Analyze sequential data to build recurrent and recursive models.		
CO4: Understand, learn and design GANs for the selected problems		
CO5: Understand the concept of Auto-encoders and enhancing GANs using autoencoders.		

Course Contents –

Unit	Content	Teaching hours
1	INTRODUCTION TO DEEP LEARNING: Historical Trends in Deep Learning, Why DL is Growing, Artificial Neural Network, Non-linear classification example using Neural Networks: XOR/XNOR, Single/Multiple Layer Perceptron, Feed Forward Network, Deep Feed- forward networks, Stochastic Gradient –Based learning, Hidden Units, Architecture Design, Back- Propagation	9
2	CONVOLUTION NEURAL NETWORK (CNN): Introduction to CNNs and their applications in computer vision, CNN basic architecture, Activation functions-sigmoid, tanh, ReLU, Softmax layer, Types of pooling layers, Training of CNN in TensorFlow, various popular CNN architectures: VGG, Google Net, ResNet etc, Dropout, Normalization, Data augmentation	9
3	RECURRENT NEURAL NETWORK (RNN): Introduction to RNNs and their applications in sequential data analysis, Back propagation through time (BPTT), Vanishing Gradient Problem, gradient clipping Long Short-Term Memory (LSTM) Networks, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.	9
4	GENERATIVE ADVERSARIAL NETWORKS (GANs): Generative models, Concept and principles of GANs, Architecture of GANs (generator and discriminator networks), Comparison between discriminative and generative models, Generative Adversarial Networks (GANs), Applications of GANs.	9
5	AUTO-ENCODERS: Auto-encoders, Architecture and components of auto-encoders (encoder and decoder), Training an auto-encoder for data compression and reconstruction, Relationship between Autoencoders and GANs, Hybrid Models: Encoder-Decoder GANs.	9

Text Books: Deep Learning: An MIT Press Book by Ian Goodfellow and Yoshua Bengio Aaron Courville.

Reference Books:

1. Deep Learning with Python, Francois Chollet, Manning publications, 2018
2. Advanced Deep Learning with Keras, Rowel Atienza, PACKT Publications, 2018

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester-VII

Course Code: ITH41MMP408	Course Name: Practical Based on Big Data Analytics
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0, P-2
	Evaluation Scheme: CA-30, ESE-20
Pre-requisites: Basic knowledge of programming (Python/Java), databases, and Linux command operations.	
Course Objectives: To develop hands-on skills in managing, processing, and analyzing large-scale data using Hadoop, Spark, NoSQL, and real-time analytics tools.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Set up and operate Big Data environments using Hadoop, Spark, and associated ecosystem components.	
CO2: Perform distributed data storage, file operations, and batch processing using HDFS and MapReduce.	
CO3: Use Apache Spark for large-scale analytical tasks using RDDs, DataFrames, SQL, and streaming modules.	
CO4: Implement and query NoSQL databases and real-time ingestion frameworks for analytical workflows.	
CO5: Apply machine learning and visualization techniques to domain-specific Big Data applications.	

List of Practical's:

Sr.No.	Title of the Experiment	Practical Hours
1	Install Hadoop / Spark environment & explore components	2
2	HDFS file operations (upload, retrieve, replicate, check)	2
3	Implement basic MapReduce wordcount & join programs	2
4	Spark RDD operations: transformations & actions	2
5	Spark SQL queries using structured datasets	2
6	Real-time ingestion pipeline using Kafka/Flume (demo based)	2
7	Implement NoSQL CRUD operations using MongoDB	2
8	HBase table creation, read/write & scanning operations	2
9	Spark MLlib for clustering/classification on large datasets	2
10	Big Data Visualization dashboard using Python / Tableau / Power BI	2
11	Mini Analytical Project: Domain-specific Big Data analysis (healthcare/finance/e-commerce)	10

Reference Book / Hand Books/ Lab Manual

1. Lab Manual--<https://www.slideshare.net/slideshow/bigdata-analytics-lab-manual-finalpdf/262467060>
2. Apache Spark Documentation--<https://spark.apache.org/docs/latest/quick-start.html>

Syllabus

Semester-VIII

Course Code: ITH41MMP409	Course Name: Practical Based on Deep Learning
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites:	
Course Objectives:	
<ol style="list-style-type: none"> 1. To understand the fundamentals of deep learning concepts through hands-on programming. 2. To familiarize students with Python-based deep learning libraries such as TensorFlow, Keras, and PyTorch. 3. To implement basic neural network models including perceptron and feed-forward neural networks. 4. To apply activation functions, loss functions, and optimization techniques in practical scenarios. 5. To design and train simple deep learning models using standard datasets. 	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Apply basic Python programming and deep learning libraries to implement neural network models.	
CO2: Implement and analyze artificial neurons, perceptron models, and feed-forward neural networks.	
CO3: Use activation functions, loss functions, and optimization techniques in deep learning models.	
CO4: Design, train, and evaluate simple deep learning models using standard datasets.	
CO5: Develop and implement Convolutional Neural Networks (CNN) for basic image classification tasks.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Introduction to Python for Deep Learning Write basic Python programs using NumPy and Pandas for array and data operations.	2
2	Introduction to Deep Learning Libraries Install and explore TensorFlow, Keras, or PyTorch and write a simple program to verify installation.	2
3	Implement a Simple Artificial Neuron Write a program to simulate a single neuron with inputs, weights, bias, and activation function.	2
4	Perceptron Model Implementation Implement a single-layer perceptron for binary classification.	2
5	Activation Functions Implementation Write programs to implement and plot activation functions such as Sigmoid, ReLU, and Tanh.	2
6	Feed Forward Neural Network Implement a basic feed-forward neural network using Keras or PyTorch	2
7	Backpropagation Concept Demonstration Demonstrate weight update using gradient descent for a simple neural network.	2
8	Train Neural Network on Simple Dataset Train a neural network on a small dataset such as XOR or Iris dataset.	2
9	Loss Functions and Optimization Implement and compare loss functions like Mean Squared Error and Cross-Entropy.	2
10	Write a program to demonstrate activation functions (Sigmoid, ReLU).	2
11	Implement a simple Convolutional Neural Network (CNN) for digit recognition.	10

Reference Book / Hand Books/ Lab Manual

1. DEEP LEARNING FOR PROGRAMMERS [SAMPLE 1.0.0] BY DRAGAN DJURIC

Syllabus Semester-VIII

Course Code: ITH41MEL407	Course Name: Geographical Information Systems	
Course Category: Major Mandatory		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic knowledge of Geography, Understanding of Maps and Cartography		
Course Objectives:		
<ol style="list-style-type: none"> 1. Capture spatial and non-spatial data 2. Store and manage large geographic datasets Organize spatial data efficiently in digital form for easy retrieval and updating. 3. Integrate data from multiple sources Combine maps, remote sensing data, census data, and field data into a single system. 4. Analyze spatial relationships and patterns Perform spatial analysis such as overlay, buffering, network analysis, and proximity analysis. 5. Support decision-making and planning, Help in urban planning, disaster management, environmental monitoring, agriculture, and transportation planning. 		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Analyze the basic component of GIS		
CO2: Classify the maps, coordinate system and projections.		
CO3: Process of spatial and attribute data and prepare thematic maps		
CO4: Identify and rectify mapping inaccuracies		
CO5: Conceptualize a GIS project		

Course Contents –

Unit	Content	Teaching hours
1	Basic Concept of GIS- Introduction to GIS, Historical evolution of GIS, Spatial and Non-Spatial Data, Component of GIS, GIS Data Models- Raster and Vector, GIS Queries, GIS Architecture, Topology, DBMS in context of GIS.	9
2	Data Input and Geo-Referencing: Data Sources of spatial data (raster and vector), GIS data collection through scanners and digitizers, Methods of digitization, Maps, Map element and Map Scale, GPS, satellite imagery, surveys, Data input methods and data editing. GIS coordinates and Projections, geometric transformation of raster and vector data, RMS error, type of coordinate system, spheroid and data.	9
3	GIS Data Management and Database Concepts: Introduction, Database Management Systems, GIS Data File Management, Database Models, Storage of GIS Data, Object-Based Data Models, Organizational Strategy of DBMS in GIS, Concepts of DBMS in Context of GIS, Hierarchical, Network, and Relational Models.	9
4	GIS Analysis and Image Processing: Overlay Analysis, Proximity Analysis, Buffer Analysis, Network Analysis- Terrain and surface analysis (Slope, Aspect, Hillshade), Tin Analysis, DEM Models. Introduction to image processing in GIS, Digital image processing concepts, Image preprocessing and enhancement techniques.	9
5	Geospatial Applications and Modeling: GIS Applications areas for Agriculture , forestry, Environmental monitoring. Urban Planning and Smart Cities. Disaster Management. Water Resources Management. Transportation and Logistics – Route optimization, traffic management, public transport planning. GIS in Public Health. Tourism and Cultural Heritage. Emerging Trends for Geospatial Technology-UAV and drone data. Real-time GIS Analytics – Monitoring transportation, environmental parameters, or disaster scenarios.	9

Text Books:

Geographic Information Systems and Science, Authors: Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind
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Reference Books:

Remote Sensing and Image Interpretation ,Authors: Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman

Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus Semester-VIII

Course Code: ITH41MEL408	Course Name: Multimodal Biometrics	
Course Category: Major Elective		
Credits: 3	Teaching Scheme: L-3 P-0	Evaluation Scheme: CA-60, ESE-40
Pre-requisites: Basic knowledge of Biometric authentication process, Awareness on different biometric devices		
Course Objectives: 1. This course introduces the fundamentals of biometric systems and multimodal recognition. 2. Understand the Biometric technology including the definition, terminologies used, parameters and basic features. 3. It also covers feature extraction, fusion techniques, and performance evaluation for reliable applications.		
Course Outcomes:		
CO1: Understand the fundamentals, evolution, components, and applications of biometric systems.		
CO2: Describe various biometric mechanisms.		
CO3: Understand Biometric recognition systems for human identification and recognition and purpose using Various biometric traits.		
CO4: categorizes biometric applications and technologies to real time Problems.		
CO5: Analyze multibiometric systems, their architectures, and sources of multiple biometric evidence.		

Course Contents –

Unit	Content	Teaching hours
1	Basic of Biometric: Introduction To Biometrics, Background And Evolution Of Biometric, What Is Biometric Recognition, Types Of Biometric-Physiological Biometrics: Face, Fingerprint, And Iris, Palm Etc. Behavioral Biometrics: Signature, Voice, Gait, Keystroke Etc. Biometric System Process-Enrollment, Verification, Identification. Component Of Biometric System, Biometric System Functionality, Applications Of Biometric Systems.	9
2	Fingerprint Recognition : Introduction, Friction Ridge Pattern, Features, Level 1 Features, Level 2 Features, Level 3 Features, Additional Features , Fingerprint Acquisition, Sensing Techniques, Image Quality, Feature Extraction- Ridge Extraction ,Minutiae Extraction.	9
3	Face Recognition: Introduction, Psychology Of Face Recognition, Facial Features, Level 1, Level 2, Level, Design of Face Recognition System, Image Acquisition Sensors, Face Detection and Feature Extraction Techniques.	9
4	Iris Recognition: Introduction, Anatomy of human eye, Design of an Iris Recognition System, Image Acquisition, Iris Segmentation, Normalization, Feature extraction, Performance Evaluation.	9
5	Multibiometrics: Introduction, Sources of Multiple Evidence, Multi-sensor systems, Multi-algorithm systems, Multi-instance systems, Multi-sample systems, Multimodal systems, Acquisition and Processing Architecture, Acquisition sequence, Processing sequence. Datasets. Levels of Fusion -Sensor-level fusion, Feature-level fusion, Score-level fusion, Fusion Techniques.	9

Text Books: 1. Anil K. Jain, Arun A. Ross, Karthik Nandakumar, Introduction to biometrics, Springer, 2011. 2. Anil K Jain, Patrick Flynn and Arun A Ross, Handbook of Biometrics, Springer, USA,2010.
Reference Books: 1. John R Vacca, Biometric Technologies and Verification Systems, Elsevier, USA, 2007. 2. Ross, Arun A., Anil K. Jain, and Karthik Nandakumar. <i>Handbook of multibiometrics</i> . Boston, MA: Springer US, 2006.
Online Resources: 1.NPTEL / SWAYAM lectures.

Syllabus

Semester-VIII

Course Code: ITH41MEP407	Course Name: Practical based on Geographical Information systems
Course Category: Major Elective	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Basic knowledge of computers and introductory GIS concepts.	
Course Objectives: To provide practical training in GIS software, focusing on QGIS for spatial data handling, analysis, and modern GIS applications	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain GIS software such as QGIS, ArcGIS, ERDAS, and ENVI and explore the QGIS interface.	
CO2: Add, visualize, and manage raster and vector data layers using QGIS.	
CO3: Create, edit, label, and query vector data using QGIS tools.	
CO4: Apply map projections, reprojection, measurements, and georeferencing techniques in QGIS.	
CO5: Analyze raster datasets and understand modern GIS applications including Web GIS and Mobile GIS.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Explain QGIS, ArcGIS, ERDAS, ENVI software; installation and explore QGIS interface, menu bar, and toolbar	2
2	Insert raster and vector layers in QGIS and study the properties of data layers.	2
3	Change visualization of raster and vector data using symbology options in QGIS.	2
4	Create vector layers (point, line, polygon) using new shapefile layer in QGIS.	2
5	Label vector data using QGIS label properties.	2
6	Study map projections and perform reprojection of raster and vector layers in QGIS.	2
7	Perform feature selection and attribute querying using QGIS query tools.	2
8	Edit vector data using toggle editing and overlay different vector layers in QGIS.	2
9	Measure area, distance, and angles using QGIS measure tools.	2
10	Perform georeferencing of raster images using the Georeferencer tool in QGIS and Visualize and analyze raster datasets; understand modern GIS applications (Web GIS, Mobile GIS concepts).	2
11	Project	10

Reference Book / Hand Books/ Lab Manual
1. Burrough, P.A. and McDonnell, R.A., <i>Principles of Geographical Information Systems</i> , Oxford University Press.
2. QGIS Documentation and Training Manual (Open Source Geospatial Foundation – OSGeo).
3. Longley, P.A., Goodchild, M.F., Maguire, D.J., and Rhind, D.W., <i>Geographic Information Systems and Science</i> , Wiley.

Syllabus

Semester-VIII

Course Code: ITH41MEP408	Course Name: Practical based on Multimodal Biometrics
Course Category: Major Mandatory	
Credits: 1	Teaching Scheme: L-0,P-2
Evaluation Scheme: CA-30, ESE-20	
Pre-requisites: Understanding of Digital Image Processing concepts, Basic programming skills in Python or MATLAB, Familiarity with matrices, vectors, and simple statistics	
Course Objectives: The objective of this course is to introduce students to learn the fundamental concepts of biometric systems and human recognition using face, fingerprint, and iris traits. It also aims to develop an understanding of image processing, feature extraction, and multimodal fusion techniques used for secure and reliable identification systems.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Understand the basic concepts, architecture, and working of biometric systems for human identification and recognition.	
CO2: Analyze unimodal biometric techniques for face, fingerprint, and iris recognition.	
CO3: Apply image processing techniques for biometric image preprocessing and feature extraction.	
CO4: Design and implement multibiometric systems using different levels of fusion and fusion techniques.	
CO5: Evaluate the performance of biometric and multibiometric systems using standard performance metrics.	

List of Practicals:

Sr.No.	Title of the Experiment	Practical Hours
1	Study the basic concepts, components, and working of a biometric system.	2
2	Perform basic image operations Read and display a biometric image (face/fingerprint/iris).	2
3	Perform fingerprint image acquisition and analyze fingerprint image quality.	2
4	Extract fingerprint features such as ridge patterns and minutiae points.	2
5	Read and display face images from a dataset.	2
6	Detect facial region from an image.	2
7	Crop and align detected face images.	2
8	Read and display iris (eye) images from a dataset.	2
9	Locate the iris region in an eye image.	2
10	Segment the iris region by masking	2
11	Implement any fusion level techniques using two biometric traits.	2
12	To Design and develop of Human Identification and Recognition System Using Biometric System	15

Reference Book / Hand Books/ Lab Manual: -1). Ashbourn, Julian. Practical biometrics. Springer Verlag London Limited, 2004. Suggested Tools & Datasets: Python / MATLAB, Public datasets: Fingerprint: FVC,Face: ORL / Yale,Iris: CASIA